CUMBERLAND
RESOURCES LTD.

MEADOWBANK GOLD PROJECT

CUMULATIVE EFFECTS ASSESSMENT

JANUARY 2005

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DESCRIPTION OF SUPPORTING DOCUMENTATION

Cumberland Resources Ltd. (Cumberland) is proposing to develop a mine on the Meadowbank property. The property is located in the Kivalliq region approximately 70 km north of the Hamlet of Baker Lake on Inuit-owned surface lands. Cumberland has been actively exploring the Meadowbank area since 1995. Engineering, environmental baseline studies, and community consultations have paralleled these exploration programs and have been integrated to form the basis of current project design.

1. The Meadowbank project is subject to the environmental review and related licensing and permitting processes established by Part 5 of the Nunavut Land Claims Agreement. To complete an environmental impact assessment (EIA) for the Meadowbank Gold project, Cumberland followed the steps listed below:

2. Determined the VECs (air quality, noise, water quality, surface water quantity and distribution, permafrost, fish populations, fish habitat, ungulates, predatory mammals, small mammals, raptors, waterbirds, and other breeding birds) and VSECs (employment, training and business opportunities; traditional ways of life; individual and community wellness; infrastructure and social services; and sites of heritage significance) based on discussions with stakeholders, public meetings, traditional knowledge, and the experience of other mines in the north.

3. Conducted baseline studies for each VEC and compared / contrasted the results with the information gained through traditional knowledge studies (see Column 1 on the following page for a list of baseline reports).

4. Used the baseline and traditional knowledge studies to determine the key potential project interactions and impacts for each VEC (see Column 2 for a list of EIA reports).

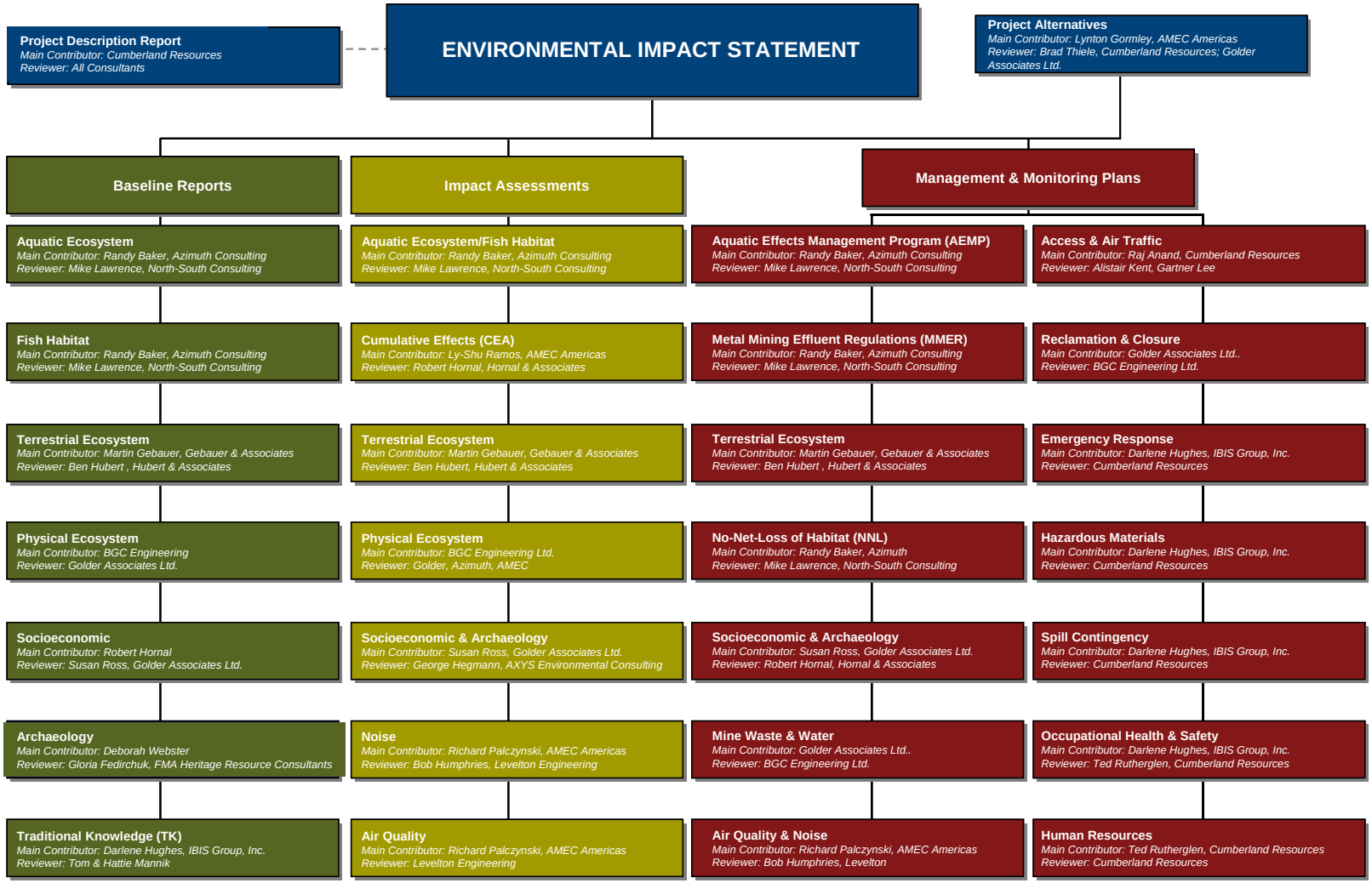
5. Developed preliminary mitigation strategies for key potential interactions and proposed contingency plans to mitigate unforeseen impacts by applying the precautionary principle (see Column 3 for a list of management plans).

6. Developed long-term monitoring programs to identify residual effects and areas in which mitigation measures are non-compliant and require further refinement. These mitigation and monitoring procedures will be integrated into all stages of project development and will assist in identifying how natural changes in the environment can be distinguished from project-related impacts (monitoring plans are also included in Column 3).

