APPENDIX F

Conformity Submission Letters to NIRB

Appendix F.1

April 4, 2005 – Conformity Letter Submission #1

CUMBERLAND
RESOURCES LTD.

#950 - 505 Burrard Street
Box 72, One Bentall Centre
Vancouver, B.C V7X 1M4

Tel: (604) 608-2557
Fax: (604) 608-2559
E-Mail: info@cumberlandresources.com
Website: www.cumberlandresources.com

CONFIDENTIAL DRAFT
FOR DISCUSSION

April 4th, 2005

Ms. Stephanie Briscoe
Executive Director
Nunavut Impact Review Board
P.O. Box 2379
Cambridge Bay, Nunavut
X0B 0C0

BY FAX and e-Mail

Dear Ms. Briscoe:

RE: Cumberland Conformity Submission in Response to NIRB March 21 Letter

Cumberland Resources Limited is pleased to provide NIRB with the information requested on March 21st to satisfy the Meadowbank Gold project Draft Environmental Impact Statement (DEIS) conformity requirements. We are also pleased that our draft submission received 564 yes decisions and only 74 no decisions. This response addresses the 74 NIRB conformity review decisions where a "no" was indicated (the red cells) in the table attached to the March 21st NIRB letter. As instructed, Cumberland has taken steps concurrent with this submission to distribute the documents to the other parties to the Meadowbank proceeding.

It was not possible for Cumberland to update the DEIS, develop and print an "integrated, cohesive revised DEIS" between 21 March and 4 April. The time available was taken up just addressing the items of non-conformity identified in the table and initiating work on the updates which were also requested on March 21st. Given that Cumberland cannot submit a revised DEIS, we have organized the attached submission on the same basis as the Guidelines and the DEIS, that is, based around the numbering system used in the Guidelines. In this way we trust this submission will easily be cross referenced to the DEIS and Guidelines.

Upon consideration of the NIRB conformity table and review of the DEIS, Cumberland notes that much of the required conformity information was already present in the DEIS and supporting documents. The difficulties contributing to the NIRB conformity ruling may have arisen from the organization of the DEIS, the level of detail provided and the fact that not every element of the Guidelines was reflected in a discrete and identifiable section in the DEIS. We have now addressed each non-conforming element of the DEIS identified by NIRB and Cumberland respectfully requests that NIRB rule that the DEIS conforms to the Guidelines based on the test set out in your letter of March 21st.

For those sections of the DEIS identified in your March 21st letter as conforming but which require clarification or an update (the yellow cells in the table), Cumberland intends to respond as quickly as possible, and in any event by the end of April. Clarification of the information in the DEIS, updates and discussion of the quality of the analysis provided is in Cumberland's view, part of the technical analysis stage and we will be working with NIRB and the parties in advance of and in the proposed technical sessions to address and resolve these concerns.

Cumberland wishes to assure NIRB and other interested parties that the information contained in this response and the results of our ongoing efforts to clarify and update selected aspects of the DEIS will be included in Cumberland's Final EIS submission.

Yours truly,

CUMBERLAND RESOURCES LTD.

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Craig Goodings
Manager, Environmental and Regulatory Affairs

3.0 EIS OVERVIEW

3.1.1 Public Involvement, Human Resources & Monitoring & Follow up Plans & Index to Volume 2

NIRB's Comment:

Provide the following missing plans: Human Resource Plan (4.24.3.1), Public Involvement Plan (4.24.3.4) and Monitoring and Follow Up Plan (4.26.1).

Provide an index for DEIS Part 2 Appendix.B.

Cumberland's Response:

Cumberland has included a Public Involvement Plan with this submission. The Human Resources Plan has been released on the ftp site and was mailed out earlier last week. The Monitoring and Follow up Plans were submitted as supporting documents with the DEIS. These can be found in the Terrestrial Ecosystem Management Plan, The AEMP plan (including the MMER and the NNL plan) and the Socioeconomic Impact Management Plan. The table of contents for Volume 2 A- E can be found in Volume 1at the end Table of Contents entitled List of Appendices after the List of Figures. We will include a TOC in Volume 2 in the final EIS as well.

4.0 SUBSTANTIVE DIRECTIVES

4.1 CORRECTIVE ACTION

NIRB's Comment:

Corrective actions undertaken in the past, distinguishing between those taken voluntarily and those taken at the insistence of a third party.

Cumberland's Response:

Cumberland Resources Ltd. has voluntarily undertaken corrective action at both the old Parker Lake Property and at the Meadowbank south camp in Nunavut. In both cases, buildings and other equipment were removed allowing the area to revegetate naturally. Cumberland has not been required to take any corrective actions based on the insistence of a third party.

4.1 PROVISION OF SECURITY

NIRB's Comment:

The provision of security to ensure payment of compensation in the event of accidents.

Cumberland's Response:

Cumberland has provided a security deposit to the KIA as part of the recently negotiated commercial surface lease. When appropriate, Cumberland will also provide security for the development of the proposed gold mine.

4.1 BOND OR FINANCIAL SECURITY

NIRB's Comment:

The Proponent shall identify and describe any obligations or requirements that it must meet to post a bond or other form of financial security to ensure payment of compensation in the event of accidents that directly or indirectly result in major damage by the project to the environment, as well as to cover the cost of planned or premature closure, whether temporary or permanent.

Cumberland's Response:

When the time comes, Cumberland will supply a bond or other form of financial security to the KIA as land owner and the water board as part of the water licence.

4.3 BASELINE DATA

NIRB'S Comment:

Further, the Proponent shall present the likely future conditions of baseline data in the absence of the project.

Cumberland's Response:

Water and sediment quality and aquatic communities in the project lakes, as well as terrestrial communities, have evolved to a stable condition and have existed in equilibrium for many hundred years. In the absence of the project, no changes to water quality, fish populations or habitat are anticipated. The magnitude of global climate change at this latitude is not sufficient to significantly affect the basic nature of aquatic communities.

4.5 PUBLIC CONSULTATION

NIRB's Comment:

Determining criteria for evaluating the significance of potential impacts.

Cumberland's Response:

Cumberland has gathered public input to determine significance of the impacts since 1996 through numerous public meetings, targeted interviews, and a three day impact workshop in 2003 as detailed on Table 4.3 pg 31 to 35 Volume 1 DEIS. Questions asked during interviews of the elders included: Are you worried about the mine development on the land and water? Are you worried about the effect mine development will have on the fish? Can you suggest ways to ensure the protection of wildlife at the project? What kinds of input and participation would you like to have in planning and monitoring the project? Are there any aspects of the project that you need further explanation about or have concerns about? The three day impact workshop held in Baker Lake in 2003 included representatives' from the Hamlet council, elders, CLARC, HTO, youth and members of the general public. At that meeting, a translated impact matrix was used and each VEC and VSEC was discussed with expected impacts from the various mine components as well as the proposed mitigation and monitoring plans.

4.5 REGIONAL CONTEXT

NIRB's Comment:

The status of ongoing land claims discussions in the southern part of the Central Kivalliq Region.

Cumberland's Response:

We are aware that land claims are ongoing in the southern Kivalliq but have no details of these negotiations, as we are not a party to them. However we believe DIAND and the NTI are parties to these negotiations. They may be able to provide information to us for the final EIS.

NIRB's Comment:

The location of other precious metal finds and other existing and potential developments.

Cumberland's Response:

Additional precious mineral finds in the area can be found on Figure 4.17 Regional Geology map. Pg 52 of the DEIS Part 1 Report. Information on other existing developments is included in the CEA report. More detail is included below:

Numerous junior and senior exploration companies are active in the Kivalliq region of Nunavut, conducting exploration for a variety of commodities including: gold, base metals (PGE's), and diamonds. A short description of these projects is provided below along with a table comparing the gold resources than have been delineated in the region. Meadowbank is the only project in Kivalliq advanced to the feasibility stage of evaluation.

Several advanced stage gold exploration programs are currently active in the Rankin Inlet area, including: the Meliadine Property (East and West) located approximately 15 km north of Rankin Inlet, and the Maze Lake Property located 100 km southwest of Rankin Inlet.

Gold Resources in the Kivalliq Region

Project	Gold Resources (oz.)			Gold Reserves (oz.) Proven and Probable
	Measured	Indicated	Inferred	
Meadowbank	225,000	3,101,000	547,000	2,768,000*
Meliadine West	n/a	853,000	482,000	n/a
Meliadine East	n/a	n/a	399,000	n/a
Committee Bay	n/a	n/a	488,000	n/a

Note: * Reserves are a subset of measured and indicated resources.

The Meliadine East project is a 50% / 50% joint venture between Cumberland Resources and Comaplex Minerals Corp., with Cumberland as the operator. The Meliadine East project has been active since the early 1990's and hosts numerous gold showings, and an inferred resource of 399,000 ounces of gold in the "Discovery" Deposit. The Meliadine West project is a 78% / 22% joint venture between Comaplex Minerals and Cumberland Resources, with Comaplex as the operator. Work on the Meliadine West project has also been ongoing since the early 1990's with more than $65 M spent on exploration since that time. An updated resource for the project, completed in March 2005, estimated that the Meliadine West project is currently host to an indicated resource of 853,000 ounces Au, combined with an inferred category resource of 482,000 ounces Au. Placer Dome operates the Maze Lake project where exploration has been ongoing since 2003. This is an early stage grassroots project that has not yet reached the resource definition stage.

The Ferguson Lake project of Starfield Resources, located 160 kilometres south of Baker Lake, targets base metal mineralization enriched in platinum group elements (pt, pd, etc). Over 61,000 m of drilling has been completed on the project to date, defining an inferred resource of 60.1 Mt grading 0.95% Cu, 0.60% Ni, and 1.32 g/t Pd.

The Committee Bay Gold project is located approximately 300 km northeast of Baker Lake. Exploration since 1992 has identified numerous gold showings on the property. One of the showings, Three Bluffs, has been advanced to the resource definition stage, with an inferred resource estimate of 488,000 ounces gold completed in the fall of 2004.

Numerous companies are also actively searching for diamonds in the Kivalliq region. Thousands of hectares of ground in the region have been acquired by exploration companies through prospecting permits issued by INAC. Permits have been acquired by both junior and senior companies, including: De Beers, BHP Billiton, Shear Minerals, Stornoway Diamond Corp., Dunsmuir Ventures, etc. Probably the most advanced of these projects is Stornoway's Aviat diamond project on the Melville Peninsula where a 7.4 tonne mini – bulk sample of kimberlite was collected in 2003 which returned a sample grade of 0.88 carats per tonne.

4.9.2 Project Need

NIRB's Comment:

It shall submit any feasibility studies and supporting documentation. The Proponent shall also demonstrate that financing has been secured for all project phases, including reclamation and security.

Cumberland's Response:

Cumberland has released the latest results of the feasibility study in the press release on 24 February 2005. Further technical information can be found on Cumberland's web site www.cumberlandresources.com in a report entiltled Meadowbank Gold project Technical Report, Nunavut March 2005. Although Cumberland is well financed for exploration, financing has not been secured to construct the mine nor for reclamation or security. Cumberland's plan is to finance the development of the Meadowbank project via a combination of debt and equity financing, the mix of which has not yet been decided.

In the case of future reclamation obligations, Cumberland intends to secure all agreed reclamation obligations over time via a combination of reclamation bonds and third party letters of credit and to finance such reclamation obligations out of future operating cash flow. Cumberland's ability to raise the requisite amount of development financing and reclamation security is dependent on market conditions if and when all requisite permits have been received. Many investors, including lending institutions in project debt financings will require that their investment commitment be conditioned upon Cumberland's receipt of all requisite permits.

In addition to the above, a number of external economic factors could adversely influence Cumberland's ability to raise the necessary financing on a cost effective basis. Such external factors include, a decrease in the US$ spot price of gold, higher interest rates, an increase in the value of the Cdn $ vs. the US$ and an increase in the cost of other commodities (i.e. oil, steel) consumed at the project.

Since the market's capacity to absorb both debt and equity capital is limited, Cumberland must compete with other companies for such capital capacity. Accordingly, potential debt and equity investors will compare both the risk and expected investment return associated with investing in Cumberland to other available investments and allocate their investment capital accordingly.

Notwithstanding the existence of a positive feasibility study on the Meadowbank project, until all requisite permits have been received on the Meadowbank project, investors in Cumberland's debt and equity will be required to assume permit risk. Therefore, unless investors feel they are adequately compensated for assuming such risk (higher interest rates, discounted equity/debt principal, etc.), they will opt to allocate their available investment dollars elsewhere.

In summary, subject to market conditions, Cumberland anticipates that it will be able to obtain or arrange conditional commitments to secure all requisite development financing and reclamation security with respect to the Meadowbank project prior to or in conjunction with the receipt of all requisite project permits.

4.10.1 WORK FORCE REQUIREMENTS

NIRB's Comment:

Work force requirements, including training required to maximize employment of Nunavummiut.

Cumberland's Response:

The mine will create up to 310 jobs during construction and 370 jobs during operations. The number of Nunavummiut employed and related training will be detailed in the IIBA and the Human Resources Plan.

4.10.1 Stockpiling of Ore

NIRB's Comment:

Figure 2-4 does not show the location of the ore stockpile as referenced on page 54 of Part 1 DEIS. Address ARD potential of ore stockpile.

Cumberland's Response:

Page 54 should reference Figure 2-5 not Figure 2.4. In any event, the location of the ore stockpile is shown as a green shaded area northwest of the plant site label, unfortunately it was not labeled as such. We will correctly label the site in the final EIS. Although the ore has the potential to produce ARD, no ARD is expected to be generated from the ore stockpile as the material will not be resident long enough at that location to generate any leachate. In addition, any runoff from the pile from snow or rain (contact water) will report to the pond to the north of the pile and be pumped to the tailings facility.

4.10.1.3 Tailings Facility Contingency Plan

NIRB's Comment:

The Proponent shall include a contingency plan in the event that discharges from the containment area do not meet licensing criteria.

Cumberland's Response:

No discharge of tailings water is planned during operations. In any event, if discharge was required but did not meet licensing criteria, it would be contained within the tailings containment facility until it was suitable for discharge or discharged to open pit.

4.10.1.3 Chemical Stability Analysis

NIRB's Comment:

Present a chemical stability analysis of processed ore.

Cumberland's Response:

The bulk of the tailings are expected to be acid generating (Golder, 2005). An accelerated weathering test conducted on a composite sample of tailing for over one year showed sustained alkalinity and neutral drainage. Testing suggests that tailings have a reserve of alkalinity that will retard the onset of ARD for the short- to medium-term.

4.10.1.3 Discuss Geotechnical Factors

NIRB's Comment:

Discuss how geotechnical factors, including permafrost, clay slippage and pooling, the seasonal seepage conditions of sand, and water and ice in pores, were considered in the design and selection of the structures to contain the processed ore. It shall also discuss the stability of the structures, including, if applicable, the question of talik zones.

Cumberland's Response:

TAILINGS DIKE

The tailing dyke has been designed to contain the tailings and to limit seepage through the foundation with the construction of a low-permeability cut-off; to have stable slopes under static and pseudo static conditions for both short- and long-term scenarios; and to be stable under frozen, partially frozen, and thawed conditions. The stability assessment included the consideration of a maximum earthquake of 1 in 975 years. A stability analysis was performed that included modeling of the anticipated seepage conditions and the resulting pore water pressures.

SLOPE STABILITY

Results of Analyses for End-of-Construction Conditions

Slope stability analyses were carried out to evaluate the short-term, end of Stage 1 construction situation. For the Full Cutoff design, the foundation till material was assumed to be permeable. For the Partial Cutoff design, the foundation till was assumed to be undrained.

In both cases, the dike was modelled with a crest elevation of 120 m. This corresponds to the first stage of construction, to be completed in Year -1 of the mine life.

For the 'Partial Cutoff' design case, the section was analyzed to determine the values of the undrained shear strength (c_u) which would yield Factors of Safety (FOS) of 1.0 and 1.3. A FOS of 1.3 is the minimum value required for the end of construction condition. A FOS of 1.0 is the value at which failure would begin to occur.

The following table presents the results of the end-of-construction conditions, and indicates that the Stage 1 dike will be stable for drained conditions with an associated FOS of 2.7.

Summary of End of Stage 1 Constructino Stability Analyses

Condition	Strength Parameters	Minimum Calculated FOS	Required Undrained Shear Strength of Foundation Till to Achieve a FOS of 1.3 (kPa)
Drained	c', ϕ	2.7	-
Undrained	c_u	See Note 1	60 to 70

Notes: 1. A factor of safety of 1.3 has been assume in order to calculate the minimum undrained shear strength of the foundation till to meet design requirements.

The analyses also indicate that, for undrained end of construction conditions, the minimum undrained shear strength of the foundation materials required to achieve a EQS of 1 .3 is about 60 to 70 kPa. The foundation soils that have been recovered during the geotechnical investigations carried out in other areas of the Meadowbank site indicate silty till material containing significant proportions of gravel and cobbles. Undrained shear strengths of this material are expected to be at least equal to or greater than 70 kPa, based on experience with similar materials at other sites. In the Partial Cutoff design case, undrained shear strength testing will be required during the detailed engineering design stage for the dike.

Results of Analyses for Long-Term, Steady-State Seepage Conditions

Slope stability analyses were done to evaluate the stability of the dike under long-term, steady-state seepage conditions, at three critical points in the life of the dike, and after closure. These were:

- In the early stages of mine life, free water ponded against the dike, with the water surface at approximately 120 masl. This situation was modelled under static and pseudostatic conditions; at the end of Year 10, deposition of tailings will be complete, and the tailings will be at their maximum elevation. This situation was modelled under static and pseudostatic conditions. This condition has not been modelled for the shorter life of mine and increased tailings final surface elevation.

- During closure of the facility, water will be allowed to flood the Portage Pit side of the tailings dike. This situation was modelled under static and pseudostatic conditions.

The results of the long-term analyses are summarized in the following table.

Summary of Long-Term Slope Stability Analyses

Failure Mode	**Minimum Calculated Factors of Safety**		**Yield Acceleration (g)**
	Static (Minimum = 1.5)	**Pseudostatic (Minimum = 1.2)**	
High Water (Water at Elevation 120 m)	2.0	1.8	0.21
End of Deposition (Tailings at Elevation 136.6)	2.3	2.2	0.41
Closure	4.9	4.3	0.43

Notes: **1.** FOS = 1.5 is minimum specified for long-term – see Ref. 7. **2.** FOS = 1.2 is minimum specified for pseudostatic – see Ref. 7.

Based on the analyses, the dike will be stable in the long-term, for static and pseudostatic loading conditions.

Seepage

Seepage analyses were carried out for the maximum section, for both the Full and Partial Cutoff Design cases. According to the current mining plan, the north portion of the Portage pit nearest the propsed tailings dike will not be mined until at least Year 4 of the mine life.

It is expected that seepage into the Portage Pit for the ‘Partial Cutoff – Alternative Section’ design will be similar to the ‘Partial Cutoff’ design, with Year 3 tailings beach and reclaim pond 200 to 300 m back from the dike face. This situation was anlysed considering the following:

- the foundation till is of higher permeability
- the dike cross-section includes a till core but no cutoff structures
- tailings have been deposited against the upstream face of the dike, and at a nominal slope into the impoundment
- the tailings pond is at a distance of 200 m from the face of the dike.

Material properties used in the analyses are presented in the following table.

Summary of Material Properties used in Seepage Analyses

Material	Hydraulic Conductivity ($X\ 10^{-6}$ m/s)	Comments/Basis for Properties
Till Core and Cutoff (Cutoff is for Full Cutoff Design only)	0.1	• Falling head tests from Dec 2002 geotechnical testing; and • Experience with materials with similar genesis and grain size distribution • If till core and/or cutoff material is thawed after initial freezing, it is possible that the hydraulic conductivity of this material could increase, unless the upstream portion of the till is maintained in a frozen state.
Rockfill	10,000	
Foundation Till – Full Cutoff Design	100	• Assumes material is free-draining
Foundation Till – Partial Cutoff Design	0.1	• Assumes material is relatively low permeability
Grout Curtain – Full Cutoff Design only	0.05	• Previous experience
Fractured Bedrock	40	• BH O3GT-TD-4 falling head packer test
Deeper Bedrock	0.001	• Report on Hydrogeology Baseline Studies.
Tailings	0.1	• Conservative estimate for fine-grained tailings, based on experience with similar materials, and published values (Vick 1990)

The following table shows the seepage flux to the Portage Pit west wall through the tailings dike.

Seepage Fluxes at the Portage Pit West Wall

Design	Flux (m^3/s/m)	Flow into Portage Pit (L/s)
Full Cutoff Design	3.3×10^{-5}	26
Partial Cutoff Design	3.5×10^{-5}	28
Partial Cutoff Design with Year 3 tailings beach (pond at 200 m from upstream dike face)	9.0×10^{-5}	71
Partial Cutoff Design with Frozen Core and Cutoff	3.3×10^{-5}	26
Full Cutoff Design with tailings beach at 100 m from upstream dike face	1.5×10^{-5}	12

It is anticipated that the majority of the seepage flows will report to the pit dewatering system. This water would be returned to the tailings reclaim pond.

The seepage analyses show that the proposed designs are effective at controlling seepage through the tailings dike.

DE-WATERING DIKES

Slope stability analyses show that the dikes will be stable under static and earthquake load conditions. Seepage modeling indicates that the total seepage through all of the dikes will be in the range of approximately 2.4 to 48.3 L/s. This value varies depending on potential cracking in the soil-bentonite cutoff wall and/or a potential gap in the cutoff wall at the bedrock contact.

Slope stability analyses were carried out for three critical sections along the Goose Island dike. Section A is located on a relatively flat foundation, Section B is the deepest section with the foundation sloping away from the pit, and Section C is the deepest section where the foundation is sloping toward the pit. Failure of Section A could potentially occur on the inside of the dike towards the open pit. Section B has the deepest water and steepest lake bottom slope along the dike alignment. The lake bottom slopes away from the pit at Section B, and failure of the dike at this location could potentially occur on the outside of the dike towards the lake. Section C is similar to Section A.

The slope stability scenarios were modeled for each of Sections A, B, and C only, as these represent the most critical dike sections. The dikes will be retaining water while men and equipment are working in the pits and hence are high consequence structures. The design life of the dikes is less than 20 years.

Results of Analyses for End-of-Construction Conditions

Slope stability analyses were carried out to evaluate the short-term, end of construction situation. The soil foundation material was assumed to be undrained. Sections A, B, and C were analyzed to determine the values of the undrained shear strength (c_u) which would yield Factors of Safety (FOS) of 1.0 and 1.3.

The analyses show that the minimum required undrained strength of the foundation must be in the range of 20 to 30 kPa, to achieve FOS of 1.0 and 1.3, respectively. The foundation soils that have been recovered during the geotechnical investigations carried out along the proposed dike alignments range from a silty till material containing significant proportions of gravel and cobbles to silty sand and gravel. Undrained strengths of this material are expected to be at least equal to if not greater than 20 to 30 kPa. Undrained shear strength testing will be required during the detailed engineering design stage for the dikes.

Results of Analyses for Long-Term Static & Pseudostatic Conditions

Slope stability analyses were done to evaluate the stability of the dikes under long-term, steady-state seepage conditions. The results of the long-term analyses of the critical failure modes are summarized in the following table.

Summary of Long-Term Slope Stability Analyses

Failure Mode	Minimum Calculated Factors of Safety		
	Section A	**Section B**	**Section C**
Failure through Cutoff Wall Static Conditions (Minimum = 1.5)	4.1	3.5	3.9
Failure through Cutoff Wall Pseudostatic Conditions (Minimum = 1.2)	3.5	3.0	3.3
Failure through Rockfill only Static Conditions (Minimum = 1.5)	2.7	1.9	3.2
Failure through Rockfill only Pseudostatic Conditions (Minimum = 1.2)	2.5	1.7	2.4
Calculated Yield Acceleration (g)			
Failure through Cutoff Wall	0.41	0.27	0.37
Failure through Rockfill only	0.36	0.16	0.36

Notes: 1. FOS = 1.5 is minimum specified for long-term. **2.** FOS = 1.2 is minimum specified for pseudo-static.

As seen in the table, the minimum calculated FOS for static conditions is 1.9, and the minimum calculated FOS for pseudo-static conditions is 1.5, both at Section B. These values exceed the minimum values indicated by the Dam Safety Guidelines (Canadian Dam Association, January 1999).

Based on the analyses, the dikes will be stable in the long-term, for static and pseudostatic loading conditions.

SEEPAGE

Seepage analyses were carried out for Sections A and B. The material parameters used in the analyses are presented in the following table.

Summary of Material Properties used in Seepage Analyses

Material	Hydraulic Conductivity (m/s)	Basis for Properties
Till Core	1×10^{-5}	Falling head tests from Dec 2002 geotechnical testing and; Experience with materials with similar genesis and grain size distribution
Rockfill	1×10^{-2}	Experience with similar materials
Overburden	1×10^{-5}	Falling head tests from Dec 2002 geotechnical testing and; Experience with materials with similar genesis and grain size distribution
Soil-Bentonite	1×10^{-9}	Published values
Backfill	1×10^{-8}	
Bedrock	4.7×10^{-7} (Section A) 2.2×10^{-7} (Section B)	BH 03GT-GI-6 packer tests BH 03GT-GI-3 packer tests previous geotechnical field investigations

The cutoff wall was modelled for the following scenarios:

1. A cutoff wall with no gaps at the bedrock contact, and no cracking within the wall.
2. A gap through the soil-bentonite cutoff wall at the bedrock interface.
3. A crack through the soil-bentonite cutoff wall, in the overburden till material.l
4. A crack through the soil-bentonite cutoff wall, in the till core material.
5. Combinations of 2, 3, and 4.

Fluxes were computed through the soil-bentonite cutoff wall for each scenario. The following table shows the predicted fluxes for each of the scenarios modelled.

Seepage Fluxes through the Soil-Bentonite Cutoff Wall

	Predicted Flux (L/s/m of length of dike)	
Scenario Modelled	**Section A**	**Section B**
No gap at bedrock contact; no crack in soil-bentonite wall	5.8×10^{-4}	$5.6 \text{ X } 10^{-4}$
No gap at bedrock contact; crack in soil-bentonite wall within overburden till	1.5×10^{-2}	7.5×10^{-3}
No gap at bedrock contact; crack in soil-bentonite wall within till core	5.9×10^{-4}	5.6×10^{-4}
0.5 m gap at bedrock contact; no crack in soil-bentonite wall	1.9×10^{-3}	6.7×10^{-3}
0.5 m gap at bedrock contact; crack in soil-bentonite wall within overburden till	1.5×10^{-2}	1.2×10^{-2}
0.5 m gap at bedrock contact; crack in soil-bentonite wall within till core	1.9×10^{-3}	5.9×10^{-3}

The predicted fluxes result in the following conclusions:

- Cracks through the cutoff wall in the section through the overburden would result in the largest increase in seepage. The increase is in the range of one to two orders of magnitude more than a wall with no cracks or defects in the overburden section. Cracks within the till core section have a negligible effect on seepage.
- A gap in the soil-bentonite cutoff wall at the bedrock contact results in an increase in seepage of approximately one order of magnitude.

Preliminary estimates of the range of seepage flows to be expected through the cutoff wall during operations are summarized on the following table.

Seepage Flows through Dikes

Dike	Predicted Flux (l/s/m of length of dike)		Length of Dike (m)	Predicted Flow through Dike and Overburden (see Note 1) (l/s)
	Section A	Section B		
No gap at bedrock contact, no crack within overburden				
Second Portage	6×10^{-4}	n/a	950	0.6
Bay Zone	6×10^{-4}	n/a	720	0.6
Goose Island	6×10^{-4}	6×10^{-4}	1724	1.2
0.5 m gap at bedrock contact, no crack within overburden (along complete length of dike)				
Second Portage	2×10^{-3}	n/a	950	1.9
Bay Zone	2×10^{-3}	n/a	720	1.4
Goose Island	2×10^{-3}	2×10^{-3}	1,724	3.4
Crack in cutoff wall within overburden (along complete length of dike)				
Second Portage	1.5×10^{-2}	n/a	950	14.2
Bay Zone	1.5×10^{-2}	n/a	720	10.8
Goose Island	1.5×10^{-2}	1×10^{-2}	1,724	23.3

Notes: 1. To calculate total flow at Second Portage and Bay Zone dikes, the seepage flux at Section A flux was applied over the total length of the dikes. To calculate total flow at the Goose Island dike, the Section A and B seepage fluxes were each applied over 70% and 30% of the dike length, respectively.