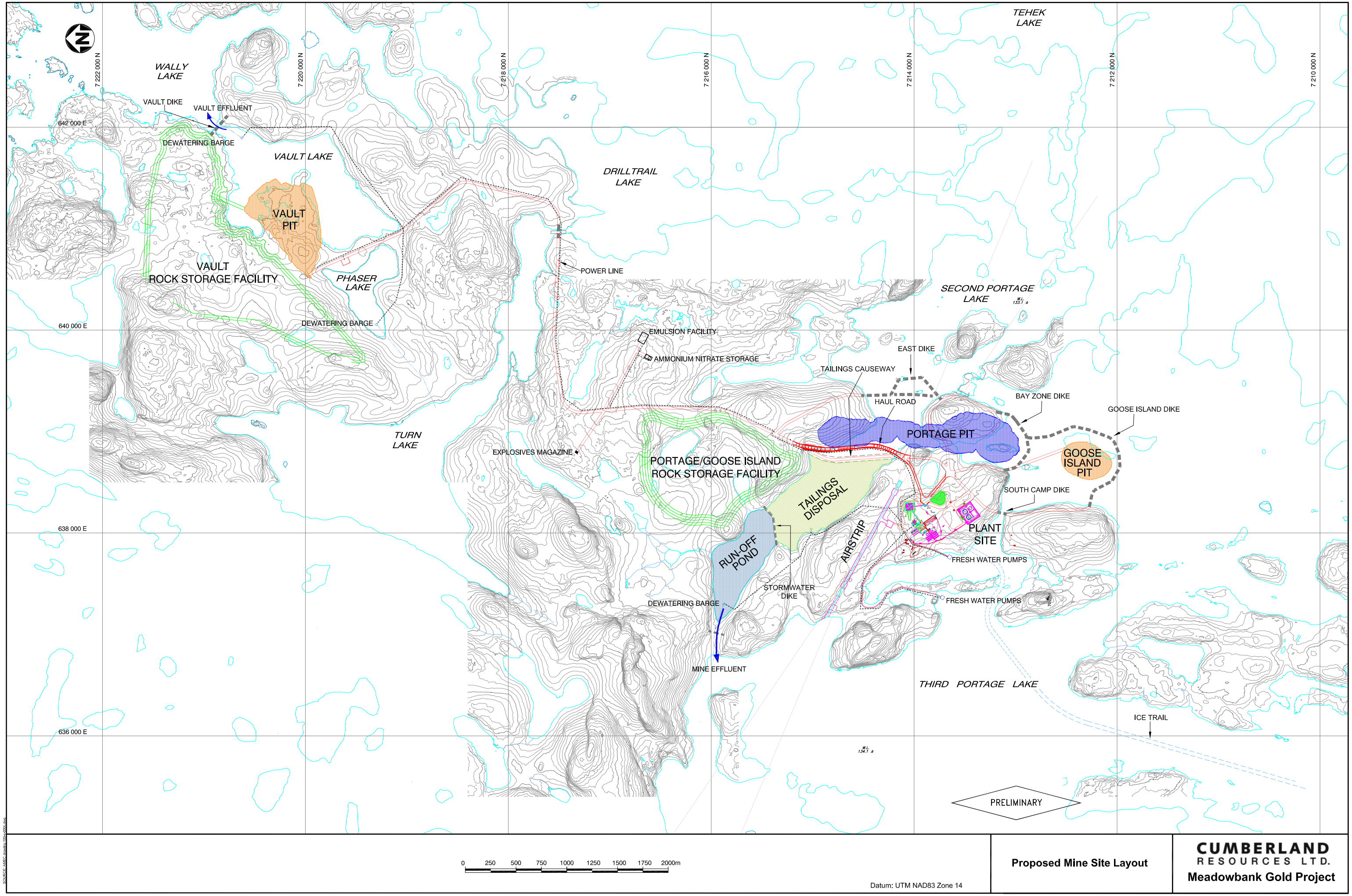
7. Produce and submit an EIS report to NIRB.

As shown on the following page, this report is part of a documentation series that has been produced during this six-stage EIA process.

EIA DOCUMENTATION ORGANIZATION CHART



PROJECT LOCATION MAP


7 222 000 N
7 220 000 N
7 218 000 N
7 216 000 N
7 214 000 N
7 212 000 N
7 210 000 N
642 000 E
640 000 E
638 000 E
636 000 E
WALLY LAKE
TEHEK LAKE
VAULT DIKE
VAULT EFFLUENT
DEWATERING BARGE
VAULT LAKE
DRILLTRAIL LAKE
VAULT PIT
VAULT ROCK STORAGE FACILITY
PHASER LAKE
POWER LINE
SECOND PORTAGE LAKE
DEWATERING BARGE
EMULSION FACILITY
AMMONIUM NITRATE STORAGE
EAST DIKE
TAILINGS CAUSEWAY
HAUL ROAD
BAY ZONE DIKE
GOOSE ISLAND DIKE
PORTAGE PIT
GOOSE ISLAND PIT
TURN LAKE
EXPLOSIVES MAGAZINE
PORTAGE/GOOSE ISLAND ROCK STORAGE FACILITY
TAILINGS DISPOSAL
SOUTH CAMP DIKE
PLANT SITE
AIRSTRIP
FRESH WATER PUMPS
RUN-OFF POND
STORMWATER DIKE
FRESH WATER PUMPS
DEWATERING BARGE
MINE EFFLUENT
THIRD PORTAGE LAKE
ICE TRAIL
PRELIMINARY
0 250 500 750 1000 1250 1500 1750 2000m
Datum: UTM NAD83 Zone 14
Proposed Mine Site Layout
CUMBERLAND RESOURCES LTD.
Meadowbank Gold Project

SECTION 1 • EXECUTIVE SUMMARY

This report examines the potential for residual effects resulting from Meadowbank Gold project activities to combine with residual effects of other actions (i.e., mineral exploration, mines and mining projects and the Hamlet of Baker Lake and associated activities) to cause a negative additive effects in valued economic components (i.e., ungulates (caribou and muskoxen), predatory mammals (wolf, wolverine, fox and grizzly bear), small mammals, fish habitat, raptors, fish population, waterfowl, air quality, other birds, water quality, permafrost, surface water quantity and distribution and vegetation cover: sedge communities, heath tundra, ridge complexes (including eskers), riparian birch and willow groves, boulder fields and rocky outcrops (including cliffs)) are assessed and presented.

The assessment was conducted following Project specific guidelines released by NIRB. The methodology used during this CEA followed the guidelines provided by the Environmental Impact Screening Committee (EISC) and the Environmental Impact Review Board (EIRB) in their October 2001 guide titled “Cumulative Effects Assessment in the Inuvialuit Settlement Region: A Guide for Proponents – Draft Two, and the Canadian Environmental Assessment Agency (CEAA) in their February 1999 guide titled, ‘Cumulative Effects Assessment Practitioners Guide’ taking into consideration the guidelines, comments and recommendations from NIRB, KIA, DSD and Federal Agencies (described above) as well as the use of professional experience and judgement of Cumberland staff and their consultants.

The assessment of cumulative effects on the ecosystem from project related actions and other actions was conducted over regional study areas specific to air quality and noise, physical ecosystem, terrestrial ecosystem and fish habitat and fish. The criteria and ranking for evaluating significance of residual impacts over respective regional scales was adapted from the Environmental Impact Assessment section for each VEC. The primary means by which cumulative impacts of construction, operation and closure/post/closure on VECs is assessed through the use of impact matrices and are presented in Appendix A of this report.

Results of this cumulative effects assessment indicate activities related to the Meadowbank Gold project will cause residual impacts on fish habitat, fish, air quality, noise, water quality, surface water quantity and distribution and permafrost on a local scale during the construction and operation phases of the life of the Project. Following closure of the mine residual impacts will also affect wildlife and wildlife habitat on a local scale. Local scale for aquatic habitats is defined as areas of the project lakes themselves, extending no further downstream than the northernmost bay of Tehek Lake, which receives water from both the Portage and Vault (Vault and Wally) systems. Local scale for terrestrial habitats is defined as a 5 km radius buffer around the main mine facilities and a 2 km radius buffer around the Vault Lake facilities.

On a regional scale the cumulative effects assessment was conducted over the area defined by the Western Churchill geologic province. This regional study area was chosen because it contains valued natural resources, has undergone intense exploration activity, is a representative area for management of wildlife habitat, encompasses the communities which may be directly or indirectly affected by project related actions and is consistent with Natural Resources Canada’s Western

Churchill Metallogeny project, a major component of Canada's Northern Resources Development Program.

Potential interaction between Meadowbank Gold project actions and actions related to the Hamlet of Baker Lake were assessed. Potential for interaction of cumulative residual effects from both actions on fish and fish habitat was evaluated within the Chesterfield Inlet basin. This assessment was based on temporal and spatial overlap of the cumulative residual impacts on fish and fish habitat from both actions. Although a linkage between these two actions was found, significant cumulative residual effects on fish or fish habitat are unlikely to occur within the Chesterfield Inlet basin.

Potential for interaction of cumulative residual effects from both actions on ungulate and ungulate habitat was evaluated within the mainland Nunavut. This assessment was based on temporal and spatial overlap of the cumulative residual impacts on ungulate and ungulate habitat from both actions. Significant cumulative residual effects on ungulate and ungulate habitat are unlikely to occur within mainland Nunavut.

There are no measurable cumulative effects on valued ecosystem components expected to occur due to current mining activities within the Regional scale of the Churchill Geological Province.

SECTION 2 • INTRODUCTION

Various human activities, which individually are considered to cause insignificant effects on an environmental or social component, may combine within a period of space and time to cause changes on that environmental component. In the literature, cumulative environmental effects are defined as:

- "Impacts on the natural and social environments which: occur so frequently in time or so densely in space that they cannot be 'assimilated' or, combine with effects of other activities in a synergistic manner" (Canadian Assessment Research Council in Nunavut Planning Commission 1997) or
- "The effect on the environment that results from the incremental impact of proposed actions when added to other past, present and reasonably foreseeable future actions." (Environment Canada in Nunavut Planning Commission 1997).
- "…changes to the environment that are caused by an action in combination with other past, present and future human actions." (Cumulative Effects Assessment Practitioners Guide. Hegmann *et al* 1999).

A Cumulative Effects Assessment (CEA) is conducted to assess any cumulative environmental effects over a 'regional' area that are likely to result from the project in combination with other projects or activities that have been or will be carried out taking into consideration the following factors:

- Valued Ecosystem Components (VECs)
- significance of the cumulative environmental effects
- comments from the public that are received in accordance with the Canadian Environmental assessment Act and regulations
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project
- any other matter relevant to the assessment by a review panel that may be required.

This CEA is focused on those residual effects resulting from past, present or reasonably foreseeable actions which occur within the area where a linkage between the residual effects of the Meadowbank Gold project (MGP) and the residual effects of other actions occurs.

This CEA follows the final Environmental Impact Statement (EIS) Guidelines for the Meadowbank project released by NIRB, dated 20 February 2004.

SECTION 3 • METHODOLOGY FOR ASSESSING CUMULATIVE EFFECTS ON VECS

The methodology used during this CEA follows the guidelines provided by the Environmental Impact Screening Committee (EISC) and the Environmental Impact Review Board (EIRB) in their October 2001 guide titled "Cumulative Effects Assessment in the Inuvialuit Settlement Region: A Guide for Proponents – Draft Two, and the Canadian Environmental Assessment Agency (CEAA) in their February 1999 guide titled, 'Cumulative Effects Assessment Practitioners Guide' taking into consideration the guidelines, comments and recommendations from NIRB, KIA, DSD and Federal Agencies (described above) as well as the use of professional experience and judgement of Cumberland staff and their consultants.

3.1 REGIONAL ENVIRONMENTAL ISSUES OF CONCERN

The issues of concern considered in this CEA were obtained from concerns and values described by the Nunavut Planning Commission in the Keewatin Regional Land Use Plan approved by INAC and DSD in 2000 as well as those expressed to CRL during community consultation sessions, and from similar studies completed for other mining ventures that have been conducted in the central mainland tundra over the past ten years: the NWT Diamonds project (now Ekati Diamond Mine™) in 1996, the Diavik Diamonds project in 1998, the Doris North Gold project in 2003, the Snap Lake Diamond project in 2003, and the Jericho Diamond Mine project in 2003.

The issues, which are listed below are considered in this CEA over the regional study area (RSA) defined by the Western Churchill geologic province. This RSA was chosen because it contains valued natural resources, has undergone intense exploration activity, is a representative area for management of wildlife habitat, encompasses the communities which may be directly or indirectly affected by project related actions and is consistent with Natural Resources Canada's Western Churchill Metallogeny project, a major component of Canada's Northern Resources Development Program.