It is anticipated that the majority of the seepage flows would be captured in toe drains excavated near the downstream toe of the dikes and pumped, most likely to the water treatment plant. The seepage captured at the drains will likely be pumped to the water treatment plant. The remaining flow would report to the open pit dewatering systems.

4.10.1.3 Discuss Control of Groundwater Seepage

NIRB's Comment:

Describe methods of controlling and monitoring groundwater seepage from the processed ore and other containment area, and the capacity to cope with storms, floods, and other intermittent natural events, using a return period that is adequately conservative (e.g., 1/100 years), including a review of similar operations elsewhere, applicable modeling information, and the results of research on the long-term thermal stability of the underlying permafrost and frozen materials.

Cumberland's Response:

The containment areas, sumps, and ditches were designed using standard practices for mines operating in the north. The height of the tailings dyke has been designed to accommodate a reclaim pond plus a 1 in 100-year, 24-hour rainfall event, leaving a minimum of 2.0 m of freeboard during operations, and 1.0 m after closure. Mill site grading is such that seepage and runoff will be directed toward the tailings storage facility or to interceptor ditches and sumps designed to handle the 1:100 year return period event. The water collected in sumps will be pumped to the tailings impoundment. Similarly, the rock storage facility runoff and seepage is directed toward the attenuation pond or to interceptor ditches and sumps designed to handle the 1:100 year return period event. The water collected in sumps is then pumped to the attenuation pond.

Thermal modeling indicates that the tailings will freeze in the long term, and that the talik that currently exists below Second Portage Arm will freeze before seepage from the tailings impoundment reaches the groundwater below the permafrost. Therefore, the potential for groundwater contamination to occur as a result of seepage from the tailings impoundment is considered to be low. During operations, monitoring wells will be installed at appropriate locations around the perimeter of the tailings facility, and within the dyke, to allow monitoring of talik water quality and the level of the phreatic surface within the dyke. These monitoring wells are expected to eventually freeze over time. Thermistors will be installed within the tailings dyke, and at intervals around the facility to continually monitor changes to the thermal regime within the dyke, and within the existing talik. If necessary, thermosyphons could be installed within the dyke to encourage freezing of the dyke, further limiting seepage to the pit during operations.

Monitoring of the permafrost thermal regime at the project site began in 1996. Twenty-two thermistor cables have been installed at the site, ranging in vertical depth from 11 to 191 m. The Meadowbank project site is underlain by continuous permafrost to depths on the order of 550 m depending on proximity to lakes. Based on the current site thermistor instrumentation, the depth of the active layer in the project area ranges from about 1.3 m in areas of shallow overburden and away from the influence of lakes, up to 4.0 m adjacent to lakes, and up to 6.5 m beneath the stream connecting Third Portage and Second Portage Lakes. Taliks extending through the permafrost will exist beneath circular lakes having a minimum diameter of 570 m, and elongate lakes having a minimum width of 320 m. Based on this, Second Portage Lake and Third Portage Lake will have taliks extending through the permafrost. Much of Vault Lake freezes to the lake bottom; consequently the talik beneath Vault Lake is considered to be isolated.

The data collected from the thermistors installed at the site in 1996 (TP96-154 and TP96-155), and in 1997 (TP97-196), indicate there are no significant variations in the permafrost thermal regime recorded by these installations over the period of seven years for which data have been collected. Based on this information the permafrost thermal regime at the site exists in a steady state. However, on-going monitoring of the existing thermistors would be continued and compared with the current baseline data.

4.10.1.4 Overburden & Waste Rock Disposal

<u>*NIRB's Comment:*</u>

Describe the physical and chemical stability of the types of materials to be stored and those to be used for containment construction with regard to the long-term acid-generation potential of the waste rock, bearing in mind the latest monitoring results from mines near by or at least in the same general region, and present a water management plan. It shall also explain the relationship between the timing of acid generation and permafrost encapsulation and cold temperatures, where possible in reference to the region in which the project will take place; Refer to monitoring results from mines nearby or in the same general region to validate long term acid generating potential predictions. Explain the *relationship between the timing of acid generation and permafrost encapsulation and cold temperatures.*

Cumberland's Response:

Materials Characterization

All waste types have been characterized with respect to long-term acid generation potential: overburden, tailings, mine site infrastructure rock and pit waste rock from each lithology, including specific chemical characterization of pit rock that will be used for construction of dykes and other infrastructure use. Long-term weathering tests have been conducted at various scales conditions to allow appropriate extrapolation of results to field conditions to predict expected mine water quality from each mine component and from area lakes. Materials characterisation and weathering characteristics are described in the Static and the Kinetic testing reports for mine site materials and all-season road quarry rock (Static tests only).

Overburden

All five overburden samples from the airstrip and Third Portage trenches have no potential to generate acidic drainage (non-PAG), having marginal to non-detectable sulphur contents and excess carbonate neutralization capacity.

Mine Site Infrastructure Rock

Rock samples from the plant site and airstrip infrastructures are also non-PAG, with 14 samples containing no detectable sulphur and one plant site rock sample having low sulphur content. All samples have excess carbonate neutralization capacity.

Vault Pit Waste Rock

25% of Vault pit waste [is] designated as PAG [the remaining 75% is non-PAG]." The Vault **PAG IV** rock kinetically tested never generated ARD within the (20 cycle) test period and sustained alkalinity levels throughout testing [the Vault PAG rock] could generate [localized ARD conditions] in time, given favourable conditions, but only after a relatively long lag period, potentially longer than the projected ten-year mine life. The bulk of the [Vault waste rock] pile is not expected to constitute a source of ARD.

Portage Area Pit Waste Rock

The Portage rock storage area has a potential to generate ARD: "The majority of [iron formation] and [quartzite] pit rock is potentially acid generating, [ultramafic] waste is non-PAG, and the acid generating potential of [intermediate volcanic] pit rock is variable, with 35% of Goose Island and Portage pit rock designated as PAG.

Tailings

The bulk of the tailing material is expected to be PAG.

Timing of Acid Generation & Permafrost Encapsulation

Water quality predictions are provided for drainage from all major mine site components, (e.g. each open pit, rock storage facilities, etc.), for area lakes in the immediate area of the proposed mine site and for pit lakes that will result from flooding of the three open pits. Predictions are based on baseline information gathered from a number of studies conducted at the Meadowbank site. Site data is most desirable to characterize current conditions. Futur conditions including ARD are determined based on long-term test results adapted, or factored to simulate the environment of the Meadowbank site. These factors are based on documented observations from other tests and actual site information, including the following northern mine sites: Diavik, Ekati, Lupin, Nanisivik, North Rankin Inlet, Snap Lake, Colomac, and Cullaton Lake. For example, the effect of cold temperature on ARD reaction rates (lowering reaction rates) is described by well known chemical equations but is also verified by laboratory and in-situ cold temperature leaching tests on mine wastes from North Rankin Inlet mine, Diavik and Cullaton Lake. Scaling factors used to derive Meadowbank mine waste weathering characteristics are largely based on experience at other sites.

The mine waste management strategy is expected to effectively mitigate ARD generation.

Waste Rock Storage Pile

Thermal modeling of the waste rock pile determined that “The internal temperature [of the waste rock storage facilities] is expected to become superchilled and freeze, which will limit internal drainage as infiltrating runoff becomes frozen. During the delay to onset of frozen conditions in the pile, drainage, if any, will be collected in the storm water attenuation pond on site and, if required, will be treated before discharge. At the end of mine life, a cover of acid-buffering material will be placed on top of the pile to host the active thaw layer.“ The Portage waste rock storage facility will be capped with non-potentially acid generating ultramafic rock from the Portage or Goose Island open pits. The thickness will be sufficient to confine the active layer within the capping layer, and hence maintain the underlying potentially acid generating waste rock in a frozen state. This material will be placed progressively as portions of the waste rock storage area reach the desired final configuration.

Tailings Containment Area

The tailings are expected to freeze from the surface during winter months, as is occurring at the closed Nanisivik mine. The design concept for the tailings storage facility involves the control of the acid generating potential and metal leaching potential of the tailings through the promotion of partial freezing of the tailings as they are deposited during operations, and complete freezing of the tailings during post-closure. At the end of the mine life, the northwest arm of Second Portage Lake will be filled to above the existing lake surface with tailings. The tailings will freeze over time, as shown from thermal modeling. Complete freezing of the tailings and bedrock beneath the lake will occur with time. For tailings not frozen during deposition, the time to begin freezing the talik beneath the lake could be 200 years if climate change is not considered and 270 years if climate change is considered. If the tailings are frozen during deposition, the time to freeze 5 m into the talik is between one and 45 years, depending on location within the lake. When climate change is considered, this time is increased to 50 years. At closure, the tailings will be progressively covered with buffering rock that will host the active thaw layer. After closure the tailings are predicted to freeze completely.

Although some of the waste rock and the tailings have the potential to generate ARD, static and kinetic tests show that 1) material composits (bulk samples) are not acid generating, and 2) some of the individual PAG materials can sustain alkaline drainage for a long period of time under under accelerated weathering conditions at room temperature. These observations are supported, for waste rock, by in-situ test work that is on-going. Extrapolating accelerated weathering rates to expected site conditions (not only affected by climate but also grain size, rock pile and tailing impoundment geometry, hydrology, etc), and considering modelled and observed freezing rates of the various mine components (tailings of Nanisivik and Rankin Inlet, waste rock pile of Diavik and Cluff Lake), it is expected that the mine waste management (freezing and caping) will become effective before the ARD potential of some of the PAG materials is realized.

4.10.1.4 Describe Groundwater Chemistry

NIRB's Comment:

Describe in qualitative and quantitative terms the chemistry of frozen groundwater from joints and fractures in the waste rock disposal area.

Cumberland's Response:

Frozen water in the waste rock pile or tailings will be pure water, it has been observed under similar climatic conditions, that the dissolved constituents concentrate in small, isolated pockets surrounded by frozen mass (water or particles). Water infiltrating through waste rock piles will be retained within the pile until the field capacity of the pile (volumetric water content) is reached, which is expected to occur sometime after mine closure. Should infiltrated water be released during operation, it would occur summer months. The water quality of infiltrated water is expected to be representative of the fully frozen pore water (rock pile groundwater). The occurrence of more slightly more concentrated waters is not expected to affect attenuation pond water quality (in Years 1 to 5) as rock storage pile drainage represents only a small proportion of the total flow volume reporting to the pond: less than 2% for the Portage RSF, compared with 21% of clean overland flow. In years 6 to end of mine life, this water will accumulate in the tailing reclaim pond and will not be released until the end of mine life.

4.10.1.5 Bulk Truck Washing Facilities

NIRB's Comment:

Describe the facilities for washing bulk trucks and other equipment, as well as any treatment of water used for washing vehicles/equipment.

Cumberland's Response:

We have a wash bay in the shop with dirty water sedimentation tanks. Contact water will be pumped to the tailings facility.

4.10.5 Melt Water Management

NIRB's Comment:

Describe how melt water, particularly with high metal content, and hydrocarbons will be managed.

Cumberland's Response:

Site drainage of all contact water will be controlled by contouring and ditching to a site attenuation pond where it is assessed for need for treatment or for discharge. (see Figure 4.21 Water Management Plan)

4.10.1.7 All-Weather Roads

NIRB's Comment:

4.10.1.7 All-Weather Roads & Winter Roads

The Proponent shall describe, where useful with the assistance of maps and drawings:

- *how the selected route(s) correspond to the needs of other developers and of the Nunavummiut*
- *proposed construction of all-weather road, including laydown areas, on-site and off-site roads, alternative routes, with particular reference to stream crossings*
- *the quantities and types of materials required for construction and maintenance*
- *construction and maintenance methods for all site roads, frequency of use, road width, and dust-suppression methods*
- *The types and numbers of vehicles to be used to transport materials and ore along the all-weather access routes, including the total number of trips expected daily and seasonally*
- *accident/incident reporting*
- *wildlife impact mitigation procedures and/or structures*
- *site reclamation.*

Cumberland's Response:

All roads whether at the mine site, in Baker Lake or the access haul road were dealt with as a project component against which the effects on the various VECs were considered. However, in order to make the analysis of the effects of the access road more easily understood, we have included a separate access road impact matrix and a description of the access road with this submission.

Baker Lake to Site Access

Previous studies on the Meadowbank project showed that transportation of goods from Baker Lake to site was a significant cost. During the exploration phase commencing in 1995 and continuing to this date, freight is received in Baker Lake during the summer shipping season. The freight and fuel is then stored until the lake ice has developed sufficiently to allow transport by a Foremost Delta 3, beginning approximately mid-January and ending approximately mid-May. The ice trail to Meadowbank is unmarked, to minimize the environmental impact, and is not traveled during whiteout conditions. This results in a haul period of approximately 90 days.

A Foremost Delta 3 is an articulated all terrain vehicle capable of carrying a deck and trailer load of 19 tonnes. Foremost also manufactures a larger ATV, the Commander, with a combined deck and trailer load capacity of 36 tonnes.

During the exploration phase, the ATV’s make one round trip per day, although two trips per day are theoretically possible. It has been estimated that for construction and operations, a fleet of up to 26 Foremost Delta 3’s or 14 Foremost Commander’s would be required, at a capital cost of around $15 M for only the equipment.

The construction of a conventional access road to the property would extend the access season while reducing the freight cost of fuel and materials substantially. It also reduces the site infrastructure required with reduced fuel storage and a smaller airstrip. In addition, conventional road access would benefit the local community by providing opportunities for transportation, lodging, freighting, and marshalling services with the community. Baker Lake would also provide primary airport services for the mine.

Route Selection

Cumberland has conducted a preliminary assessment of road routes. Two potential routes were examined using aerial photographs and topographical maps. The routes selected attempted to locate the roadway on the windward side of hills or crest of hills to minimize snow accumulation and also minimize the number of water crossings. The chosen route is 115 km long and has a total of 19 water crossings, none of them with a water depth greater than 2 m. A fisheries habitat and population assessment of all water crossings along the propsed route was made in 2005. Activities consisted of stream flow measurement and discharge, wetted width and depth, substrate characterization, fish migrations, species composition, habitat mapping and utilization and spawning activity.

The selected preliminary route is illustrated in Figure Access Road at end of this document.

Additional Studies for 2005

Additional work conducted in 2005 included a detailed snow pack investigation (in-progress) and a comprehensive soils investigation in order to avoid areas of heavy snow accumulation by drifting and determine the soil classifications of the ground to be traversed. The soils investigation also identified granular and till borrow areas and quantified the borrow sources. Final route selection has been made and an initial design of the road profile and section have been completed. Additional studies were completed in summer 2005 on archaeology, vegetation, wildlife, wildlife habitat, and aquatic resources.

Design Parameters

The road would have a travel surface of 10 m and an average height above the existing ground of 0.8 m, with gentle side slopes so not to impede the movement of wildlife. The road surface would be 3" minus material, either pit run granular or crushed product. The road will be constructed with suitable material to ensure there is no impact to surface waters. The roadway would accommodate mine production size equipment as well as conventional tractor trailer haul units on a single lane basis (see figure Road Typical section on the following page).

Construction of the road would be performed in four stages or zones. Zone 1A would be from Baker Lake to the north Hamlet boundary a distance of approximately 10 km. Zone 1B would be from the north Hamlet boundary to the north Inuit Owned Lands (I.O.L.) boundary a distance of approximately 27 km. Zone 2A would be from the north I.O.L. boundary to the south I.O.L. boundary at Tehek Lake a distance of 54 km. The final Zone 2B would be from the south I.O.L. boundary at Tehek Lake to Meadowbank a distance of 24 km. The distances quoted above are approximate and will vary depending on the final route determination.

The road would be fill construction to elevate the roadway above the existing terrain to promote natural snow removal by wind action. Water crossings would be over culverts and logging road style bridges where required. The prefabricated bridge structures would be supported by rock fill cribs at the abutments. Construction of the road would require the development of till, gravel and rock borrow areas along the access corridor. Noise and dust will be controlled and monitored as described in the management plans and impact matrix.

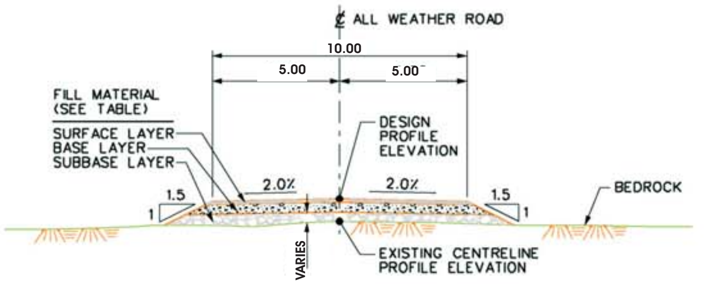
For the purpose of this study, it was assumed that mine production equipment would be used for construction of the access road. On arrival in Baker Lake on the summer barge, the equipment would be assembled and immediately commence road construction. The road would be advanced from both Baker Lake and Meadowbank simultaneously by using the current complement of construction equipment already staged at Meadowbank.

Construction of the access road will require the construction of up to five bridges. The waterways crossed by the bridges are shallow, being less than one meter in depth and do not exceed 13 m in width.

It is proposed that prefabricated steel “logging type” bridges be used for the crossings.

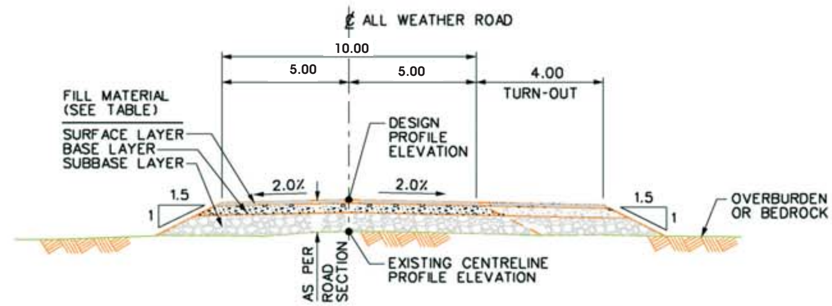
The “logging type” bridges are typically built in two sections and are connected together after placement on the bridge supports or abutments. The bridge sections are manufactured in lengths of 6, 9, 12, and 15 m and are 2.3 m in width.

The bridge deck is checkered plate steel with an anti-slip surface. Pockets are provided along the edge for the installation of guard rails. Lifting points are provided for lifting the bridge sections into position on the abutments and no in stream access is required.

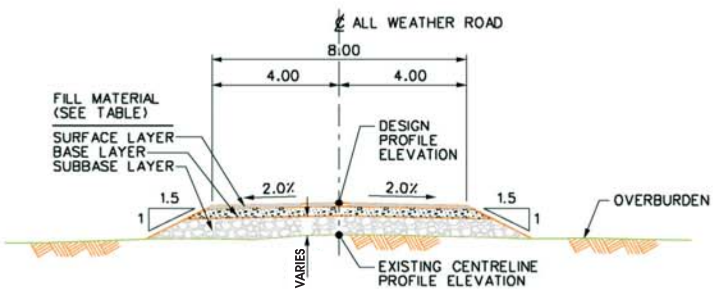


TYPICAL ALL WEATHER ROAD SECTION
ON BEDROCK OR WELL-DRAINED GRANULAR SOILS
NTS

LAYER	THK.	MATERIAL DESCRIPTION
ALL WEATHER ROAD		
SURFACE	150mm	50mm CRUSHED ROCK
BASE	300mm	NATIVE / ROCK FILL
SUBBASE	0.6m TO 1.6m	COARSE NATIVE TILL / ROCK FILL



TYPICAL ALL WEATHER ROAD WITH TURN-OUT
NTS



TYPICAL ALL WEATHER ROAD SECTION
ON ICE-RICH SOILS
NTS

CUMBERLAND RESOURCES LTD.

Meadowbank Gold Project

Tehek Lake Access Road

Typical Sections

The bridge is supported on abutments constructed on each side of the waterway and do not encroach on the watercourse.

A number of different abutment constructions can be utilized depending on the soil conditions encountered at each bridge site. The abutments can be rock filled timber cribs, rock filled Gabion or wire mesh baskets, or rock filled corrugated steel bins. No concrete constructions or pile foundations are expected. The bridge bearing seats will be either wood timber or structural steel.

Approach ramps will be conventional road section construction comprised of a base layer of coarse rock, a transitional zone of finer rock, and a travel surface of crushed rock.

Logging type bridges are considered to be temporary in nature and on decommissioning of the access, the structures are removed and the abutments disassembled leaving no evidence of their construction. No in stream work or access is required for either the installation or the removal of the structures.

The access road will also require the installation of numerous drainage culverts to provide for the unrestricted flow of surface water. Due to the low relief of the terrain and seasonal nature of the flows, most of the installations will be performed in the dry, or when frozen, that is without water flowing in the drainage course. Culverts will be of corrugated galvanized steel or HDPE (high density polyethylene) and will be sized to accommodate the maximum expected flow.

A typical culvert installation begins with the determination of the low points in the roadway profile and preparing the base to accept the pipe. Base preparation requires grading the bed to remove cobbles and create a depression for the application of a bedding sand cushion. Following compaction of the bed the culvert is placed to the design alignment and grade and the pipe is then backfilled by hand to the spring line of the pipe with fine grained granular material. Compaction of the backfill material is achieved with vibratory plate tampers and the material is placed in shallow lifts between compaction activities.

Once backfill to the spring line has been completed, the remaining backfill will be placed by machine and compacted with large mechanized compactors. Well graded granular material is used for the backfill adjacent to the pipe. General fill will be the specified road construction materials.

The culvert will have sufficient bury to withstand the loads to be applied. The roadway surface may be superellevated at the culvert location to achieve the required bury.

At mine closure, all culverts and bridges would be removed and the road bed decommissioned and scarified to promote natural vegetation.

Transportation Equipment

The road is assumed to operate year-round with allowances for shut-down due to weather conditions and repairs. For the purpose of the study it was assumed 15 days would be lost due to weather (white-outs) and 30 days due to road repairs so the road would be available 320 days/year.

For the purposes of the study, it was assumed that Cumberland would own and operate the freight hauling operation to site. The equipment and staffing required were estimated using data provided by experienced northern transportation companies.

The haul fleet would operate seven days/week all year long. Using conservative assumptions for a freight scenario, it is estimated that three trucks, with tandem trailers, making two hauls per day between Baker Lake and site, could adequately maintain the flow of material. The Owner's transport fleet would consist of:

- 5 tractor / tandem trailer units
- super B tanker trains
- 1 mechanics truck for on-road servicing
- light maintenance shop / office facility / storage for lube and spare parts
- staff of 12 persons.

Transport equipment would be radio controlled and passing would be at the established pullout locations. Traffic will be left hand drive to safely accommodate the large rock trucks. Left hand drive is most commonly used with large haul trucks as it locates the driver nearest the edge of the haul road for best visibility of the road edge. Site roads will not serve anyone other than mine operations personnel. The mine site would be restricted to authorized mine personnel only for safety reasons, similar to all such industrial sites elsewhere in the world.

As outlined in the matrices and the Terrestrial Ecosystem Management Plan, speed limits will be set and wildlife given right of way. Any wildlife sightings and/or collisions will be recorded in a wildlife log. In addition, wildlife will be surveyed along the access road by environmental staff at least two times per week.

Impacts of Road

As shown in the impact matrices, with proper mitigation and monitoring there are not expected to be any significant residual impacts from the road during construction, operation, and closure phases of the Meadowbank project. Nineteen stream crossings are proposed between Baker Lake and Meadowbank Camp. None of the streams crossed are more than 2 m deep and most are ephemeral, boulder field streams that flow primarily during spring freshet. Six of the streams contain migratory and/or spawning populations of Arctic grayling, as well as small numbers of lake trout, round whitefish, lake cisco, and Arctic char. Several small, ephermeral streams contain small numbers of ninespine stickleback. Impacts on water quality and physical features and fish movement within streams crossed by an all-weather road will be minimized through a combination of avoidance, prudent selection of crossing locations, properly installed bridges and culverts, armoring of shorelines to prevent erosion and adherence to DFO guidelines for culvert sizing and swimming velocity to allow fish passage at all times.

Five of the stream crossings will require bridges because of stream width and discharge volume. Bridges do not impede fish passage and are preferred by DFO. Small, ephemeral, low flow stream channels will be crossed by properly-sized culverts that will allow fish passage at all times. All but one stream crossed by culverts are relatively small and are not used by any other fish species except stickelback. Most culverted streams are not associated with fish-bearing headwater lakes and are not used by fish.

Hunting and fishing will not be allowed by mine employees along the access road (see Terrestrial Ecosystem Management Plan).

Access to lakes north of the community of Baker Lake by its residents is currently possible by snow machine and all-terrain vehicle. Whitehills Lake is a traditional hunting and fishing area that is regularly visited by Baker Lake people. The all-weather road will not substantially improve access to areas that are not routinely used and no significant adverse impacts on the aquatic and terrestrial environment along the access road are predicted, although some increases on local caribou harvest rates can be expected (overall harvest rates within the Baker Lake community are not expected to change significantly).

4.10.1.10 Borrow Pits

NIRB's Comment:

Update required for borrow pits for access road.

Cumberland's Response:

Borrow sites are along Baker Lake to Site access road. Borrows are expected to be located approximately every five kilometers along the route. They were identified in summer 2005 geotechnical studies, and are described in the "Road Alignment Quarry Site Geochemistry" report. Mitigation for the borrow pits is outlined in the impact matrices.

Test Pitting & Soil Sampling

To assess ground conditions and permafrost depths, 44 hand-dug soil pits were excavated along the proposed route. Samples of overburden material were collected from all 44 test pits. A selected number of samples were submitted for additional laboratory testing. The following table describes the samples collected, and the conditions observed in the field.

Characteristics of Soil Sample Test Pits

Site	Depth (m)	Soil Type	Comments
Soil-1	0-0.4	Brown silt, some clay, gravel and sand	Wet
Soil-2	0-0.3	Light brown silty Sand and Gravel	Dry
Soil-3		Sand, some gravel	No sample
Soil-4		Till	No sample
Soil-5	0-0.3	Grey brown Silt, some clay, fine gravel and sand	No GPS point
Soil-6	0-0.3	Till	
Soil-7	0-0.3	Light brown Silt, some sand, clay and gravel	

Site	Depth (m)	Soil Type	Comments
Soil-8	0.4-0.6	Grey sandy Silt with gravel	No GPS point
Soil-9	0-0.3	Till	Very stiff and hard to dig
Soil-10	0-0.3	Till	Small holes showing trace of melted ice, soil around the hole is swelling, not able to dig deeper
Soil-11		Till	Dry, no sample
Soil-12		Till	Dry, no sample
Soil-13		Till	Dry, no sample
Soil-14	0-0.5	Light brown sandy Silt, some clay and gravel	Softer in the bottom than Soil-8
Soil-15		Plastic Till	Wet, no sample
Soil-16		Till	Wet, no sample
Soil-17	0-0.35	Till	Drier than others places, no trace of permafrost
Soil-18	0-0.3	Brown silty Sand mixed with weathered rock	Very difficult to dig deeper, to much rocks
Soil-19	0-0.4	Till	Very stiff at the bottom, no trace of permafrost
Soil-20		Dark brown clayey Silt, some sand and gravel	
Soil-21		Till	Permafrost at 0.6 to 0.7 m
Soil-22	0-0.5	Dark brown clayey Silt, some sand and gravel	Soft at the base of pit, sandier at the surface
Soil-23	0-0.3	Brown Silt, some gravel, trace of sand and clay	No sample, rock at 0.3 m
Soil-24	0-0.7	Wet till	
Soil-25		Sand and Gravel	No sample
Soil-26	0-0.05	Weathered reddish rock	
Soil-27	0.4-0.5	Silty gravel	
Soil-28	0-0.4	Silty sandy Gravel	
Soil-29	0-0.5	Sand and Gravel	
Soil-30	0-0.6	Sand and Gravel	
Soil-31		Sand and Gravel	No sample
Soil-32	0-0.05	Till	Poorly-drained (type 4)
Soil-33	0-0.45	Ablation till	Sand and Gravel, well drained (type 2)
Soil-34	0-0.5	Grey clayey Silt, some sand and gravel	Permafrost at 0.5m
Soil-35	0-0.5	Grey brown Silt, some gravel, clay and sand	
Soil-36	0-0.5	Till	Poorly-drained
Soil-37		Dark brown clayey Silt, some sand and gravel	
Soil-38	0-0.3	Sand, some gravel	Nbn (permafrost classification), below 0.3 cm
Soil-39		Peat	Soft and wet peat over frozen peat, Vx (permafrost), no sample
Soil-40		Sandy till	Seems to have lost the sample
Soil-41		Sand	
Soil-42		Grey clayey Silt, some sand and gravel	
Soil-43	0-0.3	Grey sandy Silt, some gravel	Permafrost at 0.7 m, visible ice, inclusion of ice
Soil-44	0-0.5	Sand and Gravel	Collapsing hole, could not excavate deeper than 0.7 m deep

Summary of Rock Sampling

Sources of granular aggregate are relatively small in spatial extent, and are scarce along the proposed road alignment. It is expected that rock quarries will be developed along the road to provide a source of material for processed aggregates. An initial assessment of some proposed quarry sites has been undertaken to assess the potential for environmental effects associated with the aggregate sources proposed for road construction.