The issues and concerns on cumulative environmental effects of the MGP in combination with other projects or activities that have been or will be carried out in the Western Churchill geologic province (see Figure 3.1) include but are not limited to the following:

- sustainable development
- support for regional economic development
- encouragement of multiple land uses
- maintaining communities informed on and involved with land use activities
- climate change
- cumulative effects on permafrost and ground thermal regime
- global air quality and its interaction with regional development and regional environmental quality

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FIGURE 3.1
MEADOWBANK GOLD PROJECT RSA
WESTERN CHURCHILL GEOLOGICAL PROVINCE

- water quality degradation from transboundary contaminant sources and its cumulative impact on fish, birds and marine mammals
- regional water quality monitoring for early detection of potential degradation
- waste management (i.e., domestic and hazardous waste as well as waste associated with each phase of a mine's life)
- minimization of negative effect on wildlife (i.e., caribou, walrus and polar bears) resulting from development activities
- Protection of wildlife habitat (i.e., preservation of caribou calving grounds, restriction of development activities near polar bear denning areas and walrus haul-outs)
- Inclusion of mine closure and restoration plans in proposals for mining development
- Providing benefits to local residents as well as Canada as a whole from non-renewable resource development
- Utilization of traditional knowledge
- Protection and management of heritage resources
- Protection and promotion of Inuit and Inuit Owned Land's (IOL) well-being during life of project.

3.2 VALUED ECOSYSTEM COMPONENTS

Valued Ecosystem Components (VECs) are defined as:

Each of those environmental attributes or components identified as a result of an ecological and social scoping exercise. These may be determined on the basis of perceived public concerns related to social, cultural, economic and aesthetic values. They may also reflect scientific concerns of the professional community as expressed through the social scoping procedures, (i.e., hearings, questionnaires, interviews, workshops, media reports, etc.) and through technical studies' (Beanlands and Duinker, 1983).

For the MGP, VECs (see list below) were primarily identified in consultation with regulatory and government authorities, as well as through discussions with members of the local community. Each VEC is of ecological importance, and is intimately connected with one or more of the other components (CRL, March 2003).

- These are: ungulates (caribou and muskoxen)
- fish habitat
- fish population
- air quality
- water quality
- predatory mammals (wolf, wolverine, fox and grizzly bear)
- raptors
- waterfowl
- other birds
- permafrost

- surface water quantity and distribution
- small mammals
- vegetation cover: sedge communities, heath tundra, ridge complexes (including eskers), riparian birch and willow groves, boulder fields and rocky outcrops (including cliffs)

The following sections of this report provide details of the assessment of each of these components.

3.3 TEMPORAL BOUNDARIES

Temporal boundaries varied with the component of the biophysical environment and cultural resource being considered. Where possible temporal boundaries were defined as the four project phases, associated with the proposed development (i.e., construction; operation; closure; and post-closure).

CRL plans to mine these deposits over a 8 to10-year period, starting with construction in 2007, operations from 2009 to 2019, with closure activities extending until at least 2023, and post-closure monitoring commencing in 2024. Post-closure activities will end in approximately 25 years after closure, depending on regulatory requirements and post-closure monitoring.

Temporal boundaries for each project phase including temporary closure, long-term shutdown, and exploration are defined below. Provided mitigation measures and monitoring plans as described in the various section of the EIA reports corresponding to each VEC, are implemented during temporary closure, long-term shutdown, and exploration, cumulative effect resulting during these project phases would not differ from those resulting during construction, operation, closure, and post-closure and are thus not treated separately in this CEA.

3.3.1 Construction

The Construction phase of the project is the period from Year –2 to Year 0, a period when the majority of land clearing, lake dewatering, and facility development activities are undertaken. Construction of facilities during the Operation phase (i.e., 0-10 years) is considered to be part of the Operation phase.

3.3.2 Operations

The Operation phase is from Year 0 to Year 10. The primary activities during this period include ongoing development of pits, and continued expansion of waste rock and tailings piles. Construction of new facilities or structures during this phase (e.g., Goose Island dyke) are considered to be part of the Operation phase.

3.3.3 Closure & Post-Closure

The closure and post-closure phase is from Year 10 to the end of the mine monitoring period (~Year 40). Closure activities such as facility removal, deactivation of roads, revegetation and reclamation, as well as monitoring activities that extend well past the operational life of the mine, are part of this phase.

3.3.4 Temporary Closure

A temporary closure is a cessation of mining and processing operations for three to 12 months. The intention is that the mine will resume operations as soon as possible after the cause of the temporary shutdown has been removed. Possible causes for a temporary shutdown include a major mechanical equipment failure, late delivery of critical equipment or supplies, or labour conflict.

3.3.5 Long-term Shutdown

An indefinite or long-term shutdown is a cessation of mining and processing operations for an indefinite period of time greater than 12 months. The intention is that the mine will resume operations as soon as possible after the cause of the indefinite shutdown has been rectified. The site will maintain safety and environmental stability during this time. Possible causes for an indefinite shutdown include prolonged adverse economic conditions or extended labour disputes.

3.3.6 Exploration

The exploration phase occurs both prior to and during the life of the mine. Because of this less distinct timeframe, discussions regarding potential effects are considered separately from more distinct project phases.

3.4 SPATIAL BOUNDARIES

For assessment of cumulative effects on the ecosystem from project related actions and other actions the Regional Study Area (RSA) was established on a VEC-specific basis. RSA's for each VEC were grouped into the following four categories:

- air quality and noise
- physical ecosystem (surface water quality, surface water quantity and distribution and permafrost)
- terrestrial ecosystem
- fish habitat and fish population.

3.4.1 Air Quality & Noise

The RSA for the cumulative air quality and noise assessment was defined in preliminary dispersion modelling with AERMOD model and resulted in the selection of a 5 km zone around the emission sources. The RSA is extended south north by 7 km resulting from the distance between the processing plant and the Vault mine.

3.4.2 Physical Ecosystem

The Regional Study Area (RSA) for assessment of cumulative effects on surface water quality, surface water quantity and distribution and permafrost (Figure 3.2) was established as the unit area where regional effects would extend beyond the directly affected zone and may extend into the main basin of Tehek Lake, and the Quoich River system.

UTM NORTH
ASTRO NORTH

7220000
7218000
7216000
7214000
7212000
642000
640000
638000
636000

03VLT03-04
03VLT03-02
03GT-Therm-1
Background Thermistor
03GT-TD-1
GNP-02-03
GNP-02-01
02GT-03
MW03-03
03GT-TD-5A
02GT-04
TP-96-155
TP-96-154
TP-97-196
03GT-BH-1
03GT-GPIT-2
MW03-01
MW03-02
02GT-10
02GT-09
03GT-SPEC-F1
MW03-04
03GT-PS-2
03GT-PS-3
03GT-TF-1
General Plant Site Area
Meadowbank Camp
General Fuel Tank Storage Area
Meadowbank Climate Station
GEODETIC MARKER
1
2
3
4

0 200 400 600 800 1000
Scale in Meters

LEGEND

- 3 — Hydrometric Stations
- MW03-04 — Groundwater Monitoring Hole
- 03VLT03-04 — Inclined Thermistor Location and Direction of Installation (not to scale)
- 03GT-PS-2 — Vertical Thermistor Installation
- Flow Direction

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Figure 3.2
Hyrdometric Stations & Drainage Basins

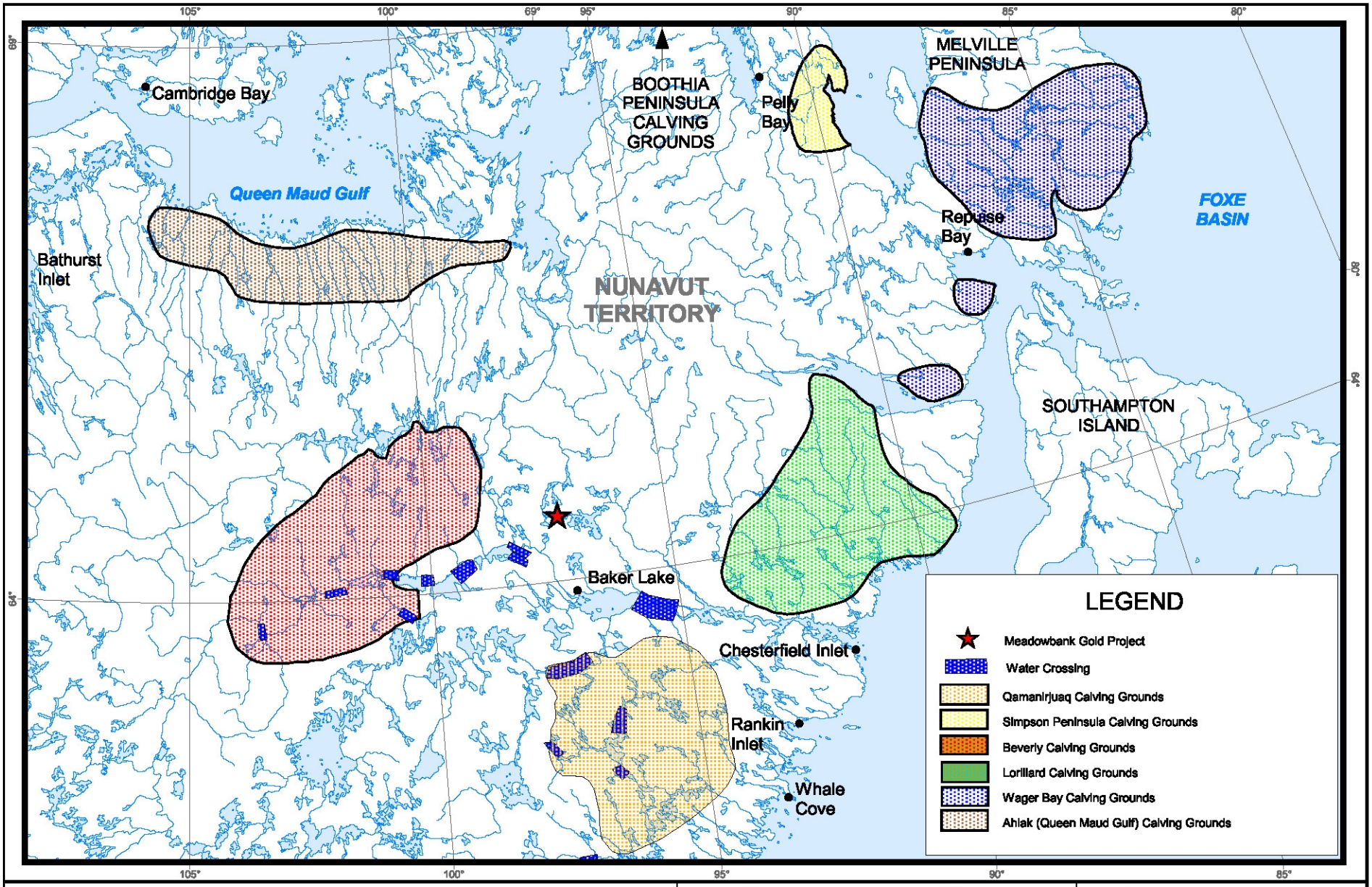
3.4.3 Terrestrial Ecosystem

The Regional Study Area (RSA) for assessment of cumulative effects on terrestrial ecosystem was established on a VEC-specific basis. At the VEC level, spatial boundaries vary depending on variables such as home range size, distribution and densities. For example, the collared lemming has a much smaller home range than the barren-ground caribou. Other species, such as geese are primarily migratory and may travel thousand of kilometres from the project area, while other animals such as the wolverine and grizzly bear have large home ranges that may extend well beyond the 100 x 100 km RSA (as defined for baseline survey and monitoring purposes). Accordingly, unique spatial boundaries have been established for each VEC (see Table 3.1).

Table 3.1: Spatial boundaries for Terrestrial Ecosystem VECs of the Meadowbank Gold Project. Boundaries (in radius centred on project facilities)

VEC	RSA	Justification
Vegetation	2 km	Vegetation is sedentary and vulnerable primarily to activities in close proximity
Ungulates	Mainland Nunavut (Figure 3.3)	Caribou individuals from several herds, including Ahiak, Boothia Peninsula, Beverly, Qamanirjuak, Lorillard, and Wager Bay are known to occur in winter Muskox are wide-ranging and have been thought to be moving northeast out of the Thelon River valley
Predatory Mammals	100 km	Grizzly bear, wolverine, and wolf are wide-ranging species with large annual home ranges[1]. Predatory mammals occur at very low densities within the study area
Small Mammals	5 km	Small mammals are quite resilient (i.e., easily habituated) to human activity Of small mammals, Arctic hare are the widest ranging (home range of 4 to 20 ha[2])
Raptors	50 km	Birds nesting in close proximity to mine facilities may be disturbed during the nesting season Nesting birds may forage considerable distances away from nesting areas Some species (e.g., Rough-legged Hawk) are migratory and undergo long-distance movements
Waterfowl	50 km	Birds nesting in close proximity to mine facilities may be disturbed during the nesting season Species may be wide-ranging during the breeding season All species are migratory, moving long-distances to wintering grounds
Other Breeding Birds	5 km	Passerines are quite resilient (i.e., easily habituated) to human activity During the breeding season, most species are restricted to home ranges <1 km[2]

Notes: 1. For males in Arctic habitats – Grizzly bears: 6,000 km² to 7,000 km²; Wolverines: 100 km² to 900 km²; and Wolves: > 60,000 km². **2.** Macdonald 1995.