The local bedrock consists of rocks of igneous, metamorphic, volcanic, and sedimentary origin. Individual bedrock types tend to extend over large distances along the road route. Samples were collected from 20 potential quarry sites located along the proposed route. The criteria for selecting potential rock quarry sites were:

1. areas of exposed bedrock ideally 200 x 200 m in extent
2. moderate relief (i.e., 5 to 10 m or more from bottom to top of outcrop)
3. sites located away from surface waters
4. avoidance of areas that are heavily mineralised
5. avoidance of outcrops with deep, extensive, and open fractures/joints
6. avoidance, if possible, of areas with deeper overburden (>0.5 m)
7. avoidance of lee slopes (S, SSE, and SE) when possible
8. well-spaced sites (5 to 10 km apart), supplementary and closer site if only small outcrops are available.

Three composite rock samples weighing 3 to 5 kg each were collected at each potential quarry site situated within 1 km on either side of the proposed access road. A total of 53 samples were collected from 18 possible quarry sites. Most quarry site outcrops consisted of one relatively homogeneous rock type.

The suite of chemical analyses performed by CEMI includes whole rock and elemental solid phase chemistry, acid-base accounting (ABA) and analysis of metal leaching potential (shake flask extraction). Acid base accounting results were compared to guidelines presented by INAC (1992) for Northern Minesites.

Geology

The following table summarizes the lithology, sulphides, and iron staining of samples collected from each of the eighteen sample locations.

Rock Sample Location & Lithology

Station ID	Primary Lithology	Visible Sulphides	Iron Staining	Notes on Texture, Fabric, Weathering
2	Granite	None	None	Medium-grained, fresh to slightly weathered
3	Granite	None	traces on fracture surfaces	Medium-grained, fresh to slightly weathered
4	Granite-Granodiorite	None	None to trace	Fine- to medium-grained, fresh locally up to 0.5 cm weathering rind
5	Granite	None	None to trace on some fractures	Fresh, weakly foliated
7	Granite	None	Traces of iron staining, mostly on fractures	Fresh, fine- to medium-grained, weakly foliated
8	Quartzite	None to very minor	Iron staining on some surfaces	Fresh, fine- to medium-grained, weakly foliated
10	Granite/ Gneiss/ Quartzite	None	None to trace	Fresh, medium-grained
11	Felsite	None	None to trace	Fresh to slightly weathered, fine grained
11B	Andesite	-	-	Moderately weathered, fine-grained
13	Metawacke	None	None to trace	Fresh to slightly weathered, fine-grained
15	Metawacke	None	None to trace	Fresh to slightly weathered
16	Metawacke	Trace	Trace	Slightly weathered
17	Mafic wacke/granite gneiss	None	Trace	Slightly weathered
18	Mafic Volcanic	None	Minor to trace	Slightly weathered
19	Granite	None to trace	None to trace	Fresh to slightly weathered
20	Granite	None	Traces on fracture surfaces	Fresh
21	Granite	None	Trace	Fresh
22	Granite	None	Trace	Fresh, weakly foliated

None of the samples exhibited visible sulphides in greater than trace amounts, and iron staining was generally minor.

Summary of Analytical Results

Station	Sample ID	Rock Type	CCME Exceedances	ARD Potential (INAC, 1992)
2	P2-2	Granite	Al, Cu	NPAG
3	P3-2	Granite	Al, Cu, Se	NPAG
4	P4-2	Granodiorite	Cu, Se	NPAG
5	P5-2	Granite	Al, Cu, Se	NPAG
7	P7-2	Granite	Al, Cu, Se	NPAG
8	P8-2	Quartzite	pH, Cu, Se	NPAG
	P8-3		pH, Al, Cu, Se	NPAG
10	P10-2	Granite/ Gneiss/ Quartzite	pH, Al, Cu, Se	NPAG
	P10-3		pH, Al, Cu, Se	NPAG
11	P11-2	Felsite	Al, As, Cu, Se	NPAG
	P11-3		Al, Cu, Se	NPAG
11B	P11b-2	Andesite	Al, Cu, Se	NPAG
	P11b-3		Al, As, Cu, Se	NPAG
13	P13-2	Metawacke	Al, Cu, Se	NPAG
15	P15-2	Metawacke	Al, Cu, Se	NPAG
	P15-3		Al, Cu, Se	NPAG
16	P16-2	Metawacke	Cu, Se	NPAG
17	P17-2	Mafic wacke/ Granite gneiss	Cr, Cu, Se	NPAG
	P17-3		Cr, Cu, Se	NPAG
18	P18-2	Mafic Volcanic	Cu, Se	NPAG
19	P19-2	Granite	Se	NPAG
20	P20-2	Granite	pH, Al, Cu, Se	NPAG
21	P21-2	Granite	pH, Al, Cu, Se	NPAG
22	P27-2	Granite	pH, Al, Cu, Se	NPAG

Note: NPAG: not potentially acid generating.

Results of whole rock and elemental analyses confirm an abundance of aluminosilicate minerals within the majority of the rock types. Aluminosilicates, such as feldspar and mica, which are typically present in the rock types being studied, provide some amount of acid neutralization potential, although they are less reactive (slower reaction kinetics and lower buffering pH) than carbonate minerals such as calcite or dolomite.

ABA results indicate that all samples are non acid generating, based on their neutralization potential ratio (NPR above 2 as per INAC (1992) guidelines), or based on their very low sulphide sulphur content.

Rock leachate pH values range from acidic to alkaline. Six of 24 samples are outside of the freshwater CEQG range for pH. The following metals exceed the freshwater CEQG for at least two samples: aluminum, arsenic, chromium, copper, and selenium. These exceedances do not necessarily imply non-compliance of actual on-site drainage water quality. Concentrations of these constituents are expected to decrease with time, as soluble salts are flushed from the excavated rock.

Although quarry sites 8, 10, 21, and 22 have a sulphide content that is expected to be too low to generate ARD, consideration should be given to avoiding these quarry sites as a precautionary measure. The quality of runoff contacting the open quarry sites and the excavated rock should be monitored during construction to document the effect of exposure of the quarry rock on receiving water quality.

4.10.1.11 Sewage Treatment & Disposal

NIRB's Comment:

Provide volumes and chemical composition of the effluent. Provide the location of the treatment system.

Cumberland's Response:

A pre-fabricated, modular-type accommodation complex for 200 persons will be supported with a sewage treatment, solid waste disposal, and potable water treatment plant. The sewage treatment facilities will be housed in a modular structure adjacent to the camp. Sewage will be collected initially from the accommodation complex during construction, and during operations, from the office area and change room facilities. Grease traps will be provided to handle the flow from the kitchen and shop sewers. The plant will be sized for an on-site construction workforce of 300 persons, while the average number of operations personnel will be around 200 people. Sewage treatment will be carried out as part of the camp facilities.

During construction, the treated effluent and grey water will be discharged to Third Portage Lake. During operations, the effluent will be pumped to the tailings pump box, then to the tailings impoundment area. The sewage volume to the tailing impoundment is estimated to be a maximum of 1.5%. Consequently, the chemical load from sewage water is of low significance relative to that of the tailings water quality and overall mine site water quality. Operations use will be designed to meet Nunavut discharge requirements. Therefore, the inclusion of sewage water in the tailings impoundment facility is not expected to significantly affect the water quality within the tailings impoundment, and would be within the accuracy of the current modelling.

The sewage treatment plant will be a rotating biological contactor (RBC) or a sequencing batch reactor (SBR) unit sized for the maximum camp capacity of 350 persons during construction although 200 persons will be the operational load. The RBC's and SBR will be part of the camp complex although separate from it. It will be connected to the camp and mill by arctic corridors. Two grease interceptors will be supplied, one at the kitchen and one at the mill. The design criteria for the effluent is 25 mg/l BOD and 25 mg/l TSS. It is expected the camp would generate 37.8 m^3 per day.

4.10.1.11 Solid Wastes & Sewage Sludge

NIRB's Comment:

Provide information on landfill and solid wastes including sewage sludge.

Cumberland's Response:

Solid waste from the accommodation camp, kitchen, shops, and offices will be burned in a waste incinerator. This will be diesel-fired and located in a prefabricated structure downwind of the facilities. Waste will be transported by pickup truck and loaded into the incinerator. Non-burnable waste will be buried in the mine waste dump. Organic materials, which include but are not limited to, paper, wood, food waste, and sewage treatment sludge, will be incinerated, and the ash will be placed within the tailings impoundment.

4.10.1.12 Location of Power House

NIRB's Comment:

Show on map

Cumberland's Response:

Although not labeled it is shown on Figure 2.5 in the DEIS, it is located in a separate building to isolate it for noise and fire risk adjacent to the tank farm above the label PLANT SITE.

4.10.1.12 Energy Balance

NIRB's Comment:

Update based on potential increase of energy requirements.

Cumberland's Response:

As previously discussed, there is no increase in energy requirement from that discussed in the DEIS. The estimated average annual fuel consumption for Meadowbank per current feasibility study is 41 M litres diesel per year, made up of 27 ML for power generation and 14 M litres for mining and mobile equipment.

4.10.3 Ore Processed per Day

NIRB's Comment:

Update required.

Cumberland's Response:

There is no change in the ore processed per day from that discussed in the DEIS. Approximately 7,500 to 5,500 tons of ore will be processed daily.

4.10.3 Factors Considered in Decision on Future Ore Bodies

NIRB's Comment:

The Proponent shall specify which factors would be considered in deciding whether to develop other ore bodies (e.g., respect of regulations, approval by affected communities of management and reclamation plans, compliance with conditions of Impact and Benefits Agreements ("IBAs"))

Cumberland's Response:

The economic viability of any new deposit will be the main factor in deciding whether to develop the deposit or not. Viability would be enhanced by higher grade, lower strip ratio, and larger size, but reduced by increased haul distances, diking requirements, potential metallurgical difficulties and permit issues. Another 4 gm/tonne deposit containing a million ounces of gold within the current feasibility study parameters could be economic up to 30 km from the proposed plant site.

4.10.5 Technology

NIRB's Comment:

Discuss how developments in technology will be monitored.

Cumberland's Response:

Cumberland will use the most up to date technology for building the mine provided it has a proven track record in arctic mining. In designing the mine infrastructure, Cumberland has relied on experienced companies Golder and AMEC to ensure that the most recent technologies are employed in the mine. Once the mine is constructed and operating, we will continue to keep abreast of the latest information in reclamation, permafrost management, community development, and environmental monitoring.

4.11 PREFERENCES IN RESPECT OF ALTERNATIVES

NIRB's Comment:

The Proponent shall present the preferences of those consulted respecting alternatives to the project including the "no-go" alternative.

Cumberland's Response:

Cumberland has gathered public input respecting alternatives to the project including the "no-go" alternative through public meetings since 1996, targeted interviews and through a three day impact workshop in 2003. The Hamlet of Baker Lake and other Kivalliq communities are supportive of the project, assuming successful negotiation of an IIBA. Baker Lake residents have indicated considerable support for an all-weather road. The “no- go” alternative is not the preferred option.

4.13.1 Vegetation Contaminant Loading

NIRB’s Comment:

The health of these species/communities and their contaminant loadings.

Cumberland’s Response:

A program to monitor contaminants, specifically heavy metals within near-field, far-field and reference areas, stratified by vegetation community (e.g., lichen, heath-sedge) has been designed and will be implemented in 2005. Food chain models will be used to predict uptake of metals and tissue concentrations in aquatic and terrestrial receptors.

4.13.2 Wildlife Contaminant Loading

NIRB’s Comment:

The health of these species populations and their contaminant loadings.

Cumberland’s Response:

Food chain models will be used to predict uptake of metals and tissue concentrations in aquatic and terrestrial receptors, through a Screening Level Risk Assessment (see response above), a modeling exercise recognized by Health Canada. In addition, threshold contaminant levels for various mammalian receptors will be established through this process.

Destructive sampling of wildlife is not warranted at this time.

4.13.3 Birds Contaminant Loading

NIRB’s Comment:

The health of these species populations and their contaminant loadings.

Cumberland’s Response:

Food chain models will be used to predict uptake of metals and tissue concentrations in aquatic and terrestrial receptors, through a Screening Level Risk Assessment (see response above), a modeling exercise recognized by Health Canada. In addition, threshold contaminant levels for various avian (e.g., waterfowl) receptors will be established through this process.

4.14 RATIONALE FOR SELECTING COMMUNITIES FOR BASELINE DATA COLLECTION

NIRB's Comment:

The Proponent shall provide a rationale for the selection of communities for which baseline data are provided.

Cumberland's Response:

Baseline data are provided for Baker Lake, Kivalliq Region, and Nunavut. With Cumberland's intent to preferentially hire and procure in Baker Lake, the expectation is that community level effects as a result of the project will be experienced only in Baker Lake. This is not to suggest that individuals from Kivalliq Region and Nunavut as a whole will not benefit, but simply that given project needs and unemployment, education and population statistics, it is unlikely that any other community would see enough of their people employed by, or businesses involved in, the project to represent potential for community level effects.

This rationale is explained, referred to and/or discussed in the Socioeconomic Baseline Report (Section 1) and in the Socioeconomic and Archaeology Impact Assessment (Sections 2.3 and 3.2). The Socioeconomic Management Plan provides the context for this rationale, in terms of Cumberland's employment and procurement policies.

4.14 DESCRIPTION OF THE SOCIO-ECONOMIC ENVIRONMENT -SOCIAL ASSISTANCE CASES

NIRB's Comment:

Social Assistance cases.

Cumberland's Response:

Neither the Government of Nunavut nor the Government of Canada is publicly reporting on social assistance cases. The National Council of Welfare (NCW), a citizens' advisory body to the Minister of Social Development Canada on matters of concern to low-income Canadians, reports 7,300, 7,300, 8,100, and 7,100 welfare recipients in Nunavut for the years to March 2000, 2001, 2002, and 2003, respectively.

4.15 BOUNDARIES FOR SOCIO-ECONOMIC ASSESSMENT

NIRB's Comment:

The boundaries for socio-economic assessment shall be based on an analysis of the socio-economic effects directly and indirectly associated with the project.

Cumberland's Response:

See response regarding communities for which baseline data was provided, above. The socioeconomic assessment considered, depending on the expected effect, Baker Lake, the region of Kivalliq, Nunavut, and for macroeconomic effects, Canada.

4.15 TEMPORAL BOUNDARIES

NIRB's Comment:

The temporal boundaries of the post-closure period may encompass many years, depending on the site and on the methods of closure. The Proponent shall give a rationale and justification for the boundaries chosen, including a description of any consultation with members of the public or technical experts.

Cumberland's Response:

As indicated in Section 4.16 of the DEIS, temporal boundaries for the post-closure period can extend for 25 years depending on monitoring results. This boundary is based on expert advice and current Nunavut regulations. The actual length of post closure monitoring will be included in the various licenses and permits.

4.17 QA/QC ON SAMPLING RESULTS

NIRB's Comment:

The reliability and scope of the results, the possibility of reproducing the analyses (repeatability), and quality control of laboratory analyses shall be analyzed critically. Provide QA/ QC analyses for results. All data based on environmental sampling necessarily involve some variability, which must be determined to assess the reliability and scope of the data. The Proponent shall, for all data obtained from environmental sampling, provide a dispersion or variability coefficient (variance, standard deviation, or preferably 95 % confidence interval, etc.) and indicate the size of the sample used. Provide as part of QA/QC analyses.

Cumberland's Response:

All surface drainage water and groundwater samples as well as rock, tailings and overburden samples that were collected for analysis were subjected to Quality Control/Quality Assurance measures to minimize errors, optimize sample representation and analytical repeatability in order to maximize the reliability of the results.

Groundwater Samples

Water sampling of the wells was conducted to obtain representative samples of the actual groundwater within the screen interval. Guideline procedures presented in USEPA (2002) were followed, including the following:

- measuring of field parameters at selected intervals until 3 stable readings (within 10% of each other) were acquired
- minimizing the exposure of the sampled water to the atmosphere
- using compressed, inert (nitrogen) gas to evacuate samples (from MW03-03[1])
- conducting in-situ measurements of sensitive chemical parameters (pH, dissolved oxygen, alkalinity, redox, where applicable)
- refrigerating samples at 4°C immediately after collection until shipment to the laboratory
- shipping the samples to the laboratory in temperature-regulated coolers within the specified sample holding times.

Upon collection of each sample, standard chain of custody procedures were adhered to. Field blanks and duplicates were also collected during sampling.

Rock & Tailing Sample Representativeness

The objective of a quality assurance/quality control (QA/QC) program is to ensure that the samples collected are representative of the material present on site, and that reported results are defensible and within an acceptable level of accuracy and precision. The tailings were generated from the metallurgical processing circuit, from samples of ore considered representative of each deposit, with Third Portage ore considered representative of North Portage ore. All available decant waters were analyzed such that QA could be evaluated on the leachate solutions of the recombined tailings against those of mixed concentrate and tailings in a 20:80 mixing ratio.

Rock Sampling & Rock/Tailing Analytical Quality Control

A consistent sample collection procedure was applied for all rock samples obtained within this program. Each sample was bagged individually to avoid cross contamination, and was labelled with the sampling date, project number and a unique sample identification number. All rock samples were then shipped to the analytical laboratory along with copies of sample documentation. Similar analytical methodologies were used on all solid samples (rock, overburden, and tailing) to allow comparison of results. Analytical methods used are described in Appendices IV (SGS Lakefield Laboratory) and V (CEMI and ALS Laboratories). To assess laboratory analytical precision, replicate ABA analyses were performed on one overburden sample, two mine site infrastructure rock samples, fifteen pit rock samples and one tailing sample. Laboratory replicates of SFE leachate solutions and trench water samples were also completed by the laboratory. The relative percent differences (RPDs) for replicated analyses were calculated and their precision evaluated.

All sample preparation, preservation, quality assurance (QA), quality control (QC), sample submission and test protocols were conducted in accordance with ASTM and USEPA standards for environmental sampling and analysis. Samples were collected and prepared by Lakefield technicians. The liquid

[1] Compressed nitrogen was unavailable on site while the other three wells were being sampled, and therefore this method could not be used at these wells.

decant was preserved using ultra trace reagents. Analytical methods to determine the concentrations of parameters included standard accredited QA/QC procedures. The Laboratory Information System (LIMS No.) sample identification will correlate to the certificates of analysis.

Kinetic Testing Quality

Timing of leaching cycles was consistent throughout the testing, and all leachates were collected in a similar manner. All solutions were submitted to the same laboratory (ALS of Vancouver), with periodic samples collected in duplicate and sent to a different laboratory (Cantest of Vancouver). A total of 17 inter-laboratory duplicates were analyzed, representing 9% of the total amount of solution analyses completed. The relative percent differences (RPDs) for duplicate analyses were calculated and their precision evaluated. The RPD objective for duplicate aqueous samples is 20%, below which analytical results are considered to have acceptable precision (USEPA, 1994).

Data Analysis, Analytical Repeatability

Analytical results from the duplicate pairs (a duplicate pair consists of the concentration of a given parameter in the original sample and that of the same parameter in the duplicate sample) were compared and the relative percent difference (RPD) was calculated for each set of results greater than or equal to 5 times the method detection limit (MDL). For these results, a water quality objective of less than 20% RPD was established as per USEPA recommended methods (USEPA, 1994). Where one or two results of the duplicate pair were less than 5 times MDL, a margin of +/- MDL was considered acceptable.

Quality Control

Every batch of samples will contain at least 10% duplication and two certified third party standards. Corrective Actions: 1) Check all record keeping to ensure that no errors have been made in the analysis procedure; 2) Examine ICP for any physical reason for the failure. If an obvious problem is detected, re-analyze the existing digested sample solutions for the entire batch; 3) If the above fails to produce passable data or if an obvious problem is not detected, re-digest and re-analyze the entire batch from the beginning; 4) Be sure to double check all sample labelling and record keeping.

4.18 STATEMENTS ABOUT RELEVANCE ETC. OF DATA

NIRB's Comment:

The Proponent shall provide clear statements regarding the availability, relevance, and quality of the data.

Cumberland's Response:

All of Cumberland's data is available to anyone who requests it. To ensure the relevance and quality of the baseline data collected, qualified specialists were hired to collect and interpret the data and qualified labs used to analyze the data. In addition, all reports were sent out to external experts for review before being included in the DEIS.

4.19 CONSULTATION DURING SIGNIFICANCE DETERMINATION

NIRB's Comment:

Hence, the concerned communities, as well as other individuals and organizations, shall be fully consulted in defining impact significance.

Clarify how this was done.

Cumberland's Response:

Cumberland has gathered public input to determine significance of the impacts since 1996 through numerous public meetings, targeted interviews, and a three day impact workshop in 2003 as detailed on Table 4.3 pg 31 to 35, Volume 1 DEIS. Questions asked during interviews of the elders included: Are you worried about the mine development on the land and water? Are you worried about the effect mine development will have on the fish? Can you suggest ways to ensure the protection of wildlife at the project? What kinds of input and participation would you like to have in planning and monitoring the project? Are there any aspects of the project that you need further explanation about or have concerns about? The three day impact workshop held in Baker Lake in 2003 included representatives' from the Hamlet council, elders, CLARC, HTO, youth and members of the general public. At that meeting, a translated impact matrix was used and each VEC and VSEC was discussed with expected impacts from the various mine components as well as the proposed mitigation and monitoring plans. Cumberland was presented with an award at the 2005 Nunavut Mining Symposium in recognition of its decade of community consultation and community involvement.

4.19 ASCERTAINING SIGNIFICANCE INTERVENERS ASSIGN TO IMPACTS

NIRB's Comment:

The Proponent shall describe how it will ascertain the significance that different interveners assign to each impact and how it will proceed if different interveners ascribe varying significance to VECs, VSECs, or the associated impacts.

Cumberland's Response:

Until the technical review is completed, we will not know if the interveners have different opinions significant from those included in the DEIS and supporting documents.

4.19 CONSENSUS ON SIGNIFICANCE OF IMPACTS

NIRB's Comment:

If it is impossible to attain a consensus on the significance of certain impacts, the Proponent shall present the range of viewpoints expressed and shall present and justify its preference, if any.

Cumberland's Response:

Cumberland has gathered public input to determine significance of the impacts since 1996 through numerous public meetings, targeted interviews, and a three day impact workshop in 2003 as detailed on Table 4.3 pg 31 to 35 Volume 1 DEIS. Questions asked during interviews of the elders included: Are you worried about the mine development on the land and water? Are you worried about the effect mine development will have on the fish? Can you suggest ways to ensure the protection of wildlife at the project? What kinds of input and participation would you like to have in planning and monitoring the project? Are there any aspects of the project that you need further explanation about or have concerns about? The three day impact workshop held in Baker Lake in 2003 included representatives' from the Hamlet council, elders, CLARC, HTO, youth and members of the general public. At that meeting, a translated impact matrix was used and each VEC and VSEC was discussed with expected impacts from the various mine components as well as the proposed mitigation and monitoring plans. To date no differences have been identified. Until the technical review is completed, we will not know if the interveners have different opinions significant from that included in the DEIS and supporting documents.

4.20 ROLE OF CONSULTATION IN INDICATORS & CRITERIA SELECTION

NIRB's Comment:

In doing so, the Proponent shall describe the role played by consultation with members of the public and technical experts.

Cumberland's Response:

Cumberland has gathered public input to determine significance of the impacts since 1996 through numerous public meetings, targeted interviews, and a three day impact workshop in 2003 as detailed on Table 4.3 pg 31 to 35 Volume 1 DEIS. Questions asked during interviews of the elders included: Are you worried about the mine development on the land and water? Are you worried about the effect mine development will have on the fish? Can you suggest ways to ensure the protection of wildlife at the project? What kinds of input and participation would you like to have in planning and monitoring the project? Are there any aspects of the project that you need further explanation about or have concerns about? The three day impact workshop held in Baker Lake in 2003 included representatives' from the Hamlet council, elders, CLARC, HTO, youth and members of the general public. At that meeting, a translated impact matrix was used and each VEC and VSEC was discussed with expected impacts from the various mine components as well as the proposed mitigation and monitoring plans. In addition to the public input, qualified specialists were hired to collect and interpret the data and qualified labs used to analysis the data. In addition, all reports were sent out to external experts for review.

4.21.1.2 Characteristics of Processed Ore

NIRB's Comment:

The characteristics and toxicity of the processed ore, including fines, and windblown dust.

Cumberland's Response:

The chemical, mineralogical and physical characteristics of tailings as well as process water quality have been described in the DEIS and supporting documents. The tailings are expected to have a grain size of up to 50 to 60 µ. The tailings are detoxified of cyanide and made up of mostly pyrite and pyrotite. They are expected to be acid generating. Under the mine and waste management plan, process water will be recycled to the mill and will not be discharged to the receiving environment until the tailing reclaim pond is drained at closure, at which time the tailing water will be treated before discharge: The tailing impoundment will be operated to minimize dust generation and upon closure will also be designed to minimize dusting. The potential for dust generation from the tailings facility will be reduced after the placement of the cover, or capping, material. The particle size and minimum durability of the cover materials will be assessed in the detailed design phase to limit the potential for dust generation or erosion. These aspects, together with the eventual freezing of the tailings in the containment area are such that the potential impacts of processed ore containment area on the receiving environment are expected to be minimal.

4.21.1.3 Metal Content of Groundwater

NIRB's Comment:

The metal content of frozen groundwater in the waste rock.

Cumberland's Response:

Considering the expected chemical characteristics of frozen waster rock pile pore water (rock pile groundwater) (Section 4.10.1.4 response), the small amount of drainage water that is expected to be generated in the summer will be collected in the attenuation pond and treated, if necessary, before discharge. Fluctuations in water quality will be monitored and managed before discharge such the overall effect of frozen waste rock groundwater quality on the receiving environment is expected to be minimal.

4.21.1.3 Suitability of Overburden for Reclamation

NIRB's Comment:

The suitability of the overburden as a substrate for reclamation activities.

Cumberland's Response:

The overburden materials are expected to be till. Some of the till will be used in the construction of water and tailings retaining dykes (cutoff and core of dykes). The balance may be placed in the waste rock storage areas, either mixed with the waste rock. There are no plans to use this material for reclamation activities. Similarly, soft sediments are expected to be present on the lake floors. These sediments will need to be removed to beyond the footprint of the tailings dyke and the open pits after the lakes have been drawn down. It is expected that the sediments will be either disposed of in the tailings impoundment or the Portage rock storage facility.

During the development of certain areas of the mine site, some organic materials may need to be excavated. This may be particularly true in poorly drained, low-lying areas where thick organic mats may form. Where possible, this material will be stockpiled for potential use during reclamation activities.

4.21.1.3 Potential for Re-vegetation

NIRB's Comment:

The potential for re-vegetation.

Cumberland's Response:

The final surface of the processed ore (tailing) impoundment and of the Portage and Vault waste rock pile is expected to consist of relatively large diameter run-of-mine waste rock (ultramafic waste rock cover over the Portage rock storage facility and the tailings containment area). This coarse material is not expected to sustain vegetation, hence these structures will not be re-vegetated.

4.21.1.14 Impacts of Exploration Activities

NIRB's Comment:

The Proponent shall assess the potential impacts of exploration activities, whether by the Proponent or others that utilize project infrastructure.

Cumberland's Response:

As discussed in the Cumulative Effects Assessment, exploration activities by Cumberland are not expected to have an adverse impact on the environment. Drill rigs will be moved by a helicopter in the summer months and pulled over the snow and ice in the winter therefore the tundra will not be impacted. The rigs are located at one location for a short amount of time and the area cleaned up before moving to the next setup. All exploration personal will reside at the mine site so no additional living facilities will be required. No other personal other than Cumberland's employees will use the project infrastructure.

4.21.2.3 Runoff Control & Treatment

NIRB's Comment:

Moreover, the Proponent shall indicate where day-to-day operational problems might occur, particularly regarding runoff control and treatment, and predict the effects of a worst-case scenario in which there is an uncontrolled release of contaminants, including, for example, hydrocarbons, nitrate-contaminated water, or cyanide into the aquatic environment.

Cumberland's Response:

Operational considerations relating to runoff control and treatment may arise from:

- spills in the process plant area or around mill site (machinery)
- spills during water transferring processes (pipe connections)
- overflows from interceptor channels, sumps or ponds
- fluctuations in the water treatment process.

While these potential problems can typically be avoided through the use of “best management practices,” the development of routine monitoring and maintenance programs and operating procedures to ensure that prompt measures are taken to minimize potential impacts will be required.

The monitoring and maintenance programs during operations would include but not be limited to the following items for consideration:

Aquatic Effect Monitoring

Cumberland will design and implement an Aquatic Effect Monitoring Program (AEMP) for both biological and water chemistry sampling.

Water Quality Monitoring

Cumberland will continue with the water quality monitoring program at current sampling stations and frequencies.

Environmental Monitoring during Operational Period

Cumberland will continue to develop the AEMP through consultation with regulators and communities on the elements and design specifications.

Hazardous Materials

The Meadowbank project will require the transportation to site, temporary storage, and use of hazardous materials on site as part of the normal every-day activities required during the pre-development, operation and closure stages of the project. All hazardous materials used on site will require safe use practices and environmentally acceptable disposal according to the Mine Act regulations.

Hazardous materials consist of industrial chemicals for process and water treatment and hydrocarbon products, including but not limited to diesel fuel, gasoline, aviation fuel, and lubricants. Hydrocarbon products will be stored on site and used to generate electrical power and operate the site equipment. Over the life of the mine operations, it is expected that releases of petroleum hydrocarbon products will probably occur at the fuel storage areas at the mine site and at the Baker Lake site and around the process plant facilities, maintenance shops and camp areas.

All potentially hazardous materials at the site, including materials in storage, spilled materials and materials generated from the demolition of buildings and equipment, would be collected and disposed of according to an approved plan and procedure. The selected procedures would be considered comparable to the current "best management practice" for disposal of the particular wastes. It is expected that the hazardous materials would be disposed off-site at approved disposal facilities.

Spilled Materials

In the event of a hydrocarbon spill, the released product will most-likely penetrate the ground surface and flow towards the water table. To limit the infiltration and loss of released products, design measures will be provided to contain the product at fuel handling locations, including a geomembrane liner, containment berms, fuel aprons, and collection sump. Additional measures to limit the release of product into open water bodies include containment ditches, skirted oil booms, and oil absorbent pads.

All hydrocarbon product spills associated to the mine operation and closure activities require written reporting to document the release and investigation to assess the nature and extent of the impacted area resulting from the spill. Remediation of the spilled material will be subject to the investigation results.

Spilled Tailings

Tailings will be produced as a waste stream from the process plant and discharged by pipeline to the tailings impoundment facility. The tailings impoundment is designed to safely contain the tailings and the seepage water discharge from the impoundment will be collected, monitored, and treated if required prior to discharging to the environment.

Tailings spills may occur within the process area, along the pipeline route or from the tailings impoundment. The site area and tailings line route is graded such that all site runoff and any tailings spills drain towards the tailings impoundment and/or collection sumps which will be drained by pump and pipeline to the impoundment facility. Regular monitoring of the tailings pipeline, collection sumps and impoundment facility is required during mine operations.

All tailings spills associated to the mine operation and closure activities require written reporting to document the release and investigation to assess the nature and extent of the impacted area resulting from the spill. Remediation of the spilled material will be subject to the investigation results.

4.21.2.5 Wildlife Bioaccumulation

NIRB's Comment:

Bioaccumulation and biomagnification of toxins.

Cumberland's Response:

The only contaminants of concern to wildlife are metals. Metals, except mercury, do not accumulate or biomagnify in wildlife and fish. Metal concentrations in soil and vegetation (i.e., lichens, berries, sedges) will be monitored regularly to determine contaminant loading (baseline samples were collected in 2005 at mine and reference sites). The potential risks to wildlife will be assessed by conducting a Screening Level Risk Assessment which uses food chain models (using baseline conditions in plants) to predict uptake of metals and tissue concentrations in receptors (e.g., caribou). Threshold levels, beyond which health risks to wildlife may occur, will also be identified. Where contaminant issues are identified, adaptive management will be used to ensure that exposure of wildlife to metals is minimized.

4.21.2.6 Birds Bioaccumulation

NIRB's Comment:

Bioaccumulation and biomagnification of toxins.

Cumberland's Response:

The only contaminants of concern to wildlife are metals. Metals, except mercury, do not accumulate or biomagnify in wildlife and fish. Metal concentrations in soil and vegetation (i.e., lichens, berries, sedges) will be monitored regularly to determine contaminant loading (baseline samples were collected in 2005 at mine and reference sites). The potential risks to wildlife will be assessed by conducting a Screening Level Risk Assessment which uses food chain models (using baseline conditions in plants) to predict uptake of metals and tissue concentrations in receptors (e.g., waterfowl). Threshold levels, beyond which health risks to wildlife may occur, will also be identified. Where contaminant issues are identified, adaptive management will be used to ensure that exposure of wildlife to metals is minimized.

4.21.2.7 Aquatic Organisms Bioaccumulation

NIRB's Comment:

Bioaccumulation and biomagnification of toxins.

Cumberland's Response:

The only contaminants possible from the mine are metals. Most metals accumulate to only a small degree in certain fish tissues, such as kidney and liver. Only mercury accumulates and biomagnifies in the food chain, with highest concentrations in fish. Fish tissue metals and mercury concentrations will be routinely monitored (see AEMP Document) to determine if changes from baseline concentration are occurring. Given the lack of effluent discharge and very low mercury concentration in water, no change in mercury concentration in aquatic biota is anticipated.

4.21.4 (f) Navigable Waters

NIRB's Comment:

The Proponent shall assess the potential impacts on socioeconomic and cultural components, taking into account navigable waters.

Cumberland's Response:

The project will have no socioeconomic effects related to navigation of waters in Kivalliq region.

4.21.4 Prices & Cost of Living

NIRB's Comment:

Prices and the cost of living.

Cumberland's Response:

Significantly inflationary effects in Baker Lake as a result of the Meadowbank project alone are not expected. High existing levels of unemployment, anticipated low levels of migration, limits on the presence of project workforces in Baker Lake itself and the systems for provisioning and housing in Nunavut itself are factors that will limit any potential for significant effects on prices and costs of living.

4.21.5 Justify Assumptions, Models etc. Cumulative Effects Assessment

NIRB's Comment:

The Proponent shall describe and justify all assumptions, models, and information limitations and associated levels of uncertainty.

Cumberland's Response:

All assumptions, models and information limitations or associated levels of uncertainty are outlined in the Cumulative Effects Assessment, submitted as part of the Final EIS.

4.23 SUMMARY OF IMPACTS TO HIGHLIGHT IMPORTANT ONES

NIRB's Comment:

The summary shall clearly highlight those impacts judged to be of greater importance and those that may require extensive mitigation measures and monitoring.

Cumberland's Response:

Table 4-25 included in the DEIS on page 180 lists all significant impacts that require mitigation and monitoring.

4.24.1 Overview Solid Wastes

NIRB's Comment:

Domestic and industrial solid wastes.

<u>Cumberland response:</u>

During pre-mining and mining operations, domestic and industrial solid wastes will be generated by the project. Appropriate solid waste management plans will need to be developed and implemented. Typically these will include, but not be limited to, the following activities.

Inorganic Solid Waste (Non-Hazardous)

Domestic and industrial inorganic solid waste will be segregated into material categories, including but not limited to concrete, metal, rubber, and plastic. Those materials deemed suitable for landfill deposition will be placed in a designated landfill area within the Portage waste rock storage facility. All other material considered unsuitable for landfill deposition will be packaged for shipment and disposal off-site.

Sewage Treatment & Organic Waste

The sewage treatment will be carried out as part of the camp facilities and the effluent will be treated to a Level 3 standard for discharge to the environment. Organic materials, including but not limited to paper, wood, food waste and sewage treatment sludge, will be incinerated and the ash will be placed within the tailings impoundment.

4.24.1 Human Resources

<u>NIRB's Comment:</u>

Human resources.

<u>Cumberland's Response:</u>

Management of Human Resources is discussed in the DEIS and FEIS, Socioeconomic Management and Human Resource Management plans, and in the IIBA.

4.24.1 Public Involvement

<u>NIRB's Comment:</u>

Public involvement, including a communications strategy N - Provide Public Involvement Plan as noted in Guideline 4.24.3.4.

<u>Cumberland's Response:</u>

See Public Involvement Plan included with this letter.

4.24.1 Security

NIRB's Comment:

Ability to post full security.

Cumberland's Response:

When the time comes, Cumberland will supply a bond or other form of financial security to the KIA as land owner and to the Nunavut Water Board as part of the water licence.

4.24.1 Negotiation of Agreements

NIRB's Comment:

Moreover, the Proponent shall discuss the negotiation of an agreement or agreements with the concerned communities that would permit them to participate fully in the planning, execution, and evaluation of mitigation measures. N - Include in Public Involvement Plan.

Cumberland's Response:

See Public Involvement Plan included with this letter.

4.24.2.1 Caribou

NIRB's Comment:

The Proponent shall discuss how it intends to use and/or support such initiatives as the Bathurst Caribou Management Committee.

Cumberland's Response:

Cumberland has presented the project and baseline survey results to The Beverly and Qamanirjuaq Caribou Management Board, and will be doing so again at their annual meeting in November 2005. The Board will be regularly updated with our activities. The Bathurst Caribou herd does not have any relation to this project.

4.24.3 Management of Impacts on Socio-Economic Environment

NIRB's Comment:

Human resources.

Cumberland's Response:

Management of Human Resources is discussed in the DEIS and FEIS, Socioeconomic Management and Human Resource Management plans, and the IIBA.

4.24.3 Management of Impacts on Socio-Economic Environment

NIRB's Comment:

Public involvement.

Cumberland's Response:

See Public Involvement Plan included with this letter.

4.24.3.1 Human Resources Plan

NIRB's Comment:

The Proponent shall prepare a Human Resources Plan, which might consider: human resources legislation; organization planning; succession and career plans; compensation plans and profit-sharing; benefit programmes (e.g., health care plan, work clothing and safety equipment, vacation leave); work rotation and pay schedules; health and safety programmes; hiring practices and procurement; skills and entry requirements; training and development; control of movements to and from the project site; on-site public safety with respect to firearms, while respecting the rights and needs of harvesters from adjacent communities to travel freely through the country; alcohol and drugs; smoking; sexual and gender harassment; employment for women; human resource information systems; labour relations (e.g., procedure for submitting grievances or concerns, disciplinary procedures); employee communications; incorporation of relevant IBA terms and conditions; and the use of and payment for municipal facilities and services in local communities.

Cumberland's Response:

Management of Human Resources is discussed in the DEIS and FEIS, Socioeconomic Management and Human Resource Management plans, and the IIBA.

4.24.3.4 Public Involvement

NIRB's Comment:

Provide Public Involvement Plan.

Cumberland's Response:

See Public Involvement Plan included with this letter.

4.26 MONITORING & FOLLOW UP

NIRB's Comment:

The Proponent shall present a Monitoring and Follow-Up Plan that includes compliance monitoring, (Compliance monitoring refers to verifying the Proponent's conformity with regulatory standard), *biophysical. Monitoring, (Biophysical monitoring involves the monitoring of such biophysical components as air, water, and land) and socioeconomic monitoring (Socioeconomic monitoring involves the monitoring of socioeconomic parameters, for example employment of Nunavummiut and other northerners and the purchase of goods and services in the Region).*

Cumberland's Response:

The Monitoring and Follow up Plans were submitted as supporting documents with the DEIS and FEIS. These documents include the Terrestrial Ecosystem Management Plan, the AEMP (Aquatic Effects Management Program), MMER (Metal Mining Effluent Regulations), the NNL (No-Net-Loss) plan, the Socioeconomic & Archaeology Management Plan, the Air Quality & Noise Management Plan, the Access & Air Traffic Management Plan, and the Reclamation & Closure Plan. These plans contain monitoring activities that will be continued as per the terms set out in existing regulations and as per those future terms that will be included in the future permits, licences, security bonds and leases that will be required before construction begins.

4.26.1 Distinguishing Natural from Project Change

NIRB's Comment:

How its monitoring programme would distinguish between natural environmental changes and those caused by the project.

Cumberland's Response:

Methods to distinguish between natural changes and project related changes can be found in the Terrestrial Ecosystem Management Plan, the AEMP, MMER, the NNL plan, the Socioeconomic & Archaeology Management Plan, and the Air Quality & Noise Management Plan. These include using reference lakes for aquatic changes (Figure 4.42 pg 199), continuing monitoring of wildlife on a regional and local scale to identify any changes in populations or distribution patterns, breeding bird surveys conducted before and after mine construction and at mine and reference sites, soil and vegetation sampling for contaminants before and after mine construction and at mine and reference sites.

4.26.1 Post Closure Monitoring

NIRB's Comment:

In the case of post-closure monitoring, the Proponent shall describe how long term monitoring will continue and shall identify who will assume the costs and responsibility, especially in the event of changes of corporate ownership.

Cumberland's Response:

The Monitoring and Follow up Plans were submitted as supporting documents with the DEIS. These are summarized in the DEIS and FEIS and can be found in the Terrestrial Ecosystem Management Plan, the AEMP, MMER, the NNL plan, the Socioeconomic & Archaeology Management Plan, and the

Air Quality & Noise Management Plan. These plans contain monitoring activities that will be continued as per the terms set out in existing regulations and as per those future terms that will be included in the other permits, licences, security bonds and leases that will be required before construction begins. Cumberland Resources will pay for the monitoring. This responsibility will be transferred to the new owners if there is a change of ownership.

4.26.1 Consultation on Monitoring Plans

NIRB's Comment:

The Proponent shall consult with all concerned regulatory authorities and stakeholders to maximize the chances that it proposes a clear, comprehensive, and proactive Monitoring and Follow-Up Plan.

Cumberland's Response:

Cumberland has gathered stakeholder input to determine significance of the impacts including monitoring plan since 1996 through numerous public meetings, targeted interviews, and a three day impact workshop in 2003 as detailed on Table 4.3 pg 31 to 35 volume 1 DEIS. Questions asked during interviews of the elders included: Are you worried about the mine development on the land and water? Are you worried about the effect mine development will have on the fish? Can you suggest ways to ensure the protection of wildlife at the project? What kinds of input and participation would you like to have in planning and monitoring the project? Are there any aspects of the project that you need further explanation about or have concerns about?

The three day impact workshop held in Baker Lake in 2003 included representatives' from the Hamlet council, elders, CLARC, HTO, youth and members of the general public. At that meeting, a translated impact matrix was used and each VEC and VSEC was discussed with expected impacts from the various mine components as well as the proposed mitigation and monitoring plans. Comments from regulators will come from the technical review.

Comments from regulators have also come from the technical review of the DEIS, and additional comments will be made through the technical review of the Final EIS. In addition, regular discussions have been held with Department of Fisheries staff (Derek Moggy) regarding the NNL plan and AEMP, and with Government of Nunavut, Department of Environment staff (Mike Setterington) regarding the Terretsrial Ecosystem Management Plan. Further discussions are anticipated as fine-tuning of these documents continues.

4.27 AUDITING & CONTINUAL IMPROVEMENT SYSTEM

NIRB's Comment:

The Proponent shall prepare an Auditing and Continual Improvement System to review and continually improve environmental and health and safety management. Such a system shall address:

- *monitoring and measurement*
- *non-conformance reporting*

- *corrective and preventive action plans*
- *record-keeping and documentation control*
- *audits of environmental and health and safety management.*

The Proponent shall describe the implementation of the system by discussing such things as training, awareness, competence, documentation, operational control, and records.

N - Provide details of Auditing and Continual Improvement System.

Cumberland's Response:

The FEIS, IIBA, and the Monitoring and Follow up Plans (the latter submitted as supporting documents with the FEIS) (i.e., Terrestrial Ecosystem Management Plan, AEMP plan, MMER, NNL plan, Socioeconomic & Archaeology Management Plan, Human Resource Plan, Public Involvement Plan, Occupational Health and Safety, and Emergency Response Plan) address monitoring and measurement, non-conformance reporting, corrective and preventive action plans, record-keeping and documentation control, audits of environmental and health and safety management and the implementation of the such things as training, awareness, competence, documentation, operational control, and records.

4.28 CLOSURE & RECLAMATION

NIRB's Comment:

The Proponent shall specify when a temporary closure should be considered to be permanent.

Cumberland's Response:

As long as there is gold remaining at Meadowbank any temporary closure will remain temporary. Permanent closure will occur when all the economic gold is mined. Lupin is a good example of a mine that has been temporarily closed on and off for many years and still is not permanently closed.

4.28 RECLAMATION RESEARCH PROGRAM

NIRB's Comment:

The Proponent shall discuss a research programme that is consistent and compatible with broader efforts under way within Nunavut to address challenges to reclamation, such as the cold environment, poor soil development, limited topsoil resources, slow growth rates, limited seed production, low soil moisture, and short growing seasons.

Cumberland's Response:

Restoration at the mine site will be ongoing over many years. Efforts that are achieving the desired results will be continued and those that are not will be changed or altered. All specialists will keep abreast of the latest information available on reclamation efforts in the Arctic, particularly at other mines such as Ekati, Diavik, and Jericho.

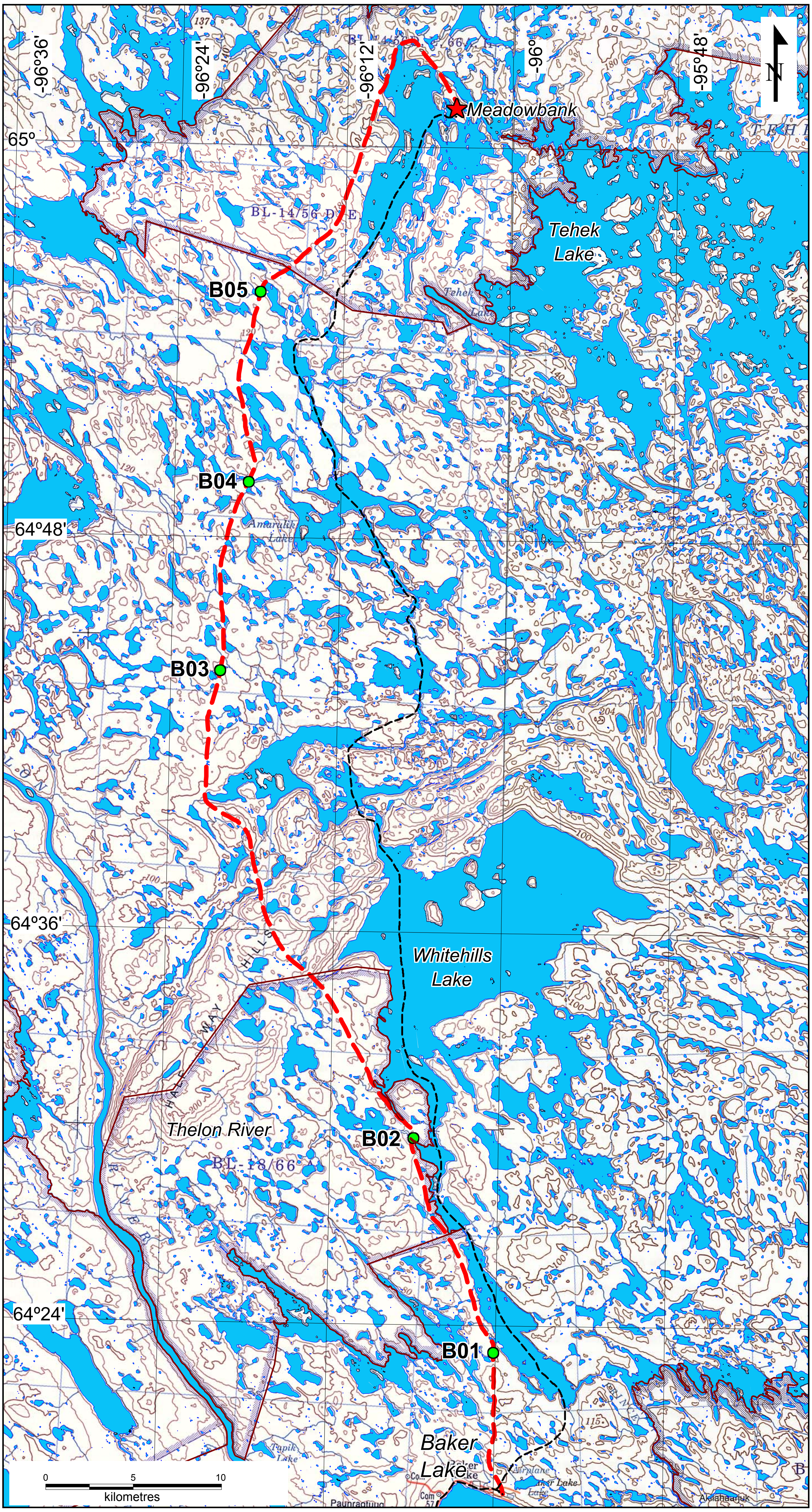
4.28 RECLAMATION RESEARCH

NIRB's Comment:

The Proponent shall evaluate the cost and feasibility of going beyond mere reclamation by enhancing wildlife habitats and undertaking other forms of beneficial landscaping.

Cumberland response:

Restoration at the mine site will be based on regulatory approvals licenses, leases and permits. Any additional reclamation work would require permission of KIA, which is the landowner, and will be addressed in development surface leases negotiated with KIA.



LEGEND

- Inuit Owned Land
- Possible Bridge Crossing
- Proposed Road Access
- Winter Road
- Meadowbank Camp

CUMBERLAND RESOURCES LTD.

Meadowbank Gold Project

Tehek Lake
Access Road

ROAD IMPACT MATRICES

Table C.1: Permafrost Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Monitoring/ Management
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Borrow Pit(s)	Loss of permafrost, cooling of remaining permafrost, and development of a new active layer	loss	local	infrequent	Short-term	all year	low	none	N/A	low	certain	none recommended
Ditches	A - Loss of permafrost, warming of remaining permafrost, and development of a new active layer in cut sections; B - where ditches are excavated through bogs, there is potential for deepening of the active layer, warming of permafrost, ground ice degradation and related thaw subsidence, slumping and sediment losses	loss	A – local B - footprint	infrequent	A – permanent B - permanent	A - all year B - summer	A - low B - high	B only: Where thaw sensitive polygons are crossed, avoid using cut sections for ditches, ensure positive drainage away from fill sections, avoid concentrating runoff waters, or use rock aprons to slow the rate of thaw penetration and stabilize the underlying soils	none	B only: Low	high	B only - Further assessment of susceptible locations along proposed ditch centrelines is required
Culverts	- see comments in operations matrix	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Access Road & Traffic	A - Loss of permafrost and development of a new active layer in cut sections; B - permafrost aggradation and formation of new active layer in fill sections - POSITIVE	negligible	local	infrequent	A – permanent B - medium-term	A - all year B - winter	low	none	N/A	low	certain	none recommended

Table C.2: Permafrost Impact Matrix – Operation

		Assessment of Unmitigated Effects							Assessment of Residual Effects			
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Influence of Mitigation on Effects Assessment	Significance of Residual Impacts		
Project Component	**Potential Effect**	**Magnitude**	**Spatial Extent**	**Frequency**	**Duration**	**Timing**		**Potential Mitigation**			**Probability**	**Management and Monitoring**
Borrow Pit(s)	Loss of permafrost, cooling of remaining permafrost, and development of a new active layer where pits continue to be operated; stabilization of permafrost temperatures and active layer thickness soon after operations cease	loss	local	infrequent	permanent	all year	low	none	N/A	low	certain	none recommended
Ditches	Stabilization of permafrost temperatures and active layer thickness; stabilization of thaw subsidence and sediment loss in bog areas	negligible	local	infrequent	permanent	all year	medium	Silt fences as required to manage sediment loss; rock aprons as required to slow the rate of thaw penetration and stabilize the underlying soils	none	low	moderate	none recommended
Culverts	Loss of permafrost, warming of remaining permafrost, and deepening of the active layer where runoff is concentrated through culverts; possible subsidence, particularly in low lying bog areas	loss	local	infrequent	medium-term	summer	low	Maintenance, as required, to restore smooth grade where thaw settlement is a problem; avoid culverts in areas susceptible to thaw settlement	none	low	moderate	Maintenance, as required, to restore smooth grade where thaw settlement is a problem
Access Road & Traffic	Stabilization of permafrost temperatures and active layer thickness - POSITIVE	negligible	local	infrequent	medium term	all year	low	none	N/A	low	certain	none recommended

Table C.3: Permafrost Impact Matrix – Closure & Post-Closure

Project Component	Potential Effect	Assessment of Unmitigated Effects						Potential Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Influence of Mitigation on Effects Assessment	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Borrow Pit(s)	Stabilization of permafrost temperatures and active layer thickness - POSITIVE	negligible	local	infrequent	permanent	all year	low	none	N/A	low	certain	none recommended
Ditches	Stabilization of permafrost temperatures and active layer thickness - POSITIVE	negligible	local	infrequent	permanent	all year	low	none	N/A	low	certain	none recommended
Culverts	Stabilization of permafrost temperatures and active layer thickness - POSITIVE	loss	local	infrequent	permanent	all year	low	none	N/A	low	certain	none recommended
Access Road & Traffic	Stabilization of permafrost temperatures and active layer thickness - POSITIVE	negligible	local	infrequent	permanent	all year	low	none	N/A	low	certain	none recommended

Table B2.1: Air Quality Impact Matrix – Construction

		Assessment of Unmitigated Effects							Assessment of Residual Effects			
		Spatial Boundaries		Temporal Boundaries								
Project Components	**Potential Effects**	**Magnitude**	**Spatial Extent**	**Frequency**	**Duration**	**Timing**	**Significance of Unmitigated Effects**	**Proposed Mitigation**	**Residual Effects/ Influence of Mitigation**	**Significance of Residual Impacts**	**Probability**	**Management and Monitoring**
Borrow Pit/	Generation of dust and gases from blasting, overburden stripping, excavation and other construction related activities resulting in poor air quality and contamination of aquatic and terrestrial habitats	Medium	Local	Contin	Long	All Year	No	Minimize quarry footprint; apply water spray during summer or use other dust suppressants; use fuel efficient machinery with emissions controls; avoid prolonged idling of service equipment vehicle engines; use specialized blasting techniques; see Air Quality and Noise Management Plan	Lower concentration of particulate and gaseous pollutants	No	Certain	Maintain vehicles in good operating condition; monitor dust fallout by static collectors (method ASTM D1739); see Air Quality and Noise Management Plan , Aquatic Environmental Management Plan, and Wildlife Management Plan.
Access Road and Traffic	Generation of dust and emissions from overburden stripping, excavation and other construction related activities resulting in poor air quality and contamination of aquatic and terrestrial habitats	Medium	Local	Contin	Perman	All Year	No	Minimize road length and width; apply water spray during summer or use other dust suppressants when necessary; use fuel efficient machinery with emissions controls; see Air Quality and Noise Management Plan, and Access and Air Traffic Management Plan	Lower concentration of particulate matter and gaseous pollutants	No	Certain	Maintain vehicles in good operating condition; see Air Quality and Noise Management Plan, and Access and Air Traffic Management Plan
	Generation of dust and emissions from frequent activity by service and vehicles accessing staging facility, and ongoing maintenance	Medium	Local	Contin	Perman	All Year	No	Minimize vehicle traffic and speeds; apply water spray during summer or use other dust suppressants when necessary; use fuel efficient machinery with emissions controls; see Air Quality and Noise Management Plan, and Access and Air Traffic Management Plan	Lower concentration of particulate matter and gaseous pollutants	No	Certain	Monitor scheduling to ensure number of trips are minimized; enforce speed limits; monitor dust fallout by static collectors (method ASTM D1739); see Air Quality and Noise Management Plan, and Access and Air Traffic Management Plan

Table B2.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
	Potential explosion or fire may release contaminants into the air	Low	Local	Infreqnt	Short	All Year	No	Follow Hazardous Materials Management Plan; follow Spill Contingency Guidelines	Unpredictable	No	Improbable	Regular maintenance checks; monitor fuel handling procedures in Hazardous Materials Management Plan