Known Caribou Calving Grounds & Water Crossings in Nunavut

NORTH

50 0 50 100 150

Scale in kilometres

Acknowledgements: Caribou calving locations from Ferguson 1987.

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Figure 3.3

3.4.4 Fish Habitat & Fish Population

The Regional Study Area (RSA) for assessment of cumulative effects on fish habitat and fish populations has been defined similar to that for physical ecosystem described above. Specifically the RSA would extend beyond the northernmost bay of Tehek Lake, which receives water from both the Portage and Vault (Vault and Wally) systems into the main basin of Tehek Lake, and into the Quoich River system. This assessment is consistent across VECs such as lake trout spawning habitat or productivity of benthic habitats.

SECTION 4 • MITIGATION OF POTENTIAL ENVIRONMENTAL EFFECTS

The influence from each project on a component represents the effect following mitigation (i.e., residual effect). Mitigation was identified in the environmental screening documents, local environmental assessment or mine closure and reclamation guideline documents for each project considered in this CEA (see Section 5.9 Actions Considered below). Specific mitigation for the components of MGP can be found in respective environmental impact assessment sections for each VEC identified above. Examples of mitigation strategies include: avoiding development near wildlife sensitive areas; reducing the disturbed surfaces to as small an area as possible; where possible salvage soil for reclamation and revegetation purposes; adopting development and operating ethics that reduces and avoids interactions to the maximum practical extent; changing engineering systems; redesigning mining and operational plans; constructing deterrent structures near containment areas; waste management practices; and water management (including implementation of sediment control measures during each phase of the project, construction of containment berms and managing surface runoff).

SECTION 5 • SUMMARY OF PROJECT RESIDUAL ENVIRONMENTAL EFFECTS

Assessment of project residual environmental effects on VECs which may result from project related activities are presented within the various sections of the CRL EIA reports listed below for the MGP:

- Air Quality Impact Assessment
- Terrestrial Ecosystem Impact Assessment
- Aquatic Ecosystem Impact Assessment
- Noise Impact Assessment
- Physical Environmental Effects (Water Quantity & Quality and Permafrost Valued Ecosystem Components).

This information is summarized in Section 5.1 below and used in this CEA for the MGP.

5.1 SUMMARY OF POTENTIAL PROJECT RESIDUAL ENVIRONMENTAL EFFECTS AFTER MITIGATION

Standardized project facilities associated with construction, operation and closure and post-closure that were addressed during the impact assessment are described in the following Table 5.1.

Table 5.1: Project Facilities Addressed during the Impact Assessment

Project Component	Project Component
Main Facilities	Sewage & Waste Disposal
Construction Noise & Activity	Attenuation Pond Discharge
Dykes	Non-Contact Diversion Facilities
East Dyke	Storage (at Plant Site)
West [Tailings] Dyke	AN/Explosives Storage & Emulsion Plant
Portage South Dyke	*Vault Facilities*
Goose Island & 3rd Portage Arm Dykes	Construction Noise & Activity
Dewatering	Vault Dyke
2nd Portage Lake	Vault Lake Dewatering & Drainage Facilities
Portage Pit (3rd Portage Lake)	Vault Pit
Goose Island (3rd Portage Lake)	Vault Waste Dump
Pits	Vault Area Effluent Discharge
Portage Pit	Vault Access Road & Traffic
Goose Island Pit	Access Road Culverts (Tern Lake)
Waste Dump (Portage)	Mine Shop/Office
Borrow Pit(s)	*Other Facilities*
Tailings Disposal Facilities	Winter Road & Traffic
Main Site Roads & Traffic	Baker Lake Access Road & Traffic
Airstrip & Air Traffic	Barge Landing Facility
Mine Plant and Associated Faculties	Barge Traffic
Freshwater Intake & Pipeline	In-town Staging Facility
Discharge Facilities & Pipeline	Explosives Magazine
Site Accommodations	Tank Farm

A summary of potential residual impacts after mitigation associated with the project activities summarized in the above table is presented in Tables 5.2, 5.3 and 5.4 included below. No significant residual impacts were determined to result from MGP activities throughout the life of the mine.

Existing marine transport routes will be used during each phase of the project. The increase in marine barge traffic is expected to cause small incremental rise of noise and hydrocarbon emissions along the transport route. Hazardous material handling guidelines; spill contingency guidelines; and protocols and standards for barge operators will be followed. Mitigation will reduce the magnitude and frequency of effects on marine mammals to negligible levels.

Table 5.2: Potential Project Residual Impacts from Mine Site Construction after Mitigation

VEC	Description of Residual Impact	Spatial Extent	Residual Impact
Fish habitat	Reduction of fish habitat in Second Portage, Third Portage and Vault Lakes	Local	Yes
		Regional	No
Fish population	Reduction of fish productivity in Second Portage, Third Portage and Vault Lakes and into the main basin of Tehek Lake	Local	Yes
		Regional	No
Air quality	Degradation of air quality due to emissions resulting from combustion of diesel fuel in the power plant and vehicles including nitrogen oxides, carbon monoxide, sulphur dioxide and particulate matter (PM10 and PM2.5); and fugitive dust emissions from tailings, overburden and waste disposal and process operations including ore hauling.	Local	No
		Regional (for road)	No
Noise	Increased noise levels	Local	Yes
		Regional	No
Water quality	Degradation of water quality due effluent discharges, emission fallout and sediment releases containing high metals, sediment, nutrients, and/ or hydrocarbon concentrations.	Local	Yes
		Regional	No
Surface water quantity & distribution	Change in water circulation pattern	Local	Yes
		Regional	No
Permafrost	Increase of active layer thickness	Local	Yes
		Regional	No
Ungulates	None	Local	No
		Regional	No
Ungulate habitat	Degradation of ungulate habitat due to mine construction	Local	No
		Regional	No

Table 5.3: Potential Project Residual Impacts from Mine Site Operation after Mitigation

VEC	Description of Residual Impact	Spatial Extent	Residual Impact
Fish habitat	Reduction of fish habitat in Second Portage, Third Portage and Vault Lakes	Local	Yes
		Regional	No
Fish population	Reduction of fish productivity in Second Portage, Third Portage and Vault Lakes and into the main basin of Tehek Lake	Local	Yes
		Regional	No
Air quality	Degradation of air quality due to emissions resulting from combustion of diesel fuel in the power plant and vehicles including nitrogen oxides, carbon monoxide, sulphur dioxide and particulate matter (PM10 and PM2.5); and fugitive dust emissions from tailings, overburden and waste disposal and process operations including ore hauling.	Local	No
		Regional	No
Noise	Increased noise levels	Local	Yes
		Regional	No
Water quality	Degradation of water quality due to effluent discharges, emission fallout and sediment releases containing high metals, sediment, nutrients, and/ or hydrocarbon concentrations.	Local	Yes
		Regional	No
Surface water quantity & distribution	Change in water circulation pattern	Local	Yes
		Regional	No
Permafrost	Increase of active layer thickness	Local	Yes
		Regional	No
Ungulates	None	Local	No
		Regional	No
Ungulate habitat	Degradation of habitat	Local	No
		Regional	No

Table 5.4: Potential Project Residual Impacts from Mine Site Post Closure after Mitigation

VEC	Description of Residual Impact	Spatial Extent	Residual Impact
Fish habitat	Reduction of fish habitat in Second Portage, increase in habitat in Third Portage and Vault Lakes	Local	No
		Regional	No
Fish population	Possible increase in fish productivity due to an increase in fish habitat	Local	No
		Regional	No
Air quality	None	Local	No
		Regional (for road)	No
Noise	None	Local	No
		Regional	No
Water quality	Short term degradation of water quality due to run-off	Local	Yes
		Regional	No
Surface water quantity & distribution	Change in water circulation pattern	Local	Yes
		Regional	No
Permafrost	Reduction of active layer thickness and increase of taliks	Local	Yes
		Regional	No
Predatory mammals	None	Local	No
		Regional	No
Small mammals	None	Local	No
		Regional	No
Raptors	None	Local	No
		Regional	No
Waterfowl	None	Local	No
		Regional	No
Other breeding birds	None	Local	No
		Regional	No
Ungulates (caribou & muskoxen)	None	Local	No
		Regional	No
Ungulate habitat (caribou & muskoxen)	None	Local	No
		Regional	No

5.2 ACTIONS CONSIDERED

Actions are any project or activity of human origin. Projects are some form of physical work that is planned, constructed and operated; activities arise over time due to an ongoing human presence (Hegmann et al. 1999). Actions considered in this CEA focused on current projects or reasonably foreseeable future projects or settlements within the Western Churchill geologic province which when added to project actions of MGP would likely cause an additive effect. As explained in Section 3.1, this RSA was chosen because it contains valued natural resources, has undergone intense exploration activity, is a representative area for management of wildlife habitat, encompasses the

communities which may be directly or indirectly affected by project related actions and is consistent with Natural Resources Canada's Western Churchill Metallogeny project, a major component of Canada's Northern Resources Development Program.

5.2.1 Mineral Exploration

The vast majority of mineral exploration camps are in place for a matter of one to a few years. The footprint of the camps is relatively small (a few ha. at most), and no heavy equipment or extensive land disturbance are generally involved (various NIRB and NWT Preliminary Screening reports 2003-2004 from NIRB and MVRMA – Preliminary Screenings websites 2004). Activities associated with exploration include but are not limited to geological mapping and prospecting, geophysical surveys, claim staking and geochemical sampling. Disturbance is limited to the physical presence of the camp, pedestrian traffic causing minor disturbances to vegetation cover in immediate vicinity of prospecting activities, and the noise of human activities, each of which are very localized. While concentrated helicopter-supported exploration may lead to wildlife disturbance in an area, the MGP would not contribute to this effect since:

- the number of people employed in exploration will be small (up to a maximum of 10) and therefore impact of their presence will be low
- exploration crews will be accommodated within the mine camp.

Under current regulations, exploration land disturbances must be fully reclaimed as part of close out of land use permits and water licences. Exploration activities are also so widely spread that only the Beverly and Qamanirjuaq barren ground caribou herd and possibly grizzly bears are likely to be affected by more than one project that also includes the MGP.

Exploration projects are assessed to have unmeasurable cumulative effects because their impacts are transitory, very localized, and have very low impact to their project areas and therefore are not actions considered in this CEA.

5.2.2 Mines & Mining Projects

No other mining project located within the Western Churchill geologic province is currently operating or at some stage in the project permitting process.

Closed mines located within the Western Churchill geologic province include the Cullaton Lake / Shear Lake property (Latitude 61°16' N; Longitude 98° 30' W NTS: 65G/8) and Nanisivik mine (Latitude 72° 0'N; Longitude 85° 0'W). The Cullaton Lake / Shear Lake property comprised two close-by gold deposits and produced ferrous-based ore. The mine opened in 1981 and operated to 1985 (Canada. Statistics Canada, Canada's Mineral Production, Preliminary Estimate). The Nanisivik mine is located in Nunavut on northern Baffin Island, on the southern shore of Strathcona Sound, approximately 750 km north of the Arctic Circle. It was permanently closed in September 2002 (BWR 2004).

5.2.3 Hamlet of Baker Lake

The Hamlet of Baker Lake is located on Baker Lake's northwest shore 70 km south of the MGP site, near the mouth of the Thelon River. It is 320 km inland from the west coast of the Hudson Bay. The Hamlet of Baker Lake with a population of 1,500 covers an approximate area of 92 ha. Baker Lake serves as the source of potable water for the Hamlet.

A summary of available information relevant to the assessment of linkages between MGP related residual effects and residual effects of other actions likely to cumulate and cause adverse effects are presented in Table 5.5 below.

Table 5.5: Actions with Potential Linkages Considered in the Cumulative Effects Assessment

Project Land Use	Project Phase	Type of Development	Total Footprint (ha)	Predicted Duration (years)	Through Put at Peak Production (t/d)	Approximate Distance from MGP (km)	VEC
MGP[1]	Permitting	open pit	862	2006-2023	4700		
Cullaton Lake/ Shear Lake property[2]	Post-Closure monitoring	underground	n/a	n/a	~1000	400 SW	-Ungulate -Air Qualiy
Nanisivik mine[3]	Closure (September 2002)	underground	n/a	2002-2010	2200	850 NE	-Air Quality
Hamlet of Baker Lake[4]	N/A	Hamlet	~ 92	N/A	(population) 1,500	70 S	-Ungulate -Air Quality -Water Quality (fish and fish habitat)

Notes: 1. Information obtained from CRL. Meadowbank Gold project Description Report, March 2003. **2.** Canada. Statistics Canada, Canada's Mineral Production, Preliminary Estimate, no: 26-202, Ottawa, 1998. **3.** Information obtained from the BWR (Breakwater Resources Limited) 2004. http://www.breakwater.ca/oper/oper.htm and CanZinco Ltd. March 2004. Nanisivik Mine, 2004 Reclamation and Closure Plan. **4.** Information obtained from the Municipality of Baker Lake webpage, July 2004. http://www.bakerlake.org/index.htm.

ha = hectare

t/d = tonnes per day

km = kilometers

n/a = not available at time of writing this CEA report; or not applicable to this land use type.