Table B2.2: Air Quality Impact Matrix – Operation

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Monitoring/ Management
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	Generation of dust and emissions from maintenance activities resulting in poor air quality and contamination of aquatic and terrestrial habitats	Low	Local	Contin	Long	All Year	No	Use dust suppressants as necessary; use fuel efficient machinery with emissions controls; see Air Quality and Noise Management Plan, and Access and Air Traffic Management Plan	Lower concentration of particulate matter and gaseous pollutants	No	Certain	Maintain vehicles in good operating condition; see Air Quality and Noise Management Plan, and Access and Air Traffic Management P Enforcement of traffic speeds; maintain equipment in good repair in order to reduce emissions;
	Generation of dust and emissions from frequent activity by service and vehicles accessing staging facility	Medium	Local	Contin	Long	All Year	No	Minimize vehicle traffic and speeds; use dust suppressants as necessary; use fuel efficient machinery with emissions controls; see Air Quality and Noise Management Plan, and Access and Air Traffic Management Plan		no	Certain	Monitor scheduling to ensure number of trips are minimized; enforce speed limits; monitor dust fallout by static collectors (method ASTM D1739); see Air Quality and Noise Management Plan, and Access and Air Traffic Management Plan

Table B2.3: Air Quality Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Borrow Pit/ Quarry	No effect											
Roads and Airstrip	Generation of dust during re-grading and recontour embarkment	Low	Local	Discontinue after abandonme nt	Short	Summer	No	**Apply dust suppressants; control vehicles movement**	Lower dust concentration; improved visibility	No	Moderate	**Supervise the operation**
Access Road	Generation of dust during re-grading and recontour embarkment	Low	Local	Discontinue after abandonme nt	Short	Summer	No	**Apply dust suppressants; control vehicles movement**	Lower dust concentration; improved visibility	No	Moderate	**Supervise the operation**

Table B3.1: Noise Impact Matrix – Construction

		Assessment of Unmitigated Effects							Assessment of Residual Effects			
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects					
Project Components	**Potential Effects**	**Magnitude**	**Spatial Extent**	**Frequency**	**Duration**	**Timing**		**Proposed Mitigation**	**Residual Effects/ Influence of Mitigation**	**Significance of Residual Impacts**	**Probability**	**Management and Monitoring**
Borrow Pits	High noise levels from blasting, excavation, and material handling will disturb wildlife and result in reduced habitat effectiveness	High	Local	Contin	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; limit noisy operation to day time use; use specialized blasting techniques	Lower noise levels	no	Certain	Maintain vehicle mufflers and noisy components; monitor noise levels and behavioral responses of wildlife
Access Road and Traffic	Moderate noise levels associated with construction	Medium	Local	Frequent	Medium	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; Use quietest machinery available	Lower noise levels	No	Certain	Maintain equipment in good repair
	Moderate noise associated with traffic and road maintenance activities, Noise associated with grading and snowplowing	Medium	Local	Contin	Long	All Year	No	Use newer trucks, loaders and dozers equipped in efficient mufflers; minimize vehicular traffic and speeds; convoy shipments whenever possible; limit random traffic; schedule transportation for daytime hours whenever possible	Lower noise levels	No	Certain	Enforcement of traffic speeds; maintain equipment in good repair in order to reduce tire noise

Table B3.2: Noise Impact Matrix – Operation

		Assessment of Unmitigated Effects							Assessment of Residual Effects			
		Spatial Boundaries		Temporal Boundaries								
Project Components	**Potential Effects**	**Magnitude**	**Spatial Extent**	**Frequency**	**Duration**	**Timing**	**Significance of Unmitigated Effects**	**Proposed Mitigation**	**Residual Effects/ Influence of Mitigation**	**Significance of Residual Impacts**	**Probability**	**Management and Monitoring**
Borrow Pits	High noise levels from blasting, excavation, and material handling will disturb wildlife and result in reduced habitat effectiveness	High	Local	Contin	Long	All Year	Yes	Use newer trucks, loaders and dozers equipped in efficient mufflers; use quietest machinery available; limit noisy operation to day time use; use specialized blasting techniques	Lower level noise	no	Certain	Maintain vehicle mufflers and other noisy components; monitor noise levels and behavioral responses of wildlife
Access Road and Traffic												
	Moderate noise associated with traffic and road maintenance activities, Noise associated with grading and snowplowing; traffic noise	Medium	Local	Contin	Long	All Year	No	Use newer vehicles equipped in efficient mufflers; minimize vehicular traffic and speeds; convoy shipments whenever possible; limit random traffic; schedule transportation for daytime hours whenever possible	Lower level noise	No	Certain	Enforcement of traffic speeds; maintain equipment in good repair; maintain roads in order to reduce tire noise

Table B3.3: Noise Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	Road removed	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A1: Surface Water Quantity Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Mine Waste and Water Management Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Culverts	Culverts will reduce ability to discharge spring freshet resulting in increases in water levels	Medium	Local	Continuous	Medium-term	Summer	Yes	Culverts will be sized (ie., 2.5 m diameter) to handle 1:100 year flood events and increased discharge due to annual freshet; culverts will be installed in winter when the outlet is frozen to the bottom, ensuring no disruption of flow	With no constraints on water discharge, the potential magnitude of the impact would be low	No	High	Ongoing hydrological monitoring will be conducted.
Access Road & Traffic	Interference with local surface drainage patterns	Low	Local	Infrequent	Medium	Summer	No	Maintain roads in good condition and maintain adequate drainage pattern.	NA	No	Certain	Use sedimentation traps, selection of more durable materials for road surfacing.

Table A.2: Surface Water Quantity Impact Matrix – Operation

Project Components	Potential Effects	Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects	Proposed Mitigation	Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	Mine Waste and Water Management Plan
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Culverts	Culverts will reduce ability to discharge spring freshet resulting in increases in water levels	Medium	Local	Continuous	Medium-term	Summer	Yes	Culverts will be sized (ie., 2.5 m diameter) to handle 1:100 year flood events and increased discharge due to annual freshet	With no constraints on water discharge, the potential magnitude of the impact would be low	No	High	Ongoing hydrological monitoring wil be conducted; check culverts on regular basis for blockages and ensure free-flowing
Access Road & Traffic	Interference with local surface drainage patterns	Low	Local	Infrequent	Medium	Summer	No	Maintain roads in good condition and maintain adequate drainage pattern.	NA	No	Certain	Use sedimentation traps, selection of more durable materials for road surfacing.

Table A.3: Surface Water Quantity Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects					Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects			Mine Waste and Water Management Plan
		Spatial Boundaries			Temporal Boundaries							
		Magnitude	Spatial Extent	Frequency	Duration	Timing			Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
Access Road & Traffic	Roads to be decommissioned and reclaimed to restore drainage patterns - POSITIVE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Culverts	Culverts removed to restore natural drainage patterns - POSITIVE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B.1: Water Quality Impact Matrix – Construction

Project Component	Potential Effect	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Influence of Mitigation on Effects Assessment	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Culverts	(see comments in Operations Matrix)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Access Road, culverts & Traffic	Sedimentation, dusting, fuel and load spills from traffic affects quality in water bodies along transit route.	low to medium	footprint	Continuous/ Rare	Short-term	All Year	low to medium	Use of dust suppressants, watering, road preparation and/or other dust control procedures (see Air Quality and noise Management Plan). Use BMP for sediment control in ditches and control of runoff. Implement Spill Contingency Plan and other emergency responses, when required.	medium	low	medium	Spill Contingency Plan, Emergency Response Plan, and Accidents and Malfunctions Plan Monitor conditions. See Mine Waste and Water Management Plan, Aquatic Environmental Management Plan, Air Quality and Noise Management Plan

Table B.2: Water Quality Impact Matrix – Operation

Project Component	Potential Effect	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Management and Monitoring
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Influence of Mitigation on Effects Assessment	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Roads & Traffic	Diesel spills to local water bodies	Medium	Footprint to Local	Rare	Medium to Long term	Year Round	Medium to Low	Best Management Practices and Spill Contingency Plans	Medium	Low	High	Spill Contingency Plan, Emergency Response Plan, and Hazardous waste Management Plan ,Aquatic Environment Management Plan.
	Dust from traffic releases metals and nitrogen species to local water bodies	Low	Footprint/Local	Frequent	Medium-term	Year round	Low	Dust control water will be drawn from the Portage Attenuation Pond (Abandonment & Restoration Plan) within Portage catchment. Dust control water for haul roads outside the Portage catchment areas will be drawn from Phase Lake in an effort to keep contact water within the mining areas. (Abandonment & Restoration Plan)	Medium	Low	High	Air Quality and Noise Monitoring Plan
	Metals, acidity and nitrogen species in runoff and seepage from road bed are released to local water bodies	Low	Footprint to Local	Frequent	Medium to Long term	Summer	Low	Select rock with low ARD and metal leaching potential will be used for construction. Best Management Practices for sediment and erosion control)	Medium	Low	medium	Mine site monitoring, and settling pond cleanout
Culverts	Metals, acidity and nitrogen species in runoff and seepage from road bed	Medium	Footprint to Local	Rare	Medium to Long term	Year Round	Medium to Low	Select rock with low ARD and metal leaching potential will be used for construction. Best Management Practices for sediment and erosion control	Medium	Low	High	Mine site monitoring, and settling pond cleanout

Table B.3: Water Quality Impact Matrix – Closure & Post Closure

Project Component	Potential Effect	Assessment of Unmitigated Effects: Spatial Boundaries: Magnitude	Assessment of Unmitigated Effects: Spatial Boundaries: Spatial Extent	Assessment of Unmitigated Effects: Temporal Boundaries: Frequency	Assessment of Unmitigated Effects: Temporal Boundaries: Duration	Assessment of Unmitigated Effects: Temporal Boundaries: Timing	Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Influence of Mitigation on Effects Assessment	Assessment of Residual Effects: Significance of Residual Impacts	Assessment of Residual Effects: Probability	Management and Monitoring
Roads	Continued leaching of metals and acidity from active layer rock	Medium	Footprint	Frequent	Long-term	Summer	Medium	Selection of appropriate construction rock. (see Water and Waste Management Plan). Contingency (where monitoring indicates unanticipated metal leaching or acidic drainage) capping with nominal 2 m layer of UM rock.	High	Low	moderate	
Culverts	N/A after removal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Traffic	N/A after final closure	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table B6.1: Vegetation Cover Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Culvert	NA since no terrestrial component	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Access Road, Borrow pits and Traffic	Vegetation loss and disturbance	Low	Local	Contin	Perman	All Year	No	Minimize number of borrow pits required and road dimensions	Permanent vegetation loss at local level	No	Certain	Incourage Revegetation along road edges
	Dust and emissions may result in potential vegetation degradation and increased contaminant levels	Low	Local	Contin	Long	Summer	No	Minimize vehicular traffic and speeds; implement dust control measures; restrict off-road access and use	Limited and local habitat degradation	No	Moderat	Monitor contaminant levels in vegetation adjacent to roads; continue phenology studies
	Introduction of non-native plant species	Low	Local	Infrqnt	Long	All Year	No	Ensure vehicles are washed and clean before being used on site	Low likelihood of occurrence due to hostile environment for non-native species	No	Moderat	Monitor plant species composition
	Potential fuel spills may degrade surrounding vegetation and increase contaminant levels	Low	Local	Infreqnt	Short	All Year	No	Provide containment berm around fuel storage area; follow Hazardous Materials Handling Guidelines; follow Spill Contingency Guidelines	No residual effects anticipated	No	Moderat	Regular maintenance checks; follow Hazardous Materials Handling Guidelines

Table B6.2: Vegetation Cover Impact Matrix – Operation

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road,Borrow Pits and Traffic	No further vegetation loss and disturbance	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dust and emissions may result in potential vegetation degradation and increased contaminant levels	Low	Local	Contin	Long	Summer	No	Minimize vehicular traffic and speeds; implement dust control measures; restrict off-road access and use	Limited and local habitat degradation	No	Moderat	Monitor contaminant levels in vegetation adjacent to roads; continue phenology studies
	Introduction of non-native plant species	Low	Local	Infrqnt	Long	All Year	No	Ensure vehicles are washed and clean before being used on site	Low likelihood of occurrence due to hostile environment for non-native species	No	Moderat	Monitor plant species composition
	Potential fuel spills may degrade surrounding vegetation and increase contaminant levels	Low	Local	Infreqnt	Short	All Year	No	Provide containment berm around fuel storage area; follow Hazardous Materials Handling Guidelines; follow Spill Contingency Guidelines	No residual effects anticipated	No	Moderat	Regular maintenance checks; follow Hazardous Materials Handling Guidelines

Table B6.3: Vegetation Cover Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects – Spatial Boundaries – Magnitude	Spatial Boundaries – Spatial Extent	Temporal Boundaries – Frequency	Temporal Boundaries – Duration	Temporal Boundaries – Timing	Significance of Unmitigated Effects	Potential Mitigation	Assessment of Residual Effects – Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	Wildlife Management and Monitoring Plan
Access Road and Borrow Pits and Traffic	Vegetation loss and disturbance	Low	Local	Contin	Long	All Year	No	Scarify roads, remove culverts, restore drainage patterns, stabilize slopes, consider rehabilitation as esker habitat, suppress dust during reclamation	Some permanent alteration of vegetation cover likely	No	High	Reclamation activities as outlined in Wildlife Management Plan and Abandonment & Restoration Plan
	Dust and emissions may result in potential vegetation degradation and increased contaminant levels	Low	Local	Contin	Long	Summer	No	Scarify roads, remove culverts, restore drainage patterns, stabilize slopes, consider rehabilitation as esker habitat, suppress dust during reclamation	Low potential for ongoing impacts to roadside vegetation	No	Moderat	Reclamation activities as outlined in Wildlife Management Plan and Abandonment & Restoration Plan
Culvert	Possible disturbance to riparian vegetation during removal	Low	Local	Contin	Long	Summer	No	Minimize disturbance to nearshore vegetation during removal of culverts	Minor amount of vegetation loss	No	Moderat	As per Abandonment & Restoration Plan

Table B7.1: Ungulates Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects: Spatial Boundaries: Magnitude	Assessment of Unmitigated Effects: Spatial Boundaries: Spatial Extent	Assessment of Unmitigated Effects: Temporal Boundaries: Frequency	Assessment of Unmitigated Effects: Temporal Boundaries: Duration	Assessment of Unmitigated Effects: Temporal Boundaries: Timing	Assessment of Unmitigated Effects: Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Residual Effects/ Influence of Mitigation	Assessment of Residual Effects: Significance of Residual Impacts	Assessment of Residual Effects: Probability	Wildlife Management and Monitoring Plan
Access Road and Traffic	Loss and avoidance of foraging habitat, deflection from normal travel routes, energetic costs	Low	Local	Contin	Long	All Year	No	Minimize required roads and reduce road dimensions; do not use obstructive berms along road edges	Residual effect expected to be minor	No	Certain	Monitor ungulate movements and aggregations; revegetate areas disturbed during construction
	Mortality due to vehicle/ungulate collisions	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; ungulates have right-of-way at all times	Mortality due to collisions is unlikely given various mitigation measures	No	Moderat	Monitor ungulate movements and aggregations; drivers need to report any collisions and near misses with ungulates
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; ungulates have right-of-way at all times	Animals are expected to become habituated to noise therefore residual impacts are expected to be minor	No	High	Daily logs of ungulates, locations, numbers, sex and direction of travel; rports of aggregations along roads and near facilities
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in forage species	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; use dust suppressants; maintain vehicles in good operating condition	Residual impacts limited to habitats near roads; since ungulates are wide ranging, exposure to contamination is expected to be very limited	No	Moderat	Monitor contaminant levels in vegetation adjacent to roads
	Ungulates may use roads as travel corridors resulting in increased mortality from predators	Low	Local	Frequent	Long	All Year	No	Do not berm roads to reduce crossing barriers	Negligible residual effects anticipated	No	Moderat	drivers must report ungulate sightings; maintain wildlife log of all wildlife sightings
	Increased hunting pressure; mortality from vehicles	Low	Regional	Frequent	Long	All Year	Yes	Limit use of road to mine employees; prohibit mine employees from hunting; enforce speed limits; yield right of way to ungulates and all wildlife; confine traffic to winter road	Reduced potential for mortality with change in frequency of impact to Infrequent	No	Moderat	Report all ungulate/vehicle collisions; enforcement of no-hunting policy along road

Table B7.2: Ungulates Impact Matrix – Operation

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	Loss and avoidance of foraging habitat, deflection from normal travel routes, energetic costs	Low	Local	Contin	Long	All Year	No	Minimize required roads and reduce road dimensions; do not use obstructive berms along road edges	Residual effect expected to be minor	No	Certain	Monitor ungulate movements and aggregations; revegetate areas disturbed during construction
	Mortality due to vehicle/ungulate collisions	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; ungulated have right-of-way at all times	Mortality due to collisions is unlikely given various mitigation measures	No	Moderat	Monitor ungulate movements and aggregations; drivers need to report any collisions and near misses with ungulates
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; ungulates have right-of-way at all times	Animals are expected to become habituated to noise therefore residual impacts are expected to be minor	No	High	Daily logs of ungulates, locations, numbers, sex and direction of travel; rports of aggregations along roads and near facilities
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in forage species	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; use dust suppressants; maintain vehicles in good operating condition	Residual impacts limited to habitats near roads; since ungulates are wide ranging, exposure to contamination is expected to be very limited	No	Moderat	Monitor contaminant levels in vegetation adjacent to roads
	Ungulates may use roads as travel corridors resulting in increased mortality from predators	Low	Local	Frequent	Long	All Year	No	Do not berm roads to reduce crossing barriers	Negligible residual effects anticipated	No	Moderat	drivers must report ungulate sightings; maintain wildlife log of all wildlife sightings
	Increased hunting pressure; mortality from vehicles	Low	Regional	Frequent	Long	All Year	Yes	Limit use of road to mine employees; prohibit mine employees from hunting; enforce speed limits; yield right of way to ungulates and all wildlife; confine traffic to winter road	Reduced potential for mortality with change in frequency of impact to Infrequent	No	Moderat	Report all ungulate/vehicle collisions; enforcement of no-hunting policy along road

Table B7.3: Ungulates Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	Loss and avoidance of foraging habitat, deflection from normal travel routes, energetic costs; risks and disturbances to ungulates from traffic during closure and post-closure will decrease and ultimately become minimal	Low	Local	Contin	Long	All Year	No	Scarify roads, remove culverts, restore drainage patterns, stabilize slopes, consider rehabilitation as esker habitat, suppress dust during reclamation	Some permanent habitat alteration likely	No	Certain	Monitor ungulate movements and aggregations; revegetate areas disturbed during construction; reclamation activities as outlined in WMP and A&R
	Mortality due to vehicle/ungulate collisions	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; ungulates have right-of-way at all times	Mortality due to collisions is unlikely given various mitigation measures	No	Moderat	Monitor ungulate movements and aggregations; drivers need to report any collisions and near misses with ungulates
	Reduced habitat effectiveness in adjacent areas due to noise and activity; reduced potential for effect as site is decommissioned	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; ungulates have right-of-way at all times	Animals are expected to become habituated to noise therefore residual impacts are expected to be minor	No	High	Daily logs of ungulates, locations, numbers, sex and direction of travel; rports of aggregations along roads and near facilities
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in forage species	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; use dust suppressants; maintain vehicles in good operating condition	Residual impacts limited to habitats near roads; since ungulates are wide ranging, exposure to contamination is expected to be very limited	No	Moderat	Monitor contaminant levels in vegetation adjacent to roads
	Ungulates may use roads as travel corridors resulting in increased mortality from predators; no effect once road is no longer used	Low	Local	Frequent	Long	Winter	No	Do not berm roads to reduce crossing barriers	Negligible residual effects anticipated	No	Moderat	drivers must report ungulate sightings; maintain wildlife log of all wildlife sightings

Table B7.3 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
	Increased hunting pressure; mortality from vehicles; reducing threat as need for road decreases	Low	Regional	Frequent	Long	Winter	Yes	Limit use of road to mine employees; prohibit mine employees from hunting; enforce speed limits; yield right of way to ungulates and all wildlife; confine traffic to winter road	Reduced potential for mortality with change in frequency of impact to Infrequent	No	Moderat	Report all ungulate/vehicle collisions; enforcement of no-hunting policy along road

Table B8.1: Predatory Mammals Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	Loss and avoidance of habitat and associated prey populations; deflection from normal travel routes; energetic costs	Low	Local	Contin	Long	All Year	No	Minimize required roads and reduce road dimensions	Residual effect expected to be minor	No	Certain	Monitor predatory mammal movements; revegetate areas disturbed during construction
	Mortality due to vehicle/predatory mammal collisions	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; predatory mammals have right-of-way at all times	Mortality due to collisions is unlikely given various mitigation measures	No	Moderat	Monitor predatory mammal movements; drivers need to report any collisions and near misses with predatory mammals
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; predatory mammals have right-of-way at all times	Animals are expected to become somewhat habituated to noise or occur at very low densities in the project area, therefore residual impacts are expected to be minor	No	High	Daily logs of predatory mammals, locations, numbers, and direction of travel
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; use dust suppressants; maintain vehicles in good operating condition	Residual impacts limited to habitats near roads; since predatory mammals are very wide ranging, exposure to contamination is expected to be very limited	No	Moderat	Monitor contaminant levels in vegetation and other indicators adjacent to roads
	Area of habitat alteration not expected to result in measurable effect on prey populations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B8.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
	Increased hunting pressure; mortality from vehicles	Medium	Regional	Frequent	Long	All year	Yes	Limit use of road to mine employees; prohibit mine employees from hunting; enforce speed limits; yield right of way to predatory mammals and all wildlife; confine traffic to winter road	Reduced potential for mortality with change in frequency of impact to Infrequent	No	Moderat	Report all predatory mammal/vehicle collisions; enforcement of no-hunting policy along road

Table B8.2: Predatory Mammals Impact Matrix – Operation

Project Components	Potential Effects	Assessment of Unmitigated Effects – Spatial Boundaries: Magnitude	Spatial Extent	Temporal Boundaries: Frequency	Duration	Timing	Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects – Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	Wildlife Management and Monitoring Plan
Access Road and Traffic	No additional habitat loss or disturbance anticipated during the operation phase	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mortality due to vehicle/predatory mammal collisions	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; predatory mammals have right-of-way at all times	Mortality due to collisions is unlikely given various mitigation measures	No	Moderat	Monitor predatory mammal movements; drivers need to report any collisions and near misses with predatory mammals
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; predatory mammals have right-of-way at all times	Animals are expected to become somewhat habituated to noise or occur at very low densities in the project area, therefore residual impacts are expected to be minor	No	High	Daily logs of predatory mammals, locations, numbers, and direction of travel
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey	Low	Local	Contin	Long	All Year	No	Minimize vehicular traffic and speeds; use dust suppressants; maintain vehicles in good operating condition	Residual impacts limited to habitats near roads; since predatory mammals are very wide ranging, exposure to contamination is expected to be very limited	No	Moderat	Monitor contaminant levels in vegetation and other indicators adjacent to roads
	Area of habitat alteration not expected to result in measurable effect on prey populations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Increased hunting pressure; mortality from vehicles	Medium	Regiona l	Frequent	Long	Winter	Yes	Limit use of road to mine employees; prohibit mine employees from hunting; enforce speed limits; yield right of way to predatory mammals and all wildlife; confine traffic to winter road	Reduced potential for mortality with change in frequency of impact to Infrequent	No	Moderat	Enforcement of no-hunting policy along road; follow up on all reports of illegal hunting

Table B8.3 Continued

Table B8.3: Predatory Mammals Impact Matrix – Closure & Post-Closure

		Assessment of Unmitigated Effects							Assessment of Residual Effects			
		Spatial Boundaries		Temporal Boundaries								
Project Components	**Potential Effects**	**Magnitude**	**Spatial Extent**	**Frequency**	**Duration**	**Timing**	**Significance of Unmitigated Effects**	**Proposed Mitigation**	**Residual Effects/ Influence of Mitigation**	**Significance of Residual Impacts**	**Probability**	**Wildlife Management and Monitoring Plan**
Access Road and Traffic	Mortality due to vehicle/predatory mammal collisions; the potential for this effect will reduce substantially after mine closure	Low	Local	Infreqnt	Short	All Year	No	Scarify roads, remove culverts, restore drainage patterns, stabilize slopes, consider rehabilitation as esker habitat, suppress dust during reclamation	Some permanent habitat alteration likely	No	Moderat	Monitor ungulate movements and aggregations; revegetate areas disturbed during construction; reclamation activities as outlined in WMP and A&R
	Reduced habitat effectiveness in adjacent areas due to noise and activity; the potential for this effect will reduce substantially after mine closure	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and tendency of predatory mammals to become habituated to noise and activity	No	High	None recommended
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey; the potential for this effect will reduce substantially after mine closure; some potential contamination if they utilize reclaimed road surfaces (see below)	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition; ensure that road materials are inert and do not contribute unacceptable contaminant levels into the environment;	Potential area of contamination is very small; proportion of potentially contaminated prey within diet of predatory mammals will likely be low; potential exposure is seasonal for most predatory mammal species	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators

Table B9.1: Small Mammals Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	Loss and disturbance of terrestrial foraging habitat; disruption of movement and dispersal	Low	Local	Contin	Perman	All Year	No	Minimize required roads and reduce road dimensions	Minor alteration and loss of foraging habitat	No	Certain	Monitor small mammal populations; see Vegetation Cover matrices for more habitat-specific recommendations
	Mortality due to vehicle/small mammal collisions	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; small mammals have right-of-way; convoy shipments whenever possible; limit random traffic	Potential for vehicle/small mammal collisions is expected to be low	No	Moderat	Drivers will report any collisions and near misses with small mammals; a wildlife sighting log book will be maintained
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and tendency of small mammals to become habituated to noise and activity	No	High	None recommended
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey and forage species	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contamination is very small; proportion of potentially contaminated prey or forage species within diet of locally resident small mammals will likely be low	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators
	POSITIVE - Possible increased living opportunities for small mammals (e.g., Arctic ground squirrel) on road edges and rock fill areas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B9.2: Small Mammals Impact Matrix – Operation

Project Components	Potential Effects	Assessment of Unmitigated Effects: Spatial Boundaries: Magnitude	Spatial Boundaries: Spatial Extent	Temporal Boundaries: Frequency	Temporal Boundaries: Duration	Temporal Boundaries: Timing	Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	Wildlife Management and Monitoring Plan
Access Road and Traffic	No additional habitat loss or disturbance anticipated during operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mortality due to vehicle/small mammal collisions	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; small mammals have right-of-way; convoy shipments whenever possible; limit random traffic	Potential for vehicle/small mammal collisions is expected to be low	No	Moderat	Drivers will report any collisions and near misses with small mammals; a wildlife sighting log book will be maintained
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and tendency of small mammals to become habituated to noise and activity	No	High	None recommended
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey and forage species	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contamination is very small; proportion of potentially contaminated prey or forage species within diet of locally resident small mammals will likely be low	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators
	POSITIVE - Possible increased living opportunities for small mammals (e.g., Arctic ground squirrel) on road edges and rock fill areas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B9.2 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects: Spatial Boundaries: Magnitude	Spatial Boundaries: Spatial Extent	Temporal Boundaries: Frequency	Temporal Boundaries: Duration	Temporal Boundaries: Timing	Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	Wildlife Management and Monitoring Plan
	Potential fuel spills may degrade surrounding habitats and increase contaminant loading in prey and forage species	Low	Local	Infreqnt	Short	All Year	No	Provide containment berm around fuel storage area; follow Hazardous Materials Handling Guidelines; follow Spill Contingency Guidelines	Potential for contamination is low and potential for small mammals to consume contaminated prey or forage species is even lower	No	Low	Regular maintenance checks; follow Hazardous Materials Handling Guidelines
Culverts	***POSITIVE*** – Some improved wildlife movement opportunities across in summer	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B9.3: Small Mammals Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries								
		Magnitude	Spatial Extent	Frequency	Duration	Timing	Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
Dewatering												
Access Road and Traffic	Mortality due to vehicle/small mammal collisions; the potential for this effect will reduce substantially after mine closure	Low	Local	Infreqnt	Short	Summer	No	Scarify roads, remove culverts, restore drainage patterns, stabilize slopes, consider rehabilitation as esker habitat, suppress dust during reclamation	Some permanent habitat alteration likely	No	Moderat	Monitor movements and aggregations; revegetate areas disturbed during construction; reclamation activities as outlined in WMP and A&R
	Reduced habitat effectiveness in adjacent areas due to noise and activity; the potential for this effect will reduce substantially after mine closure	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and tendency of small mammals to become habituated to noise and activity	No	High	None specific to small mammals recommended
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey and forage species; the potential for this effect will reduce substantially after mine closure; some potential contamination if small mammals utilize reclaimed road surfaces (see below)	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition; ensure that road materials are inert and do not contribute unacceptable contaminant levels into the environment	Potential area of contamination is very small; proportion of potentially contaminated prey or forage species within diet of locally resident small mammals will likely be low	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators
	POSITIVE - Possible increased living opportunities for small mammals (e.g., Arctic ground squirrel) on road edges and rock fill areas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B9.3 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects: Spatial Boundaries: Magnitude	Assessment of Unmitigated Effects: Spatial Boundaries: Spatial Extent	Assessment of Unmitigated Effects: Temporal Boundaries: Frequency	Assessment of Unmitigated Effects: Temporal Boundaries: Duration	Assessment of Unmitigated Effects: Temporal Boundaries: Timing	Assessment of Unmitigated Effects: Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Residual Effects/ Influence of Mitigation	Assessment of Residual Effects: Significance of Residual Impacts	Assessment of Residual Effects: Probability	Wildlife Management and Monitoring Plan
	POSITIVE – Small mammals may be attracted to reclaimed road bed areas for living and foraging once vegetation has become reestablished; reclaim activities will involve scarifying roads, restoring drainage, suppressing dust, and considering rehabilitation of roads as esker-like habitat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Culverts	***POSITIVE*** – Culverts will be removed and the land recontoured, drainage patterns restored, and animal movement patterns reduced but restored to original configurations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B10.1: Raptors Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects						Potential Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Roads and Traffic	Loss and disturbance of terrestrial foraging habitat	Low	Local	Contin	Perman	All Year	No	Minimize required roads and reduce road dimensions	Minor alteration and loss of foraging habitat	No	Certain	None specific to raptors recommended (see Vegetation Cover matrices for more habitat-specific recommendations
	Mortality due to vehicle/bird collisions	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; raptors have right-of-way	Potential for vehicle/raptor collisions is expected to be very low	No	Moderat	Drivers will report any collisions and near misses with raptors; a wildlife log will be maintained to document raptor sightings
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and absence of nesting birds in the area	No	High	A wildlife log will be maintained to document raptor sightings
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contamination is very small; proportion of potentially contaminated prey within diet of locally resident raptors is very low; potential exposure is seasonal for most raptor species	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators

Table B10.2: Raptors Impact Matrix – Operation

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Roads and Traffic	No additional habitat loss or disturbance anticipated during operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mortality due to vehicle/bird collisions	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; raptors have right-of-way	Potential for vehicle/raptor collisions is expected to be very low	No	Moderat	Drivers will report any collisions and near misses with raptors; a wildlife log will be maintained to document raptor sightings
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and absence of nesting birds in the area	No	High	A wildlife log will be maintained to document raptor sightings
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contamination is very small; proportion of potentially contaminated prey within diet of locally resident raptors is very low; potential exposure is seasonal for most raptor species	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators

Table B10.3: Raptors Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	No additional habitat loss or disturbance anticipated	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mortality due to vehicle/bird collisions; the potential for this effect will reduce substantially after mine closure	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; raptors have right-of-way	Potential for vehicle/raptor collisions is expected to be very low	No	Moderat	Drivers will report any collisions and near misses with raptors; a wildlife log will be maintained to document raptor sightings
	Reduced habitat effectiveness in adjacent areas due to noise and activity; the potential for this effect will reduce substantially after mine closure	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and absence of nesting birds in the area	No	High	A wildlife log will be maintained to document raptor sightings
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey; the potential for this effect will reduce substantially after mine closure; some potential contamination if they utilize reclaimed road surfaces (see below)	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contamination is very small; proportion of potentially contaminated prey within diet of locally resident raptors is very low; potential exposure is seasonal for most raptor species	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators
	POSITIVE - Prey species (e.g., passerines and ptarmigan) may be attracted to reclaimed road bed areas for roosting, foraging and possibly nesting once vegetation has become reestablished	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B11.1: Waterfowl Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	Loss and disturbance of terrestrial foraging habitat	Low	Local	Contin	Perman	All Year	No	Minimize required roads and reduce road dimensions	Minor alteration and loss of foraging and roosting habitat	No	Certain	None specific to waterfowl recommended (see Vegetation Cover matrices for more habitat-specific recommendations
	Mortality due to vehicle/bird collisions	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; waterfowl have right-of-way	Potential for vehicle/waterfowl collisions is expected to be very low	No	Moderat	Drivers will report any collisions and near misses with waterfowl; a wildlife log will be maintained to document waterfowl sightings
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and absence of nesting birds in the area	No	High	A wildlife log will be maintained to document waterfowl sightings
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in forage species	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contamination is very small	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators

Table B11.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects: Spatial Boundaries: Magnitude	Spatial Boundaries: Spatial Extent	Temporal Boundaries: Frequency	Temporal Boundaries: Duration	Temporal Boundaries: Timing	Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	Wildlife Management and Monitoring Plan
	Potential fuel spills may degrade surrounding habitats and increase contaminant loading in forage species	Low	Local	Infreqnt	Short	All Year	No	Provide containment berm around fuel storage area; follow Hazardous Materials Handling Guidelines; follow Spill Contingency Guidelines	Potential for contamination is low and potential for waterfowl to consume contaminated forage species is much lower	No	Low	Regular maintenance checks; follow Hazardous Materials Handling Guidelines
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Perman	All Year	No	Minimize number of take-offs and landings; pilots will be required to observe approach height guidelines	Air plane arrivals and departures are expected to be infrequent and waterfowl have not been observed nesting in the vicinity of the airstrip	No	High	Habitats in the vicinity of the airstrip will be surveyed on a regular basis for the presence of nesting waterfowl
	Potential habitat degradation due to dust and emissions and potential for increased contaminant loading in forage species	Low	Local	Contin	Perman	Summer	No	Minimize number of take-offs and landings	Low utilization of the airstrip is not expected to result in notable contamination of adjacent habitats	No	Moderat	Monitor contaminant levels in vegetation and possible other indicators adjacent to the airstrip
Culverts	Disruption of movement opportunities for waterfowl	Low	Local	Contin	Medium	Summer	No	None recommended	Residual effects are considered to be low due to low waterfowl densities and ability for waterfowl to fly around obstructions	No	Certain	None recommended

Table B11.2: Waterfowl Impact Matrix – Operation

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	Loss and disturbance of terrestrial foraging habitat	Low	Local	Contin	Perman	All Year	No	Minimize required roads and reduce road dimensions	Minor alteration and loss of foraging and roosting habitat	No	Certain	None specific to waterfowl recommended (see Vegetation Cover matrices for more habitat-specific recommendations
	Mortality due to vehicle/bird collisions	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; waterfowl have right-of-way	Potential for vehicle/waterfowl collisions is expected to be very low	No	Moderat	Drivers will report any collisions and near misses with waterfowl; a wildlife log will be maintained to document waterfowl sightings
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and absence of nesting birds in the area	No	High	A wildlife log will be maintained to document waterfowl sightings
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in forage species	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contamination is very small	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators
Culverts	Disruption of movement opportunities for waterfowl	Low	Local	Contin	Medium	Summer	No	None recommended	Residual effects are considered to be low due to low waterfowl densities and ability for waterfowl to fly around obstructions	No	Certain	None recommended

Table B11.3: Waterfowl Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	No additional habitat loss or disturbance anticipated	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mortality due to vehicle/bird collisions; the potential for this effect will reduce substantially after mine closure	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; waterfowl have right-of-way	Potential for vehicle/waterfowl collisions is expected to be very low	No	Moderat	Drivers will report any collisions and near misses with waterfowl; a wildlife log will be maintained to document waterfowl sightings
	Reduced habitat effectiveness in adjacent areas due to noise and activity; the potential for this effect will reduce substantially after mine closure	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and absence of nesting birds in the area	No	High	A wildlife log will be maintained to document waterfowl sightings
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in forage species; the potential for this effect will reduce substantially after mine closure	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contamination is very small; proportion of potentially contaminated forage species within diet of locally resident waterfowl is likely low; potential exposure is very seasonal for most waterfowl species	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators
	POSITIVE – Waterfowl may be attracted to reclaimed road bed areas for roosting, foraging and possibly nesting once vegetation has become reestablished	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B12.1: Other Breeding Birds Impact Matrix – Construction

Project Components	Potential Effects	Assessment of Unmitigated Effects – Spatial Boundaries: Magnitude	Spatial Extent	Temporal Boundaries: Frequency	Duration	Timing	Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	Wildlife Management and Monitoring Plan
Access Road and Traffic	Loss and disturbance of terrestrial foraging habitat	Low	Local	Contin	Perman	All Year	No	Minimize required roads and reduce road dimensions; avoid construction of roads during breeding bird season; identify active nests	Minor alteration and loss of foraging habitat	No	Certain	Identify and monitor active nests of songbirds, shorebirds and ptarmigan; see Vegetation Cover matrices for more habitat-specific recommendations
	Mortality due to vehicle/bird collisions	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; birds have right-of-way	Potential for vehicle/bird collisions is expected to be very low	No	Moderat	Drivers will report any collisions and near misses with birds
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and tendency of birds to become habituated to noise and activity	No	High	None recommended
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contaminatio n is very small; proportion of potentially contaminated prey within diet of locally resident birds will likely be low; potential exposure is seasonal for most bird species	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators

Table B12.1 Continued

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries								
		Magnitude	Spatial Extent	Frequency	Duration	Timing	Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
	Potential spills may degrade surrounding habitats and increase contaminant loading in prey	Low	Local	Infreqnt	Short	All Year	No	Provide containment berm around fuel storage area; follow Hazardous Materials Handling Guidelines; follow Spill Contingency Guidelines	Potential for contamination is low and potential for birds to consume contaminated prey is even lower	No	Low	Regular maintenance checks; follow Hazardous Materials Handling Guidelines

Table B12.2: Other Breeding Birds Impact Matrix – Operation

Project Components	Potential Effects	Assessment of Unmitigated Effects: Spatial Boundaries: Magnitude	Spatial Boundaries: Spatial Extent	Temporal Boundaries: Frequency	Temporal Boundaries: Duration	Temporal Boundaries: Timing	Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	Wildlife Management and Monitoring Plan
Access Road and Traffic	No additional habitat loss or disturbance anticipated during operations	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mortality due to vehicle/bird collisions	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; birds have right-of-way	Potential for vehicle/bird collisions is expected to be very low	No	Moderat	Drivers will report any collisions and near misses with birds
	Reduced habitat effectiveness in adjacent areas due to noise and activity	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and tendency of birds to become habituated to noise and activity	No	High	None recommended
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition	Potential area of contaminatio n is very small; proportion of potentially contaminated prey within diet of locally resident birds will likely be low; potential exposure is seasonal for most bird species	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators

Table B12.3: Other Breeding Birds Impact Matrix – Closure & Post-Closure

Project Components	Potential Effects	Assessment of Unmitigated Effects						Proposed Mitigation	Assessment of Residual Effects			Wildlife Management and Monitoring Plan
		Spatial Boundaries		Temporal Boundaries			Significance of Unmitigated Effects		Residual Effects/ Influence of Mitigation	Significance of Residual Impacts	Probability	
		Magnitude	Spatial Extent	Frequency	Duration	Timing						
Access Road and Traffic	Mortality due to vehicle/bird collisions; the potential for this effect will reduce substantially after mine closure	Low	Local	Infreqnt	Short	Summer	No	Minimize vehicular traffic and speeds; birds have right-of-way	Potential for vehicle/bird collisions is expected to be very low	No	Moderat	Drivers will report any collisions and near misses with birds
	Reduced habitat effectiveness in adjacent areas due to noise and activity; the potential for this effect will reduce substantially after mine closure	Low	Local	Contin	Perman	All Year	No	Minimize vehicular traffic and speeds	Reduced habitat effectiveness is expected to be minimal due to small area of impact and tendency of birds to become habituated to noise and activity	No	High	None recommended
	Habitat degradation due to dust and exhaust and potential for increased contaminant loading in prey; the potential for this effect will reduce substantially after mine closure; some potential contamination if they utilize reclaimed road surfaces (see below)	Low	Local	Contin	Perman	Summer	No	Minimize vehicular traffic and speeds; use dust suppressant techniques on an as-needed basis; maintain vehicle in good running condition; ensure that road materials are inert and do not contribute unacceptable contaminant levels into the environment;	Potential area of contamination is very small; proportion of potentially contaminated prey within diet of locally resident birds will likely be low; potential exposure is seasonal for most bird species	No	Moderat	Monitor contaminant levels in road side vegetation and possible other indicators
	POSITIVE - Passerines and ptarmigan may be attracted to reclaimed road bed areas for roosting, foraging and possibly nesting once vegetation has become reestablished	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table B13.1: Fish Impact Matrix – Construction

Project Component	Potential Physical and Ecological Effect	Assessment of Unmitigated Effects: Spatial Boundaries – Magnitude	Spatial Boundaries – Spatial Extent	Temporal Boundaries – Duration	Temporal Boundaries – Frequency & Timing	Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Residual Effect / Influence of Mitigation	Significance of Residual Effects	Certainty of Prediction	Aquatic Environment Management Program (AEMP) Description
Access Road and Traffic	Terrain disturbance, introduction of particulates to lakes during rain events, aerial dispersion of particulates, local habitat disturbance, road dust. Smothering of fish eggs, impaired feeding efficiency by fish; toxicity due to metals introduction.	L	L	S	F	NO	Construction activities in and around waterways will be avoided. No direct contact of vehicles in lakes. Dust suppressants applied to roads. Other dust control measures for aerial emissions.	Mitigation will eliminate exposure pathways and result in negligible ecological effects.Negligible ecological effects on fish. Mitigation will reduce magnitude, extent, and frequency of effects.	NO	High	Targeted monitoring during road construction will be implemented if necessary. Water quality monitoring adjacent to mine site will be conducted routinely at a variety of locations. Targeted monitoring during construction will be implemented when necessary. See AEMP
Culverts	Culverts installation could disturb fish movement	L	L	S	R	NO	Construct during winter. Place coarse grain substrate in bottom of culverts to replace habitat loss. Culverts will be designed with maximum discharge velocity of 0.6 m/s to ensure fish passage. See Aquatic Environmental Management Plan and No Net Loss Report (2004).	Culverts will mitigate crossing impact. Crossing will be constructed in winter when there are no fish movements therefore resulting in neglible ecological effects.	NO	High	Routine monitoring to confirm that movements of fish is not impaired. (see AEMP).

Table B13.2: Fish Impact Matrix – Operation

Project Component	Potential Physical and Ecological Effect	Assessment of Unmitigated Effects: Spatial Boundaries – Magnitude	Spatial Boundaries – Spatial Extent	Temporal Boundaries – Duration	Temporal Boundaries – Frequency and Timing	Significance of Unmitigated Effects	Proposed Mitigation	Assessment of Residual Effects: Residual Effect / Influence of Mitigation	Significance of Residual Effects	Certainty of Prediction	Aquatic Environment Management Program (AEMP) Description
Borrow Pit/Quarry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Access Road and Traffic	Terrain disturbance, introduction of particulates to lakes during rain events, aerial dispersion of particulates, local habitat disturbance, introduction of dust from runoff from roads. Potential adverse physiological effects to fish (leading to stress) and potential for increased egg mortality.	L	L	M	F	NO	Avoid operating heavy equipment in and around waterways. No direct contact of vehicles in lakes. Dust suppresants applied to roads. Other dust control measures for aerial emissions. Perimiter ditches to direct contact runoff with roads, waste piles, airstrip, etc. to tailings facility (see Golder 2004?).	Negligible ecological effects on fish. Mitigation will eliminate pathways of contamination, reducing magnitude, extent and duration of impacts.	NO	High	Routine, annual monitoring of the road to determine if any adverse effects can be observed and corrected (see AEMP). Implement emergency spills response in event of an accidental spill.
Culverts	Potential for impaired fish passage because of high water velocity during spring freshet; visual barrier to fish movement because of long culvert length.	L	L	M	I	NO	Install rip rap along shorelines and approaches to road crossing and within dike to encourage movement by fish. Install culvert to maintain discharge velocity <0.6 m/s to ensure fish passage.	Possible reduced movement by fish Adequate culvert sizing will ensure that fish passage is not compromised.	NO	High	See AEMP Targeted study.

Table B13.3: Fish Impact Matrix – Closure & Post-Closure

Project Component	Potential Physical and Ecological Effect	Assessment of Unmitigated Effects				Assessment of Residual Effects		
		Spatial Boundaries		Temporal Boundaries		Influence of Activity/ Residual Effect	Significance of Residual Effects	Certainty of Prediction
		Magnitude	Spatial Extent	Duration	Frequency and Timing			
Roads and Traffic	Roads will be decommissioned; land will be restored.	NA	NA	NA	NA	NA	NA	NA
Airstrip and Air Traffic	Airstrip will be decommissioned; land will be restored.	NA	NA	NA	NA	NA	NA	NA
Culverts	Removal in winter when natural stream channel is frozen. Minor disturbance to localized fish during closure; no residual effects following restoration.	NA	NA	NA	NA	NA	NA	NA

Table B14.1: Fish Habitat Impact Matrix – Construction

Project Component	Potential Physical and Ecological Effect	Assessment of Unmitigated Effects				Significance of Unmitigated Effects	Assessment of Residual Effects				Aquatic Environment Management Program (AEMP) Description
		Magnitude	Spatial Extent	Duration	Frequency and Timing		Proposed Mitigation	Residual Effect / Influence of Mitigation	Significance of Residual Effect	Certainty of Prediction	
Borrow Pit/Quarry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Roads and Traffic	Terrain disturbance, introduction of particulates to lakes during rain events, aerial dispersion of particulates, local habitat disturbance, road dust. Smothering of benthos and fish spawning habitat, impaired feeding efficiency by fish; toxicity due to metals introductions.	L	L	S	F	NO	Construction activities in and around waterways will be avoided. No direct contact of vehicles in lakes. Dust suppresants applied to roads. Other dust control measures for aerial emissions..	Negligible residual effect. Mitigation will reduce the frequency and duration of effects and eliminate the exposure pathway and ecological effects.	NO	High	Targeted monitoring during road construction will be implemented if necessary. See AEMP (2004) Routine, annual monitoring of the road will be conducted to determine if any adverse effects to fish habitat at key crossing areas can be detected and corrected, if necessary (see AEMP).
Culvert	Culverts will be installed in the dry season during winter when natural stream channel is frozen. Elimination of fish habitat beneath culvert footprint	L	L	S	R	NO	Construct during winter. Place coarse grain substrate in bottom of culverts to replace habitat loss. see Aquatic Environmental Management Plan and No Net Loss Report (2004).	Negligible residual effect.	NO	High	Annual monitoring to confirm that rep rap habitat at entry and exit points to culvert is stable and functioning as designed (see AEMP).

Table B14.2: Fish Habitat Impact Matrix – Operation

Project Component	Potential Physical and Ecological Effect	Assessment of Unmitigated Effects				Significance of Unmitigated Effects	Assessment of Residual Effects				Aquatic Environment Management Plan (AEMP) Description
		Magnitude	Spatial Extent	Duration	Frequency and Timing		Proposed Mitigation	Residual Effect /Influence of Mitigation	Significance of Residual Effect	Certainty of Prediction	
Borrow Pit/Quarry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Roads and Traffic	Terrain disturbance, introduction of particulates to lakes during rain events, aerial dispersion of particulates, local habitat disturbance, road dust. Potential for reduction in primary and especially secondary productivity.	L	L	L	F	NO	Operation activities in and around waterways will be avoided. No direct contact of vehicles in lakes. Dust suppresants applied to roads. Other dust control measures for aerial emissions.	Negligible ecological effect on fish. Mitigation will eliminate pathways of contamination, reducing magnitude, extent and duration of impacts.	NO	High	Water quality monitoring will be conducted routinely at a variety of locations. Targeted monitoring during construction will be implemented when necessary. See AEMP.
Culverts	Reduced productivity because of shading by road crossing. Loss of benthic habitat.	L	L	L	F	NO	Install rip rap along shorelines and approaches to road crossing to replace low value, soft sediment habitat with higher value habitat.	Negligible residual impact. Mitigation will protect habitat and lessen effects.	NO	High	Annual monitoring of shoreline stability at Turn Lake crossing (see AEMP).

Table B14.3: Fish Habitat Impact Matrix – Closure & Post-Closure

Project Component	Activity/ Ecological Effect	Assessment of Unmitigated Effects				Assessment of Residual Effects		
		Spatial Boundaries		Temporal Boundaries				
		Magnitude	Spatial Extent	Duration	Frequency and Timing	Influence of Activity/ Residual Effect	Significance of Residual Effects	Certainty of Prediction
Borrow Pit/Quarry	Decommissioned.	NA	NA	NA	NA	NA	NA	NA
Roads and Traffic	Roads will be decommissioned; land will be restored.	NA	NA	NA	NA	NA	NA	NA
Culverts	Removal in winter when natural stream channel is frozen. Minor disturbance to localized benthos and periphyton during closure; no residual effects following restoration.	NA	NA	NA	NA	NA	NA	NA

Appendix F.2

April 30, 2005 – Conformity Letter Submission #2

CUMBERLAND
RESOURCES LTD.

#950 - 505 Burrard Street
Box 72, One Bentall Centre
Vancouver, B.C V7X 1M4

Tel: (604) 608-2557
Fax: (604) 608-2559
E-Mail: info@cumberlandresources.com
Website: www.cumberlandresources.com

April 30th, 2005

Ms. Stephanie Briscoe
Executive Director
Nunavut Impact Review Board
P.O. Box 2379
Cambridge Bay, Nunavut
X0B 0C0

BY FAX and e-Mail

Dear Ms. Briscoe:

RE: Meadowbank Gold Project Conformity Submission

On April 8th, the Nunavut Impact Review Board (NIRB) provided its conformity ruling and instruction in respect of the Technical Meeting and Prehearing Conference for the Meadowbank Gold project (Meadowbank). In that letter, NIRB listed seven conditions to upon which its conformity ruling was dependent. Cumberland responds to each of those conditions below.

1. Respond to the Yellow Highlighted Cells in the Conformity Table Attached to the NIRB March 21, 2005 Letter:

That response document is attached.

2. Clarify the Status and Development of Cumberland's "Monitoring and Follow Up Plan"

More information on monitoring and follow up is contained in the yellow highlighted cell attachment section 4.26.1.

3. The Effect of Further Feasibility Studies on Project Design

Cumberland is not planning to conduct another feasibility study.

4. Cumberland Commits to a Timeline for Completion of Guideline 4.10.1.10 for Borrow Pits

Following completion of the geotechnical and geochemical investigations and determination of the final access road alignment, Cumberland Resources Ltd will provide to NIRB a drawing of the proposed road indicating potential borrow pits, quarries and bridges. Estimated quantities to be procured from each borrow pit or quarry as well as the proposed access to the borrow areas will be included. Pit and quarry management plans will also be provided. Cumberland will satisfy this Guideline requirement in the FEIS.

A geophysical survey along the proposed access road was completed in 2005 to map snow depth, and to assess the potential for ground ice at some of the proposed bridge crossings.

An initial program of mapping and sampling of overburden and rock from potential borrow sources has been undertaken. To assess ground conditions and permafrost depths, 44 hand-dug soil pits were excavated along the proposed route. Samples of overburden material were collected from all 44 test pits. A selected number of samples were submitted for additional laboratory testing.

Summary of Rock Sampling

The local bedrock consists of rocks of igneous, metamorphic, volcanic, and sedimentary origin. Individual bedrock types tend to extend over large distances along the road route. Samples were collected from 20 potential quarry sites located along the proposed route. The criteria for selecting potential rock quarry sites were:

1. areas of exposed bedrock ideally 200 x 200 m in extent
2. moderate relief (i.e. 5 m to 10 m or more from bottom to top of outcrop)
3. sites located away from surface waters
4. avoidance of areas that are heavily mineralised
5. avoidance of outcrops with deep, extensive, and open fractures/joints
6. avoidance, if possible, of areas with deeper overburden (>0.5 m)
7. avoidance of lee slopes (S, SSE, and SE) when possible
8. well-spaced sites (5 to 10 km apart), supplementary and closer site if only small outcrops are available.

Three composite rock samples weighing 3 to 5 kg each were collected at each potential quarry site situated within 1 km on either side of the proposed access road. A total of 53 samples were collected from 18 possible quarry sites. Most quarry site outcrops consisted of one relatively homogeneous rock type.

The suite of chemical analyses performed by CEMI includes whole rock and elemental solid phase chemistry, acid-base accounting (ABA) and analysis of metal leaching potential (shake flask extraction). Acid base accounting results were compared to guidelines presented by INAC (1992) for Northern Minesites.

Results of whole rock and elemental analyses confirm an abundance of aluminosilicate minerals within the majority of the rock types. ABA results indicate that all samples are non acid generating, based on their neutralization potential ratio (NPR above 2 as per INAC (1992) guidelines), or based on their very low sulphide sulphur content. Rock leachate pH values range from acidic to alkaline. Six of 24 samples are outside of the freshwater CEQG range for pH. The following metals exceed the freshwater CEQG for at least two samples: aluminum, arsenic, chromium, copper and selenium. These exceedances do not necessarily imply non-compliance of actual on-site drainage water quality. Concentrations of these constituents are expected to decrease with time, as soluble salts are flushed from the excavated rock.

The locations of all sampling sites are included as figures in the Project Alternatives Plan. Estimated volumes to be excavated from each of the potential quarry sites will be developed during detailed engineering design, once road cross sections have been developed. During detailed engineering design, a program of water management, including ditch design, management of silt through the use of settling ponds or other mitigative procedures such as the use of silt fences or hay bales, and permafrost monitoring plans will be developed for the proposed road access.

5. Program to Monitor Contaminants and Loading

The environmental health studies were initiated in the summer of 2005 with collection of baseline soil and vegetation (i.e., lichens, berries, sedges) samples from various stations within (mine site) and adjacent (reference site) to the Meadowbank Camp. Cumberland will not be sampling wildlife tissues (destructive sampling) in order to monitor contaminant levels in wildlife. The environmental health program will simply involve analysis of plant and soil samples, and use a risk assessment procedure (i.e., Screening Level Risk Assessment) to predict contaminant levels in receptors such as voles, raptors and caribou. Threshold levels of contamination or exposure will be established, beyond which health risk to wildlife may be anticipated. Where contamination issues have been identified, adaptive management of sources or sites will be undertaken to reduce contaminant levels and risks to wildlife.

Health Canada has requested that all mine developments operating in the Northwest Territories undertake a similar exercise. Perhaps a coordinated approach would be a more efficient use of resources.

Cumberland is not aware of any special permits that are required for the collection of small amounts of soil and vegetative matter other than the Nunavut Research Institute Certificate.

6. A Communication Strategy as in Guidelines 4.24.1 for the Communities of Chesterfield Inlet and Rankin Inlet

Cumberland has already filed a Public Involvement Framework Report in response to NIRB’s request for a Plan for Public Involvement. The requirement for a “communication strategy” is included within the 4.24.1 and more detail on the requirement is provided in 4.24.3.4 of the Guidelines.

Section 3 of the Cumberland Public Involvement Framework Report outlines a series of mechanisms through which communication aimed at involvement of the public and residents of affected communities can be ensured. The mechanism used to address a particular issue will depend on the nature, importance and urgency of the issue being addressed and how many of the communities are affected. Cumberland will, however, commit to ensuring that interested parties, residents and organizations in Chesterfield Inlet and Rankin Inlet are informed and involved in any distribution of information about the Meadowbank project and that they are involved in an appropriate fashion when matters related to the project affect their communities.

Negotiation of the Inuit Impact and Benefits Agreement (IIBA) between Cumberland and the Kivalliq Inuit Association (KIA) is at an advanced stage. Cumberland expects that the final IIBA will include mechanisms to encourage the involvement of Inuit residents and Kivalliq communities affected by the project.

7. Involvement of Hamlets outside the IIBA

The KIA represents the Inuit of the Kivalliq Region for purposes of negotiating an IIBA. This means that the KIA represents a significant majority of Kivalliq residents in all communities in these negotiations. The requirement for an IIBA is based in Article 26 of the Nunavut Land Claims Agreement (NLCA) and is mandatory.

Hamlets as local governments are established by territorial legislation and may or may not be affected by the project depending on the effects of the project on their community.

Cumberland has an extensive history of involvement with the Hamlet of Baker Lake and our DEIS and FEIS has identified Baker Lake as an affected community. Cumberland will negotiate land requirements and other matters related to the project with the Hamlet of Baker Lake consistent with its jurisdiction under territorial law. We have already undertaken such discussions with Baker Lake and will bring these negotiations to a conclusion as the project develops.

It is Cumberland’s view, set out in the FEIS, that the Meadowbank project will not have impacts in other Kivalliq communities, although a few individuals may benefit from employment, training and/or business opportunities. Consequently, negotiations of special arrangements with other hamlets are not contemplated at this time.

We trust that the information provided in this submission will satisfy the conditions set out by NIRB for the termination of the conformity phase of the Meadowbank proceeding. Cumberland is eager to move on to addressing any technical issues and concerns which may be raised by reviewers of the FEIS.

Yours truly,

Craig Goodings

3.1 PRESENTATION OF EIS

NIRB's Comment:

Maps, other than those used for orientation and context, shall be contained in a separate volume. Provide maps in a separate volume.

Cumberland's Response:

We felt that all the maps included in the DEIS were required for orientation and context. In the FEIS, these are included in a separate section in Volume 1 following the report.

3.4 FORMAT

Concordance table

NIRB's Comment:

Provide a corrected Concordance table that references supporting documentation.

Cumberland's Response:

The concordance table does contain references to the supporting documents (see pages ii-v on the concordance table). The FEIS concordance table is more detailed.

4.1 THE PROPONENT

NIRB's Comment:

It shall specify the mechanisms used to ensure that corporate policies are respected. Provide a discussion of mechanisms to ensure that policies are respected.

Cumberland's Response:

Cumberland has established a formal Code of Business Conduct and Ethics Policy (hereinafter, "Business Conduct Policy") that all directors, employees and consultants must adhere to. This Business Conduct Policy covers all aspects of Cumberland's business, including accounting, environmental health and safety and human resources. Each director, officer and employee of the Company is accountable for complying with the Business Conduct Policy. Failure to comply will be subject to disciplinary action. The Business Conduct Policy, which is posted on the Company's website, also specifies procedures for anonymously reporting violations within the Company."

4.3 BASELINE DATA COLLECTION

NIRB's Comment:

Provide evaluation of the adequacy and confidence levels of the baseline data.

Cumberland's Response:

To evaluate the adequacy and confidence of the baseline data collected, qualified specialists were hired to collect and interpret the data and qualified labs used to analyze the data. In addition, all reports were sent out to external experts for review before being included in the FEIS. The collection of baseline data for engineering and environmental purposes was initiated at a very early stage in the development of the project. Some data, for example permafrost baseline date, have been collected since 1996. This is almost ten years of data and serves as a substantial baseline database. The data that have been collected from the various aspects of the project, both environmental and engineering, have been compared with available data from similar sites in Northern Canada, and in some cases worldwide, to evaluate the reliability of the data. Where necessary, baseline data and assumptions used in modelling have been reviewed by independent experts in various fields of science and engineering.

4.4 TRADITIONAL KNOWLEDGE

NIRB's Comment:

Provide detail on plans to pursue the collection and integration of Traditional Knowledge into phases of the project.

Cumberland's Response:

Cumberland will continue to gathered traditional knowledge throughout the life of the project by targeted interviews, elder meetings, public meetings, Hamlet meetings, Inuit employees working on the environmental monitoring programs, interaction with the HTO and the community lands and resource committee (CLARC).

4.5 PUBLIC CONSULTATION

NIRB's Comment:

Provide clarification on how public consultation was used to determine mitigation measures.

Cumberland's Response:

Cumberland has gathered public input to determine mitigation measures since 1996 through numerous and on going public meetings, targeted interviews, and a three day impact workshop in 2003 as detailed on Table 4.3 pg 31 to 35 volume 1 DEIS. Questions asked during interviews of the elders included: Are you worried about the mine development on the land and water? Are you worried about the effect mine development will have on the fish? Can you suggest ways to ensure the protection of wildlife at the project? What kinds of input and participation would you like to have in planning and monitoring the project? Are there any aspects of the project that you need further explanation about or have concerns about? The three day impact workshop held in Baker Lake in 2003 included representatives' from the Hamlet council, elders, CLARC, HTO, youth and members of the general public. At that meeting, a translated impact matrix was used and each VEC and VSEC was discussed with expected impacts from the various mine components as well as the proposed mitigation and monitoring plans.

4.5 PUBLIC CONSULTATION

NIRB's Comment:

Provide clarification on how public consultation was used to determine monitoring activities.

Cumberland's Response:

Cumberland has gathered public input to determine monitoring activities since 1996 through numerous and on going public meetings, targeted interviews, and a three day impact workshop in 2003 as detailed on Table 4.3 pg 31 to 35 volume 1 DEIS. Questions asked during interviews of the elders included: Are you worried about the mine development on the land and water? Are you worried about the effect mine development will have on the fish? Can you suggest ways to ensure the protection of wildlife at the project? What kinds of input and participation would you like to have in planning and monitoring the project? Are there any aspects of the project that you need further explanation about or have concerns about? The three day impact workshop held in Baker Lake in 2003 included representatives' from the Hamlet council, elders, CLARC, HTO, youth and members of the general public. At that meeting, a translated impact matrix was used and each VEC and VSEC was discussed with expected impacts from the various mine components as well as the proposed mitigation and monitoring plans.

4.7 REGULATORY REGIME

NIRB's Comment:

Provide discussion on relevant regulations guidelines and policies and how they relate to the project. In particular the MMER with respect to tailings impoundment area, the proposed new Wildlife Act, GN regulations and various guidelines, INAC's Reclamation Policy.

Cumberland's Response:

MMER

The three main requirements of the Metal Mining Effluent Regulations (MMER) are: routine effluent monitoring (i.e., chemical analyses and toxicity of effluent, volume, flow and loading); an emergency response plan; and environmental effects monitoring (EEM), which includes water quality monitoring and biological monitoring (benthic invertebrate and fish survey) of the receiving environment. Cumberland Resources has prepared a detailed framework for the application of MMER for the Meadowbank project (see supporting document MMER, 2005). This document outlines the specific implementation procedures, approach, methodology, data analysis and quality control/quality assurance procedures to conduct all aspects of MMER and EEM.

The northwest arm of Second Portage Lake will contain the majority of mine tailings and will be designated as an official Tailings Impoundment Area under the MMER. The northwest arm of Second Portage Lake will be diked and fished out completely during draining of the impounded area. During the course of mine-life, the former lake will be completely filled with tailings and will no longer be considered fish habitat.

The area-weighted value of lake habitat destroyed has been determined as part of Cumberland Resources NNL (2005) framework document. Productive habitat area lost will be compensated for at post-closure under Canada Fisheries and Oceans No Net Loss of Habitat policy under the Fisheries Act. The NNL prepared for the Meadowbank project presents a range of possible options to mitigate and compensate for impacts to fish habitat in the project lakes. If impacts cannot be fully mitigated and harmful alteration, disruption or destruction (HADD) of habitat is likely to occur, it is within the discretion of Fisheries and Oceans (FAO) to issue an authorization under Section 35(2) of the Fisheries Act, provided that full compensation of the HADD can be achieved, either through onsite and/or off-site measures to create or improve existing habitat.

GN Regulations

The new Nunavut Wildlife Act (Chapter 26) came into effect on 5 December 2003. The various sections that have some applicability to the Meadowbank project are as follows:

NUNAVUT WILDLIFE ACT

Section 1: Purpose of this Act

1.2.e The precautionary principle has governed development of Cumberland's Terrestrial Ecosystem Management Plan, which includes conservative mitigation and monitoring plans.

1.2.h: Protection of wildlife and their habitat is a key component of all of Cumberland's management plans. Cumberland recognizes the intrinsic value of all wildlife.

1.2.i Cumberland has undertaken a comprehensive impact assessment of its Meadowbank Gold project and fully expects that the biological diversity of the Meadowbank area will be maintained.

1.2.j Cumberland recognizes the importance of wildlife such as caribou to the renewable resource economy, and has provided optimum protection for these resources.

1.2.k There are no wildlife or plant species in the Meadowbank area that are in danger of becoming extinct or being extirpated.

1.2.n Cumberland has communicated with the Baker Lake HTO on a regular basis. The HTO has conducted a Grizzly Bear Traditional Knowledge Study, partly funded by Cumberland, and provided traditional knowledge on other species. The HTO will likely be instrumental in participating in some of the wildlife monitoring initiatives, such as ongoing harvest studies and regular wildlife surveys along access roads.

Section 8: Guiding Principles & Concepts

Cumberland is in agreement and compliance with all of the guiding principles of Inuit Qaujimajatuqangit described in this section.

Section 19: Requirement for License

2.l Cumberland applies for and receives licenses and permits to conduct research in relation to wildlife and habitat.

Section 65: Habitat Protection

Cumberland does not substantially alter or damage or destroy any habitat without the required permits and licenses.

Section 67: Littering

Cumberland disposes of, and will continue to dispose of all waste and litter in an approved manner.

Section 72: Bird's nests

Cumberland will ensure that active nests are not disturbed during exploration, construction and other development activities.

Section 74: Pursuit of Wild Animal

Helicopter pilots adhere to a strict code of conduct with respect to wildlife. Pilots must stay above a designated height (minimum of 300 m), and chasing or harassment of wildlife is prohibited.

Section 90: Feeding Wild Animal

Cumberland prohibits the feeding of wild animals at its exploration camps and will do the same during the life of the mine. All attractants are disposed of by incineration.

Section 97: Defence of Life or Property

Although the Act permits the destruction of wildlife to preserve human life or a person's property, Cumberland has and will implement mitigation measures to ensure that wildlife is not attracted to the mine site.

Section 117: License Required

Cumberland applies for and receives licenses for all wildlife research activities.

MIGRATORY BIRDS CONVENTION ACT

Birds and their nests are protected under the Migratory Bird Convention ACT, 1994. Cumberland will ensure that active nests are not disturbed during exploration, construction and other development activities.

SPECIES AT RISK ACT

Intensive wildlife surveys at Meadowbank have not identified any Schedule 1 listed wildlife species or their critical habitats.

INAC's Reclamation Policy

The supporting document Reclamation and Closure submitted with the DEIS and FEIS incorporates the latest reclamation policy from INAC.

4.7 REGULATORY REGIME

NIRB's Comment:

Address currently held water licences, land use permits and other authorizations currently in place including dates of issue and expiry.

Cumberland's Response

Water Permit (NWB): NWB2MEA0204; application for renewal pending.

KIA Commercial lease # KVCL303H305 - effective as of 1 January 2005, currently commercial lease valid for a five year period, until 31 December 2010.

4.8 LAND TENURE

NIRB's Comment:

Provide map showing land tenure for site access and for Baker Lake storage and marshalling area.

Cumberland's response:

Figure 2.4 Baker Lake Storage and Marshalling Area in the DEIS page 5 shows area of the proposed Baker Lake storage and marshalling area. The final location of land tenure is still being discussed with the Hamlet of Baker Lake and GN. The final land tenure area will be included in the final EIS.

4.8 LAND TENURE

NIRB's Comment:

It shall further describe those areas by providing such information as file numbers, start and end dates, fees, name, provide information for site access and Baker Lake storage and marshalling area.

Cumberland's response:

We are still in discussions with the Hamlet and GN on the details of leasing land from the Hamlet. There are no details available on file numbers, start and end dates, or fees.

4.10.1 Project Components & Activities

NIRB's Comment:

4.10.1 Says there are five deposits, but only names four.

Cumberland's Response:

That should read "Four deposits." It will be corrected in the FEIS.

4.10.1 Project Components & Activities: Roads & airfields

NIRB's Comment:

Provide information on all-weather road.

Cumberland's Response:

Information on the conventional access road was provided in the previous submission to NIRB. A comprehensive assessment of habitat and fish populations with all streams potentially crossed by the all-weather road was conducted throughout the spring, summer, and fall of 2005. A separate baseline report has been prepared that documents habitat conditions and fisheries utilization. The revised EIA assesses the significance of construction and operation of the proposed all-weather road.

4.10.1 Project Components & Activities

NIRB's Comment:

Provide details on marine traffic: Provide details of traffic types and frequencies.

Cumberland's Response:

It is estimated that between three to five trips will be required between Chesterfield Inlet and Baker Lake per annum. The annual resupply to Meadowbank will require the transport of 32,000 tonnes of fuel and 27,000 tonnes of dry freight. A fuel tanker will anchor at Chesterfield Inlet and transfer fuel to two 10,000 tonne barges pushed by a coastal tug to Baker Lake for transfer of fuel to onshore storage facilities. Dry cargo will arrive at Chesterfield Inlet by container ship for transfer to 10,000 tonne barges for furtherance to Baker Lake for offloading and placement in the Baker Lake laydown facility. Freight arriving at the Port of Churchill will be loaded directly onto barges for transport by coastal tug to Baker Lake.

Only experienced marine operators with a history of operations in the arctic will be considered for the provision of services for the Meadowbank project. All vessels will comply with Canada Shipping Act regulations and possess certification of compliance for International Safety Management and International Ship and Port Security.

4.10.1 Project Components & Activities Processing Operations

NIRB's Comment:

Provide information on changes to processing operations.

Cumberland's Response:

There is no change in the processing operations from that discussed in the DEIS.

4.10.1.14 Geology / Mineralogy of the Ore Deposit & Mining Methods

NIRB's Comment:

The Proponent shall specifically address the following in Mineralogy. Provide more detail on ore mineralogy.

Cumberland's Response:

The Meadowbank gold deposits are hosted by an interbedded package of oxide facies iron formation and intermediate volcaniclastic rocks. The deposits located near Third Portage Lake: Goose Island and Portage are hosted by oxide iron formation with minor interbedded volcaniclastic units, while the Vault Deposit is hosted by volcaniclastic rocks with rare interbeds of the iron formation. Gold mineralization in both of the deposit areas is intimately associated with sulphide mineralization, dominantly pyrite and/or pyrrhotite.

Goose Island & Portage Deposits

In the main deposit area, near Third Portage Lake, ore zones are dominantly hosted by rocks of the oxide iron formation. These rocks consist of banded magnetite (Fe-oxide) and chert with lesser amounts of chlorite and grunerite as secondary minerals. Local beds of intermediate volcaniclastic rocks may be present, interbedded with the iron formations. These volcaniclastic units dominantly consist of feldspar and quartz with lesser amounts of sericite and/or chlorite as alteration products.

Gold mineralization in these deposits is intimately associated with varying amounts of pyrite and pyrrhotite, which occur in two main habits. The sulphide minerals dominantly occur as a replacement of magnetite in the oxide iron formations, where the sulphides tend to be concentrated along So//S1 planes and possibly S2 in fold limbs. Also important, at least locally, is sulphide mineralization occurring as fracture fill +/- silica and disseminations in both the iron formation and interbedded clastic units. Total sulphide content generally varies from 1 to 5%, but may be as high as 10 to 20% over short intervals. Sulphide content, the proportions of pyrrhotite versus pyrite, and the style (i.e., replacement vs fracture fill) can be variable. Gold grades generally increase with increasing sulphide content, however, there does not appear to be a specific correlation with either pyrrhotite or pyrite.

The bulk of the gold mineralization in the Goose Island and Portage Deposits is contained within the iron formations, with mineralization in the volcaniclastic units probably representing remobilization and secondary enrichment by gold bearing fluids. Gold mineralization in the volcaniclastic rocks is generally associated with moderate to strong sericite alteration.

VAULT DEPOSIT

The Vault deposit, located approximately six kilometres to the north of Third Portage Lake, is dominantly hosted by volcaniclastic rocks. The oxide iron formations are still present locally in the Vault area but they tend to be wispy and discontinuous. The ore at Vault is dominantly hosted by intermediate to locally felsic volcaniclastic rocks. These volcaniclastic units consist of varying amounts of feldspar and quartz with lesser sericite and/or chlorite as alteration products.

At the Vault Deposit pyrite is the dominant gold bearing sulphide mineral. Gold mineralization tends to be concentrated in the volcaniclastic units, where pyrite occurs as moderate to strong disseminations and local fracture fill, with percentages ranging from 1% up to 10 to 15%. There is a strong correlation between sulphide content and sericite-silica alteration. The association between sericite alteration and gold is also prevalent in the mineralized clastic units of the other deposits at Meadowbank. In the Vault area, the iron formations tend to lack significant gold mineralization, this may be due in part, to their discontinuous and wispy nature.

4.10.1.1 Geology / Mineralogy of the Ore

NIRB's Comment:

Deposit and Mining Methods Provide average extraction rate, and the expected amount of ore to be extracted each year.

Cumberland's Response:

Approximately 7,500 to 5,500 tons of ore will be processed daily, up to 2.5 to 2.7 Mt/a.

4.10.1.1 Geology / Mineralogy of the Ore

NIRB' Comment

Deposit and Mining Methods. A mine management plan indicating the sequence of development of the open pits and underground mine. Provide a mine management plan.

Cumberland's Response:

The mine management plan involves mining three open pits on a schedule that optimizes the project cash flow. Mining begins in the Portage Pit which is the largest pit and closest to the process plant. The highest grade Goose Island Pit is brought in year 2 to maximize the cash flow during the initial capital payback period. The Vault Pit is mined last, as it is the lowest grade and farthest from the process plant. The scheduling considers the required plant throughput rate, pit grades, strip ratios, required dyke and haul road construction and dewatering, among other things, to produce an economically optimized mine plan.

A detailed assessment of the overall mine development sequence, including deposition planning for the tailings basin and mine water balance, has been developed and is presented in the Mine Waste and Water Management Report. The report describes the production and usage of waste rock products including use as construction material and back-disposal into open pits where possible. The tailings deposition plan presents the depositional sequence at Years (-1), 1, 3, 5, 7, 8 and end of mine through closure. The mine development and tailings plans include the sequence for filling the pit, showing pit lake levels that are based on the mine water balance.

4.10.1.2 Ore Recovery Plant, Extraction & Concentration

NIRB's Comment:

Provide discussion on the different compounds emitted to the environment during ore processing, the related quantities, concentrations, and dispersion pathways.

Cumberland's Response:

No emissions will occur from the ore recovery plant due to two reasons: (1) the mill uses a wet process at normal temperature and no volatile substances are involved and (2) there will be an air filter of 99% efficiency which will eliminate any measurable emissions.

4.10.1.2 Ore Recovery Plant, Extraction & Concentration

NIRB's Comment:

Provide location of the ore storage pads.

Cumberland's Response:

The location of the ore stockpile is shown in the DEIS Figure 2-5 as a green shaded area northwest of the plant site label; unfortunately, it was not labeled as such. We will correctly label the site in the FEIS.

4.10.3 Processed Ore Containment (& Tailings Ponds)

NIRB's Comment:

Provide more detail in tailings characterization.

Cumberland's Response:

The tailings solids generated in the gold recovery process will have a particle size distribution with approximately 80% of the solids being finer than 60 µ. Approximately 7500 t/d of solids will be disposed of into a submarine tailings impoundment, with a majority of the solids being held underwater.

The solids will settle to provide supernatant clarity in the range of 2 to 5 ppm suspended solids, the solution chemistry will be consistent with that of a cyanide leaching process. It is expected that tailings solutions will contain 1 to 2 mg/l total cyanide and by-products from the cyanide destruction process, namely sulphate, cyanate, thiocyanate, ammonia and dissolved metals.

The process solutions held in the tailings impoundment will be re-cycled to the process facility to operate the gold recovery process and minimize the requirement for fresh water utilization in the project.

Samples of tailings were obtained directly from the metallurgical program. Samples of ore from each deposit (Goose Island, Portage, and Vault) were processed through two potential gold recovery circuits (laboratory scale) and a cyanide destruction circuit (again, laboratory scale). The two processing circuits differed in their pre-cyanidation step: the first option included a flotation of sulphide-poor tailings and cyanidation of a sulphide concentrate, while the second option excluded flotation and cyanidation was done on whole-ore tailings. Since both waste streams of the first processing option were to be recombined before discharge to the impoundment, both processing options are considered to generate chemically similar tailings as a whole. The second processing option (whole-ore cyanidation) was selected based on more favorable economics.

Tailing solids from both processing options were subjected to a static and kinetic testing program developed following the recommended methods for northern mine sites (INAC, 1992) and state-of-the-art testing protocols in independent laboratories. The objective of the testing program was to characterize the tailings in terms of their bulk chemical and mineralogical content and their weathering characteristics (potential to generate acid rock drainage and leach metals to the environment). The chemistry of tailing process water from all processing options was also evaluated. The following summarizes the results of tailing waste characterization:

Composition of tailings: In the Goose Island and Portage area, gold mineralization is hosted mainly in iron formation (IF) rock and in some intermediate volcanic (IV) rock, while in the Vault area located 5 km to the north, mineralization is hosted in IV rock only. Consequently, tailings will originate from IF and IV rock. The major rock forming minerals in IF tailings consist of quartz [SiO_2], chlorite (of the general formula: [$(Fe,Mg,Al)_6(Si,Al)_4O_{10}(OH)_8$]) and amphibole (of the general formula: [$Ca_2(Fe,Mg)_5Si_8O_{22}(OH)_2$]) with lesser magnetite [Fe_3O_4] and traces to no carbonate minerals (dolomite [$Ca,Mg(CO_3)_2$], calcite [$CaCO_3$], siderite [$FeCO_3$]; magnesium-calcium, calcium and iron carbonates respectively). IV tailing mineralogy consists mainly of quartz, muscovite, chlorite, and carbonates (predominantly dolomite with minor calcite).

For all deposits, the main sulphide minerals include pyrite [FeS_2] and pyrrhotite [Fe1-xS], with some arsenopyrite [FeAsS], and trace amounts of chalcopyrite [$CuFeS_2$] and rare sphalerite [ZnS]. The proportion of pyrrhotite decreases from south to north: the Vault deposit has minor amounts of pyrrhotite, while the Goose Island deposit has approximately equal proportions of pyrrhotite and pyrite.

Acid rock drainage potential: The bulk of the tailings are expected to be acid generating: (1) For tailings from the flotation circuit initially considered: "All concentrate and combined tailings (mix of 20% concentrate and 80% flotation tailings) [1] from each of the three deposits (Portage, Goose Island Island and Vault) along with Portage and Goose Island flotation tailings are PAG [potentially acid generating], whereas the Vault flotation tailings are non-PAG. Since all tailings will report to the same impoundment, the bulk tailing material is expected to be PAG." (2) For tailings from the currently considered process (whole ore processing): Goose Island and Portage whole ore tailings are PAG, while Vault whole ore tailing is non-PAG. Vault tailing have similar sulphur content than the Portage and Goose Island deposit tailings but have ten times the their buffering capacity, mostly from carbonate minerals. The whole ore tailing expected to be produced at Meadowbank will originated from two or sometimes three deposits at once, therefore will likely be acid generating, except for the last years when only Vault ore will be processed.

At closure, any remaining tailing process water will be monitored and treated as required, and discharged, and the tailing solids will be covered with acid-buffering run-of-mine ultramafic waste rock. With time, the tailings facility is predicted to freeze, reducing the potential for ARD to develop.

Weathering characteristics: Tailings have been subjected to accelerated weathering tests (kinetic testing). (1) For tailings from the flotation circuit initially considered:All Goose Island and Third Portage tailing streams (concentrate, combined and flotation tailings) generated ARD within a relatively short period of time after initiation of kinetic testing. These tailings have a low buffering capacity which is provided mainly by alumino-silicate minerals compared to carbonate in Vault tailings, and have a larger proportion of the more reactive pyrrhotite than the Vault tailingsAll Vault tailing leachates remained alkaline during the (20 to 40 weeks) testing period. These tailings have ample buffering capacity provided by carbonate minerals (dolomite and some

[1] The tailings described were generated from a laboratory-scale processing circuit that included flotation and cyanidation of a sulphide concentrate. The whole ore tailings are expected to have similar chemical and weathering characteristics as the combined tailings.

calcite) and can constitute a long-term source of alkalinity. Depletion calculations suggest that Vault tailings will eventually generate ARD, but after a slightly longer lag period than the current testing period (four to 15 years under accelerated weathering laboratory conditions, likely much longer under actual site conditions)." (2) for tailings from the currently considered process (whole ore processing): The combined whole ore tailings tested for over one year under accelerated weathering conditions released pH-neutral leachate and was compliant to MMER for chemical constituents. Copper was the only constituent to exceed CEQG, the latter is likely associated with sulphate catalyst added to the tailing slurry for the cyanide destruction process.

Tailings have a potential to generate ARD and, should this potential be realized, may generate poor quality leachate. Consequently, the tailings management plan that has been developed includes freezing of the tailings with time, processing of Vault ore last and covering of the tailings with a buffering waste rock in which the active layer will develop. These management strategies will reduce the potential for ARD to develop in tailings.

4.10.1.4 Overburden & Waste Rock Disposal the Proponent shall:

NIRB's Comment:

Provide a plan for overburden and waste rock handling, including the design and location of the storage sites, describing the options for each. The Proponent shall include a review of similar operations elsewhere, applicable modeling information, and the results of research on the long-term thermal stability of the underlying permafrost and frozen materials; Table 4.7 : Decision Matrix for waste rock storage option is missing.

Cumberland's Response:

Detailed discussions of the decision matrix methodology used to evaluate waste rock and tailings management alternatives are presented as Appendices to the Project Alternatives Report. Lists of operations using similar cold regions disposal strategies are contained within the reports. The detailed decision matrices used to select the appropriate disposal methods are also contained in the reports.

Mine waste storage alternatives, both rock and tailings, were evaluated using a decision matrix approach whereby a series of selection criteria were developed to describe environmental, operational, and economic factors, and to allow a comparison of the relative importance of these factors for the different sites and for the different waste streams.

The process used to evaluate the alternatives involved:

- identifying potential locations
- developing a site specific, decision matrix model to evaluate, rank, and select the best overall facility or facilities.

The objectives of the studies was to identify the most appropriate method for disposal of waste rock and tailings for the Meadowbank project based on an evaluation of technical, environmental and economic considerations. The requirements are that each facility have minimal net adverse effects on the environment, now and in the future, be technically sound with the minimal potential for failure, and be economically viable.

The contributions of the three primary categories to the overall decision making process are shown for the baseline conditions for the rock and tailings storage facilities in the following table.

Relative Contribution of Primary Categories to Decision Analysis

Primary Category	Contribution to Overall Weighting Rock Storage	Contribution to Overall Weighting Tailings Storage
Environmental	50%	55%
Operational	30%	33%
Cost	20%	12%

Each of the primary categories was subdivided to consider other sub-indicators.

Primary objectives established for the selection of an appropriate waste rock storage facility (or facilities) were to:

- minimize potential long-term environmental impacts (including ARD generation, metal leaching, seepage to the underlying groundwater regime)
- maximize ease of water management during operation
- maximize ease of decommissioning/closure
- minimize catchment area impacted
- minimize dust generation
- minimize visual impact
- minimize areas of lakes impacted;
- minimize footprint area (to reduce the volume of affected runoff)
- minimize the potential for geotechnical hazards (including slope instability, seismic risk)
- minimize haul costs.

A list of initial site selection criterion that any tailings storage facility for the Meadowbank mine site must meet was developed. This list was used as an initial screening tool, and any locations that did not meet these criteria were eliminated from further analysis. The following key site selection criteria were utilized:

- the site was required to have sufficient volume to store planned volume of tailings
- the site required the potential to provide additional capacity for tailings storage
- the location would accommodate mine expansion
- the location is within catchments of the open pits
- the site allows control and collection of the tailings supernatant.

Sites that failed to meet the initial site selection criteria were removed from further consideration. Sites that were considered further were then evaluated using further environmental, technical and economic criteria.

CURRENT THERMAL CONDITIONS

Monitoring of the permafrost thermal regime at the project site began in 1996. Twenty-two thermistor cables have been installed at the site, ranging in vertical depth from 11 to 191 m. The Meadowbank project site is underlain by continuous permafrost to depths on the order of 550 m depending on proximity to lakes. Based on the current site thermistor instrumentation, the depth of the active layer in the project area ranges from about 1.3 m in areas of shallow overburden and away from the influence of lakes, up to 4.0 m adjacent to lakes, and up to 6.5 m beneath the stream connecting Third Portage and Second Portage Lakes. Taliks extending through the permafrost will exist beneath circular lakes having a minimum diameter of 570 m, and elongate lakes having a minimum width of 320 m. Based on this, Second and Third Portage lakes will have taliks extending through the permafrost. Much of Vault Lake freezes to the lake bottom; consequently the talik beneath Vault Lake is considered to be isolated.

The data collected from the thermistors installed at the site in 1996 (TP96-154 and TP96-155), and in 1997 (TP97-196), indicate there are no significant variations in the permafrost thermal regime recorded by these installations over the period of seven years for which data have been collected. Based on this information the permafrost thermal regime at the site exists in a steady state. However, on-going monitoring of the existing thermistors is planned, along with the installation of additional thermistors in, and around the proposed rock storage facilities for on-going comparison with the baseline data.

Waste Dump Thermal & Physical Stability

The Portage rock facility was designed to minimize the footprint area and limit impact on lake areas while meeting storage requirements for the facility. The Vault rock storage facility was designed to minimize visual impact and impact on lake areas while meeting storage requirements.

A stability analysis carried out for the Portage rock storage facility, representing the most critical foundation and slope configurations of the two facilities, indicated the slopes to be stable for both shorth- and long-term conditions, for frozen, partially frozen, and thawed foundation conditions, and for pseudo-static conditions. Thermal analyses for the Portage facility indicated that the foundation and dump materials will freeze over time and will remain frozen, even with projected climate warming trends.

Tailings Facility Thermal & Physical Stability

A series of stability and thermal models were developed for the tailings dike and tailings storage facility. The results of these analyses are presented in the Project Alternatives Report within the report, and in appendices.

Based on the stability analyses, the dikes will be stable in the long-term, for static and pseudostatic loading conditions. Based on the thermal analyses, the tailings dike and tailings are indicated to freeze with time, and are indicated to remain frozen even when predicted climate change trends are considered.

ABANDONMENT & RESTORATION

The waste storage facilities will be progressively closed during mine operations. A dry cover of acid buffering ultramafic rockfill will be placed over the Portage rock storage facility to confine the permafrost active layer within relatively inert materials. Currently, it is planned to use a cover thickness of 2 m, which is greater than the currently measured active layer at the site. During operations, thermistors will be installed into the rock storage facilities to monitor the performance of these so that adaptive measures can be implemented if a thicker cover is indicated to be required.

Based on current geochemical analyses of the Vault waste rock, and on water quality predictions, the Vault rock storage facility is not expected to require a cover. During operations, monitoring of water quality of runoff from the facility will be undertaken so that adaptive management plans can be implemented if predicted water quality differs from actual water quality.

Each rock pile will be contoured to provide a shape consistent with the surrounding topography and to encourage runoff from the final surface to designated drainage paths.

A network of perimeter drainage ditches and sumps will be constructed during operations around each rock facility to collect surface water runoff. During runoff from each rock facility will be directed to an attenuation storage pond. After it has been demonstrated that runoff meets quality discharge criteria, runoff will be directed to existing lakes.

Monitoring, inspection and maintenance activities will be carried out during mine operations to progressively modify the abandonment and restoration place according to the monitoring and assessment results.

Decision Matrix for waste rock storage option is included as an attachment with this letter.

4.10.1.6 Mine De-watering if Applicable, the Proponent Shall Provide

NIRB's Comment:

Provide mine inflow water quality to open pits.

Cumberland's Response:

Pit water quality predictions have been developed providing monthly average dissolved constituent concentrations over the duration mine life and post-closure. The quality of water that will accumulate in each open pit was predicted by mathematically mixing the various mine inflow components, taking into account their volumetric proportion. The water quality of each component was either obtained from data collected at the Meadowbank site (e.g., groundwater and lake water quality) or from modeled data (e.g. run-off and drainage over pit wall, water infiltrated through dikes and runoff over dike material).

OPEN PIT WATER QUALITY INPUT PARAMETERS & MODELING ASSUMPTIONS

The open pits are considered to act as sumps for drainage contacting exposed rock on the pit walls and immediate surroundings. Chemical loads to the pit include:

- infiltration through the blasting-induced fracture zone on pit walls and runoff over pit walls
- runoff and infiltrated drainage over the exposed, downstream portions of the water retention dikes
- seepage of lake water through the dikes, carrying a mass load from the lake and from water contacting the dike material
- groundwater seepage from pit walls in the Goose Island and Portage pits where taliks are intersected. No talik is intercepted by the Vault pit.

Pit waters are expected to be pumped to the Vault and Portage attenuation ponds.

Water Quality Assumptions – Open Pits

Property	Comment/Assumptions	Source
All Pits		
Surface Areas and Footprints	Linear growth of surface area and footprint until end of pit life.	Golder, 2005c
Damaged Rock Zone	The reactive thickness (of 1 meter) corresponds to the damaged rock zone where fractures allow contact of rock with air and water. F_{ps} (10%) and F_{rw} (10%) scaling factors applied.	Siskind and Fumanti, 1974
Proportion of Exposed Lithologies	Provided by cross-sections through final pit shell. Same lithological proportions assumed throughout pit life (see Table 3-10).	CRL, 2003
Explosives	15% of waste explosives assigned to pit and fully dissolved at each time step. Concentration of explosive products in pit sump calibrated against concentrations at other mine sites.	Ekati Diamond Mine, 2005; DDM, 2005.
Temperature Effect on Leaching Rates	F_{temp}: Leaching rates halved for every 10°C decrease from 25°C, for: Ca, Mg, Na, K, Si, Fe, SO_4, Cl, NO_3, and alkalinity.	Diavik, 1998; Davé and Clulow, 1996; Davé and Blanchette, 1999
	F_{ice}: Leaching rate is assumed to be 1E-10 mg/kg/wk when ambient air is at or below 0°C in D_a. All accumulated reaction products are released during June spring flush;	Snap Lake, 2002

Property	Comment/Assumptions	Source
	Temperature gradient within the fracture zone thickness (D_a): monthly average air temperature at pit wall surface to 0°C at the based of the fracture zone (D_a), split into five temperature zones (Z).	
Chemical Controls	None imposed on pit waters or drainage from in-pit rock storage piles.	Golder, this document
	pH value assigned to pit waters based on relative proportion of pit wall drainage, groundwater infiltration and direct runoff in each pit. (see Table 4.6).	
Goose Island, Third and North Portage		
Pit Inflows	Direct precipitation, runoff, groundwater inflow, dike seepage and runoff all collect in the pit and are transferred to the storm/attenuation pond	Golder 2005c
Groundwater seepage	TDS (major ions) concentration increases with time from upwelling of saline groundwater. Other constituents constant through time.	Golder 2004d
Onset of ARD	(same as RSF)	Golder, 2004a
Vault		
Pit Inflows	Direct precipitation and runoff only (no dike seepage, frozen groundwater). Waters collect in pits then are pumped to attenuation pond.	Golder, 2004c
Onset of ARD	(same as RSF)	Golder 2004a
Water Retention Dikes		
Configuration of Dikes	Double dikes with low-permeability soil-bentonite seepage cutoff between the two halves.	Golder, 2003a
Construction Material	IF material on submerged (upstream) half, IV on downstream half (dry until closure).	Golder, 2003a
Leaching Rates and Factors	Laboratory-derived loading rates from the IF rock (for seepage through dikes), UM and IV rock (for runoff over pit half of dike). F_{ps} (10%), F_{sub} (1%) and F_{temp} applied to submerged rock (based on temperature of lake water). Dike runoff leaching rate factors same as RSF.	Golder, 2005a; 2004a

Property	Comment/Assumptions	Source
Chemical Controls	No solubility controls imposed on dike seepage water. Full constituent loads transferred to pit waters	

Source: Water Quality Predictions Report (Golder, 2005).

Vault Pit Water Quality

The pH of Vault pit water is expected to remain neutral and chemical loading of pit waters are predicted to increase with time as the pit surface area increases, until the end of mine life. At the end of mine life, the flooded Vault pit water merges with that of the Vault area attenuation pond to become one water body, in the location of the former Vault Lake. Vault pit water quality is predicted to consistently meet Canadian Metal Mine Effluent Regulations (MMER) quality during operation and post closure.

Portages & Goose Island Pit Water Quality

The lithology of pit walls is such that drainage from each pit could potentially acidify before being submerged. Depending on the extend of ARD developed, if any, the pH may be slightly acidic (between 6 and 6.5). ARD is not expected to occur immediately considering the slow reaction kinetics of some of the potentially acid generating rock that will be present on portions of pit walls. During operation, the concentrations of the majority of constituents slowly rise until pit closure. The current mine plan proposes to carry out pit water quality monitoring and pH adjustment during operation, if required, to control pit water quality. Pits will gradually be filled using water drawn from Third Portage Lake during operation and at post-closure. After the Goose Island and Portage Pits have been filled, the fully flooded pits will form one large lake. The dikes separating the pit lake from Third Portage Lake will be breached after the pit Lake water quality becomes acceptable. Fish habitat features will be engineered into the dike slopes and the bottom of the re-flooded area to ensure that high value habitat can be generated. This is a key component of the NNL (2005) plan.

4.10.1.8 Airport Facilities

NIRB's Comment:

The Proponent shall describe: Airport facilities at the mine site. Verify length of airstrip. Provide frequency of use.

Cumberland's Response:

The airstrip to be constructed at Meadowbank will have a runway surface 1,100 m in length, and 30.5 m in width, and be capable of handling Hawker Siddely HS-748 size aircraft. The runway surface will be compacted crushed rock and will be treated with a dust suppressant. A short apron and taxiway will be provided for parking aircraft during loading and unloading operations. The airstrip will be provided with runway lighting and be equipped with a non directional beacon

(NDB) for navigation. It is expected that up to 3 flights per week will be scheduled. The airstrip may be extended to a total length of 1,525 m and runway width of 50 m during the operational mine life to allow larger aircraft to land.

4.10.1.8 Airport Facilities

NIRB's Comment:

The Proponent shall describe: Provide deicing and containment system.

Cumberland's Response:

A dedicated deicing plant and equipment will not be provided at the Meadowbank airstrip. Aircraft will carry the required application equipment and the appropriate deicing agent. Overspray and runoff will report to the airstrip drainage system and be directed to the tailings impoundment. Quantities will be minimal.

4.10.1.8 Airport Facilities

NIRB's Comment:

The Proponent shall describe construction methods; Provide quantities and sources of material for construction and maintenance.

Cumberland's Response:

Construction of the Meadowbank airstrip will be conventional cut and fill operations, using material cut from the airstrip alignment elevations above grade and placed in areas below the design grade. Additional fill materials will be sourced from the pre stripping operations in the open pits. Surfacing of the airstrip will be crushed rock procured from the mine prestripping operations.

The airstrip will require 44,600 m^3 of cut and 57,000 m^3 of fill to achieve the design grade.

4.10.1.9 Fuel & Explosives Storage Sites

NIRB's Comment:

Provide quantities of explosives to be stored.

Cumberland's Response:

The annual consumption of explosives at the Meadowbank site will be 11,164 tonnes, comprised of 11,095 tonnes of ANFO (ammonium nitrate / fuel oil) and 69 tonnes of detonators. It is to be noted that ammonium nitrate is not an explosive; it only becomes explosive after on-site mixing with fuel oil. ANFO is produced on site as required for immediate loading into the drilled boreholes and detonation. It is not stored for future use but is produced on a daily basis. The quantity of explosives stored on site therefore is 69 tonnes, which are the detonators. Storage of explosives is governed by federal regulations and requires certified and registered storage facilities and monitoring by Mines Inspectors.

4.14 DESCRIPTION OF SOCIO-ECONOMIC ENVIRONMENT

NIRB's Comment:

Present baseline data on a community-by-community basis on such components as:

- *Provide number of children under care of the state/ territory.*

Cumberland's Response:

Neither the Government of Nunavut nor the Government of Canada are publicly reporting on the number of children under care in Nunavut. In 2003, the National Children's Alliance commissioned the Child Welfare League of Canada to prepare a status report on children in care in Canada[2] however the League was unable to obtain numbers of children in care for Nunavut.

The most recent public numbers are from the Government of the Northwest Territories. The number of children in care, in Nunavut specifically, for the fiscal years 1996-1999 are provided in the Annual Report of the Director of Child and Family Services[3]. There were between 280 and 300 children in care over this three-year period, with no trend discernible.

4.16 TEMPORAL BOUNDARIES

NIRB's Comment:

Provide temporal boundaries for socioeconomic impacts.

Cumberland's Response:

The socioeconomic assessment noted impacts that were expected to continue to be experienced beyond the close of the project. There is normally no "end" date for many socio-economic effects including those such as job experience gained as a result of employment or improved educational status as a result of education and training opportunities.

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[2] *See http://www.nationalchildrensalliance.com/nca/pubs/2003/Children_in_Care_March_2003.pdf*

[3] See *http://www.hlthss.gov.nt.ca/content/publications/reports/directors_report/directorsreport98_99.pdf*

4.21 IMPACT ASSESSMENT

NIRB's Comment:

Provide a description of any changes to project impact assessment resulting from project design changes identified in Cumberland's letter dated 8 March 2005 regarding Feasibility Study Results on the Meadowbank Gold project. Provide assessment of impacts for temporary closure.

Cumberland's Response:

There is no change in the design of the mine from that discussed in the DEIS. Temporary closure impacts are dealt with as part of the impacts during operations as most activities that have impacts will continue during temporary closure e.g., truck traffic, noise, and water use.

4.21.1.2 Processed Ore Containment (& Tailings Ponds)

NIRB's Comment:

Anticipated volume of tailings in relation to the storage capacity of the lake. Update required.

Cumberland's Response:

There is no change in the anticipated volume of tailings from that discussed in the DEIS. The tailings facility is designed to store approximately 15 Mm^3 of tailings over the life of the mine.

4.21.1.3 Waste Rock, Ore & Overburden Storage

NIRB's Comment:

Provide information for ore stockpiles.

Cumberland's Response:

The location of the ore stockpile is shown in the DEIS Figure 2-5 as a green shaded area northwest of the plant site label; unfortunately, it was not labeled as such. We will correctly label the site in the FEIS.

The locations for Waste Rock , Ore, and Overburden stockpiles are shown clearly on the General Site Plan for the project. A certain amount of waster rock and overburden will be used in the construction of site facilities, and in the construction of the de-watering and tailings dike. This is described in detail in the Mine Waste and Water Management Report. Overburden not used in the construction of the de-watering and tailings dikes will be dispose of in the tailings facility, within the Portage or Vault rock storage facilities, or will be stockpiled on surface for later use in reclamation activities.

4.21.1.6 Sewage & Solid Waste Management

<u>NIRB's Comment:</u>

Provide information of landfill segregation and leaching.

<u>Cumberland's Response:</u>

A pre-fabricated, modular-type accommodation complex for 200 persons will be supported with a sewage treatment, solid waste disposal, and potable water treatment plant. The sewage treatment facilities will be housed in a modular structure adjacent to the camp. Sewage will be collected initially from the accommodation complex during construction, and during operations, from the office area and change room facilities. Grease traps will be provided to handle the flow from the kitchen and shop sewers. The plant will be sized for an on-site construction workforce of 300 persons, while the average number of operations personnel will be around 200 people. Sewage treatment will be carried out as part of the camp facilities; the effluent will be treated to a Level 3 standard for discharge to the environment.

During construction, the treated effluent and grey water will be discharged to Third Portage Lake. During operations, the effluent will be pumped to the tailings pump box, then to the tailings impoundment area. The sewage volume to the tailing impoundment is estimated to be a maximum of 1.5%. Consequently, the chemical load from sewage water is of low significance relative to that of the tailings water quality and overall mine site water quality. Operations use will be designed to meet Nunavut discharge requirements. Therefore, the inclusion of sewage water in the tailings impoundment facility is not expected to significantly affect the water quality within the tailings impoundment, and would be within the accuracy of the current modelling.

Solid waste from the accommodation camp, kitchen, shops, and offices will be burned in a waste incinerator. This will be diesel-fired and located in a prefabricated structure downwind of the facilities. Waste will be transported by pickup truck and loaded into the incinerator. Non-burnable waste will be buried in the mine waste dump. Organic materials, which include but are not limited to, paper, wood, food waste, and sewage treatment sludge, will be incinerated, and the ash will be placed within the tailings impoundment.

4.21.1.9 Air & Ground Traffic

<u>NIRB's Comment:</u>

The Proponent shall assess the potential impacts, including those resulting from interactions with wildlife, relating to air and road traffic, taking into account the type, frequency, and timing of traffic, particularly low-flying fixed- and rotary-wing aircraft, noise levels, and, in the case of road traffic, stream crossings. Update required

Cumberland's Response:

There is no change in the air traffic from that discussed in the DEIS. Impacts on road traffic are included in the DEIS, FEIS and Supporting Documents, and in the previous letter submission to NIRB.

4.21.1.10 Borrow Pits & Quarry Sites

NIRB's Comment:

The Proponent shall assess the potential impacts of borrow pits and quarry sites, including noise and dust levels, slope stability, thawing of permafrost and ground ice, melt water runoff, habitat loss, and interactions with wildlife. Update required.

Cumberland's Response:

Potential impacts of borrow pits and quarry sites are included in the DEIS, FEIS and Supporting Documents, and in the previous letter submission to NIRB. Much of the rock to be used in the construction of the on-site facilities, including the construction of the pit de-watering and tailings dikes, will be derived from the Portage open pit. Details of the development of the stable pit slope design criteria for the various open pits are contained within Appendix A of the Mine Waste and Water Management Report. Details of modeling predictions of noise and dust levels from the mine are contained in supporting documents. Details of permafrost ground conditions, and ground ice are contained in the Baseline Physical Ecosystem Report, and other supporting documents. Detailed geomorphologic assessment of perglacial processes observed at the project site, along the proposed access road, and at Baker Lake have been completed. The results of these are contained as appendices to the Baseline Physical Ecosystem Report.

At this time the development of an additional quarry site at the project is unforseen, if required, then independent studies would be undertaken for this case and would include geotechnical engineering, geochemical, and environmental studies.

4.21.1.13 Accidents & Malfunctions

NIRB's Comment:

The Proponent shall assess the potential impacts, including those resulting from interactions with wildlife, of accidents and malfunctions, including worst-case scenarios, and shall evaluate their probability of occurrence. Provide worst case scenarios and probabilities of occurrence.

Cumberland's Response:

The probability of an accident or malfunction is extremely low. In the case of a major uncontained fuel spill, there may be potential toxic effects to bird species, particularly waterbirds that attempt to utilize the slick or contaminated water. However, as outlined in the impact matrices of the DEIS, all fuel storage areas will have containment berms, and daily on-site monitoring will ensure that all potentially detrimental interactions between mine activities and facilities are identified and mitigated immediately.

Potential spills of cyanide granules during transportation to the Meadowbank Camp, if not cleaned-up immediately, may result in exposure of birds, small mammals and other wildlife that inadvertently ingest the cyanide granules. Waterfowl, such as geese, may be particularly susceptible to poisoning because of their ingestion of gravel-type substances. However, all transporting of cyanide will be according to established protocols and guidelines, and any spills will be cleaned up immediately (see Spill Contingency, Hazardous Materials, and Emergency Response plans – Draft EIS).

4.21.4 Social, Economic & Cultural Components

NIRB's Comment:

Provide project contribution to increased levels of contaminants in traditional foods.

Cumberland's Response:

The Meadowbank area is currently only used incidentally for hunting and the gathering of traditional foods. Nevertheless, the potential for elevated levels of contaminants in traditional food plants through dust and emissions is considered to be very low. To ensure that Cumberland's prediction of "no impact to traditional foods' is accurate, a comprehensive environmental health monitoring program will be established that regularly samples and analyses soils and vegetation.

Fish comprises a small but important and nutritious component of the diet of community members of Baker Lake. Baseline metals and mercury concentrations in domestically captured fish species (i.e., lake trout, Arctic char, round whitefish) from project and regional lakes have been determined in baseline studies. All metals for which there are health-based guidelines (i.e., arsenic, antimony, mercury) are well below threshold concentrations for all lakes and species. Although the EEM program does not require that metal or mercury concentrations in fish be measured, tissue samples will be measured for all metals during each three-year fish survey cycle. In addition, Cumberland Resources integrated Aquatic Effects Monitoring Program (AEMP, 2005) stipulates annual monitoring of fish tissue for metals and mercury to ensure that increased tissue concentrations do not go undetected. Reporting of tissue metals concentrations will be made to the appropriate regulatory agency on an annual basis.

4.21.4 Social, Economic & Cultural Components

NIRB's Comment:

Provide Appendix B of Socioeconomic and Archaeology Impact Assessment.

Cumberland's Response:

Appendix B has been sent to all parties.

4.24.1 Overview

NIRB's Comment:

Provide location of hazardous waste land farm.

Cumberland's Response:

Hazardous waste will be handled and conveyed in compliance with federal and territorial regulations. Containerized waste including contaminated soil will be stored at an on site temporary storage area prior to removal off site to a permitted disposal facility. It will be located adjacent to the airstrip on the north side, between the airstrip and the tailings containment area, as indicated in Figure 2.5 Proposed Mine Site Layout. Runoff from the land farm area will be directed to the tailings area.

4.26.1 Overview

NIRB's Comment:

The Proponent shall present a Monitoring and Follow-Up Plan that includes compliance, biophysical and socioeconomic monitoring programmes, and a follow-up programme to integrate the monitoring results into a coherent programme of action and to evaluate the effectiveness of mitigation measures during operation and after the final closure of the project. (Compliance monitoring refers to verifying the Proponent's conformity with regulatory standards. Biophysical monitoring involves the monitoring of such biophysical components as air, water, and land. Socioeconomic monitoring involves the monitoring of socioeconomic parameters, for example employment of Nunavummiut and other northerners and the purchase of goods and services in the Region.) In every case, the Proponent shall explain what is to be monitored, why it needs to be monitored, and how it will be monitored.

Cumberland's Response:

As discussed in the previous submission, monitoring and following plans where submitted with DEIS. Each document explains why, how and what is to be monitored. For example the AEMP (2004) document describes the rationale, framework, strategy, methodology and scope of management plans to be implemented during mine construction, operation and post-closure. Management consists of a range of activities, including mitigation and environmental monitoring. Monitoring is designed to detect potential adverse effects on aquatic valued ecosystem components in order that (further) mitigation can be applied as necessary to eliminate or reduce adverse effects. The AEMP is a dynamic, practical guide that identifies the source of physical and chemical stressors to the receiving environment, pathways of potential exposure, the ecological receptors at potential risk, mitigation measures, and the specific parameters to be monitored, and their frequency, geographic location, and duration. The AEMP takes an integrated, ecosystem-based approach that links mitigation and monitoring of physical/chemical effects on key ecological receptors in the receiving environment. At its core, this AEMP will address key issues, water quality, fish habitat, and fish populations.

The core program of the AEMP is a general strategy to monitor water and sediment quality, periphyton, benthic invertebrates, and fish, based on major mine construction, operation, and infrastructure components such as dykes, effluents, stream crossings, and roads. This general design will be implemented prior to and during construction and operation of the mine and will be conducted each year, until closure. Note that requirements under the Metal Mining Effluent Regulations (MMER) are considered part of the foundation to core studies pertaining specifically to mine effluent sources. The AEMP also describes specific targeted studies that typically have narrower temporal or spatial bounds or are designed to address specific questions related to particular components of mine development during construction or operation. These are integrated with, and complementary to, the core monitoring design.

Compliance Monitoring documents (Compliance monitoring refers to verifying the Proponent's conformity with regulatory standards) include the AEMP, MMER, NNL, and Reclamation and Closure Plan.

Biophysical Monitoring documents (Biophysical monitoring involves the monitoring of such biophysical components as air, water, and land.) include Terrestrial Ecosystem Management Plan, Air Quality and Noise Management Plan, AEMP, NNL and MMER.

Socioeconomic Monitoring documents (Socioeconomic monitoring involves the monitoring of socioeconomic parameters, for example employment of Nunavummiut and other northerners and the purchase of goods and services in the Region.) include the Socioeconomic and Archeology Management Plan, Human Resource Management Plan and the future negotiated IIBA.

We expect that all these plans will be altered as a result of the upcoming NIRB technical review, licensing stages (e.g. water license) and IIBA negotiations.

4.26.2 Community Liason Committees

NIRB's Comment:

Provide confirmation that the provisions under Section 4.26.2 will be met through the IIBA.

Cumberland's Response:

Given that the IIBA will be a negotiated document, Cumberland intends to meet the provisions of Section 4.26.2.

4.28 CLOSURE & RECLAMATION

NIRB's Comment:

It shall also discuss how the Reclamation and Closure Plan would be updated periodically by, for example, incorporating ongoing research and technological advances. Provide discussion on how research and on-going technological advances will be incorporated into updates of the Reclamation and Closure plan.

Cumberland's Response:

Reclamation at the mine site will be on going over many years. Efforts that are achieving the desired results will be continued and those that aren't will be changed or altered. All specialists will keep abreast of the latest information available on reclamation efforts in the arctic.

TABLE 4.7: WASTE ROCK STORAGE AREAS DECISION MATRIX			ROCK STORAGE OPTIONS (Portage and Goose Pits)				SCORE, S_{IND} (1=worst 9=best)			
Key Indicators	Sub-Indicators	Weighting, W_{IND}	Stockpile Option A North-west from Second Portage Lake	Stockpile Option B North-west from Second Portage Lake	Stockpile Option C East from Vault Haul Road - Small Footprint	Stockpile Option D East from Vault Haul Road - Large Footprint	A	B	C	D
Key Details	Crest Elevation to Store 60 Mm3		205 m	172 m	210 m	178 m				
	Maximum elevation of nearby land		El. 192 m	El. 192 m	El. 164 m	El. 164 m				
	Maximum height from foundation		66 m	28 m	71 m	94 m				
	Total Surface Area		1,400,000 m2	3,000,000 m2	1,280,000 m2	2,200,000 m2				
	Capping volume (assumes 2m thickness)		2,800,000 m3	6,000,000 m3	2,560,000 m3	4,400,000 m3				
Environmental Factors * (50% of Weighted Total)	Sub-catchment area	5	147 ha	426 ha	215 ha	268 ha	9	3	4	5
	Footprint area	4	134 ha	296 ha	126 ha	222 ha	8	4	9	5
	Area of lakes impacted	4	12.4 ha	29.2 ha	26.8 ha	34.2 ha	9	3	5	1
	Potential for geotechnical hazards[1]	3	Moderate	Low	Moderate	Moderate	2	9	2	2
	Visual Impact	3	Moderate	Low-Moderate	Moderate	Low-Moderate	5	9	6	7
	Potential for dust generation	6	High	Moderate	Moderate	Moderate	4	9	3	6
	Potential for seepage to groundwater	6	Moderate	Moderate	Moderate	Moderate	8	6	9	7
	Potential for ARD generation	7	Moderate	Moderate to High	Moderate	Moderate to High	8	1	9	4
	Potential for Metal Leaching	6	Low	Low	Low	Low	1	1	1	1
	Sum of Environmental Weightings, $\sum W_{ENV}$	44	**Weighted Subtotals for Environmental Factors, $IND_{SCORE} = \sum(W_{IND} \times S_{IND})$**				**268**	**199**	**241**	**188**
Operational Factors * (30% of Weighted Total)	Difference between crest and adjacent land	5	+13 m	-20 m	+46 m	+14 m	6	9	1	6
	Ease of water management	7	Good	Good	Good	Good	8	9	2	1
	Catchment impacted	6	Same as Mine	Same as Mine	Adjacent catchment	Adjacent catchment	9	9	1	1
	Ease of decommissioning/closure	8	Place dry cover	Place dry cover	Place dry cover	Place dry cover	1	1	1	1
	Sum of Operational Weightings, $\sum W_{OPS}$	26	**Weighted Subtotals for Operational Factors, $IND_{SCORE} = \sum(W_{IND} \times S_{IND})$**				**148**	**170**	**33**	**51**
Economic Factors * (20% of Weighted Total)	Distance from north edge of North Portage Pit	18	1,200 m	1,700 m	1,000 m	1,400 m	8	5	9	6
	Sum of Economic Weightings, $\sum W_{COST}$	18	**Weighted Subtotals for Cost Factors, $IND_{SCORE} = \sum(W_{IND} \times S_{IND})$**				**144**	**90**	**162**	**116**
TOTAL OPTION SCORE = $\sum IND_{SCORE}$			**560**	**459**	**436**	**355**	**560**	**459**	**436**	**355**

Notes
1. Includes consideration of foundation conditions, impact of seismicity, and height of structure
N:\Final\2003\1413\03-1413-427\[Table 5-6 Waste Rock Decision Matrix.xls]Waste Rock Dumps