5.2.4 Assessment of Spatial & Temporal Overlap

The spatial and temporal overlap existing between the decommissioning, closure and post-closure activities of the Cullaton Lake / Shear Lake property and Nanisivik mine; activities associated with the Hamlet of Baker Lake and MGP are described in Table 5.6 below. As described in respective impact assessment reports for air quality, terrestrial ecosystem and aquatic ecosystem /fish habitat and summarized in Tables 5.2, 5.3 and 5.4 presented above, residual impacts on air quality, wildlife (i.e., ungulates; predatory mammals; small mammals; raptors; waterfowl; and other breeding birds) and wildlife habitat are not expected to result from MGP related activities in a regional extent.

Table 5.6: Assessment of Spatial & Temporal Overlap between MGP & Other Actions

VEC	Action	RSA	Duration	Rational	Overlap with MGP
Water Quality	MGP	Extends beyond directly impacted lakes and may extend into the main basin of Tehek Lake.	Construction, Operation, Closure and Post Closure (2007-2049)	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects occur beyond the direct area of impact and may extend into the main basin of Tehek Lake, and into the Quoich River system.	-
	Cullaton Lake / Shear Lake property	Kognak River watershed	Post Closure monitoring	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects occur beyond the direct area of impact and may extend into the lower Kognak River.	No spatial overlap
	Nanisivik mine	Twin Lake watershed	Closure and Post Closure, 2002-2010	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects occur beyond the direct area of impact and may extend into the Strathcona Sound.	No spatial overlap
	Hamlet of Baker Lake	Chesterfield Inlet (see Figure 5.1)	Indefinite	Regional effects from the Hamlet of Baker Lake on water quality may extend to the mouth of Chesterfield Inlet.	No spatial overlap
Surface Water Quantity and Distribution	MGP	Extends beyond directly impacted lakes and may extend into the main basin of Tehek Lake.	Construction, Operation, Closure and Post Closure (2007-2049)	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects occur beyond the direct area of impact and may extend into the main basin of Tehek Lake, and into the Quoich River system.	
	Cullaton Lake / Shear Lake property	Kognak River watershed	Post Closure monitoring	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects occur beyond the direct area of impact and may extend into the lower Kognak River.	No spatial overlap
	Nanisivi mine	Twin Lake watershed	Closure and Post Closure, 2002-2010	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects occur beyond the direct area of impact and may extend into the Strathcona Sound.	No spatial overlap

Table 5.6 – Continued

VEC	Action	RSA	Duration	Rational	Overlap with MGP
	Hamlet of Baker Lake	Baker Lake basin (see Figure 5.1)	Indefinite	No measurable regional effects from the Hamlet of Baker Lake on surface water quantity and distribution is expected beyond the boundaries of Baker Lake.	No Spatial overlap
Fish Population	MGP	Extends beyond directly impacted lakes and may extend into the main basin of Tehek Lake, and into the Quoich River system	Construction, Operation, Closure and Post Closure (2007-2049)	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects on water quality occur over a larger spatial scale, and, in this assessment, may extend beyond the northern bay of Tehek Lake into the Quoich River system. This effect on water quality can affect fish population.	-
	Cullaton Lake / Shear Lake property	Kognak River watershed	Post Closure monitoring	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects on water quality occur beyond the direct area of impact and may extend into the lower Kognak River. This effect on water quality can affect fish population.	No spatial overlap
	Nanisivik mine	Twin Lake watershed	Closure and Post Closure, 2002-2010	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects on water quality occur beyond the direct area of impact and may extend into the Strathcona Sound. This effect on water quality can affect fish population.	No spatial overlap
	Hamlet of Baker Lake	Chesterfield Inlet basin (see Figure 5.1)	Indefinite	Regional residual effects from Hamlet of Baker Lake related actions on fish populations may extend to the mouth of Chesterfield Inlet.	No spatial overlap

Table 5.6 – Continued

VEC	Action	RSA	Duration	Rational	Overlap with MGP
Fish Habitat	MGP	Extends beyond directly impacted lakes and may extend into the main basin of Tehek Lake, and into the Quoich River system	Construction, Operation, Closure and Post Closure (2007-2049)	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects water quality occur over a larger spatial scale, and, in this assessment, may extend beyond the northern bay of Tehek Lake into the Quoich River system. This effect on water quality can affect fish habitat. This is consistent across VECs such as lake trout spawning habitat or productivity of benthic habitats	-
	Cullaton Lake / Shear Lake	Kognak River watershed	Post Closure monitoring	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects on water qulaity occur beyond the direct area of impact and may extend into the lower Kognak River. This effect on water quality can affect fish habitat.	No spatial overlap
	Nanisivik	Twin Lake watershed	Closure and Post Closure, 2002-2010	Spatial Extent is a measure of the geographic boundary of residual effects. Regional effects on water quality occur beyond the direct area of impact and may extend into the Strathcona Sound. This effect on water quality can affect fish habitat.	No spatial overlap
	Hamlet of Baker Lake	Chesterfield Inlet basin (see Figure 5.1)	Indefinite	Regional residual effects from Hamlet of Baker Lake related actions on fish habitat may extend to the mouth of Chesterfield Inlet.	No spatial overlap

Table 5.6 – Continued

VEC	Action	RSA	Duration	Rational	Overlap with MGP
Ungulates	MGP	Mainland Nunavut (Figure 3.3)	Construction, Operation, Closure and Post Closure (2007-2049)	Caribou individuals from several herds, including Ahiak, Boothia Peninsula, Beverly, Qamanirjuak, Lorillard, and Wager Bay are known to occur in winter Muskox are wide-ranging and have been thought to be moving northeast out of the Thelon River valley	No spatial overlap
	Cullaton Lake / Shear Lake		Post Closure monitoring		No spatial overlap
	Nanisivik		Closure and Post Closure, 2002-2010		No spatial overlap
	Hamlet of Baker Lake	Mainland Nunavut (Figure 3.3)	Indefinite	Caribou individuals from several herds, including Ahiak, Boothia Peninsula, Beverly, Qamanirjuak, Lorillard, and Wager Bay are known to occur in winter Muskox are wide-ranging and have been thought to be moving northeast out of the Thelon River valley	Possible spatial overlap

Table 5.6 – Continued

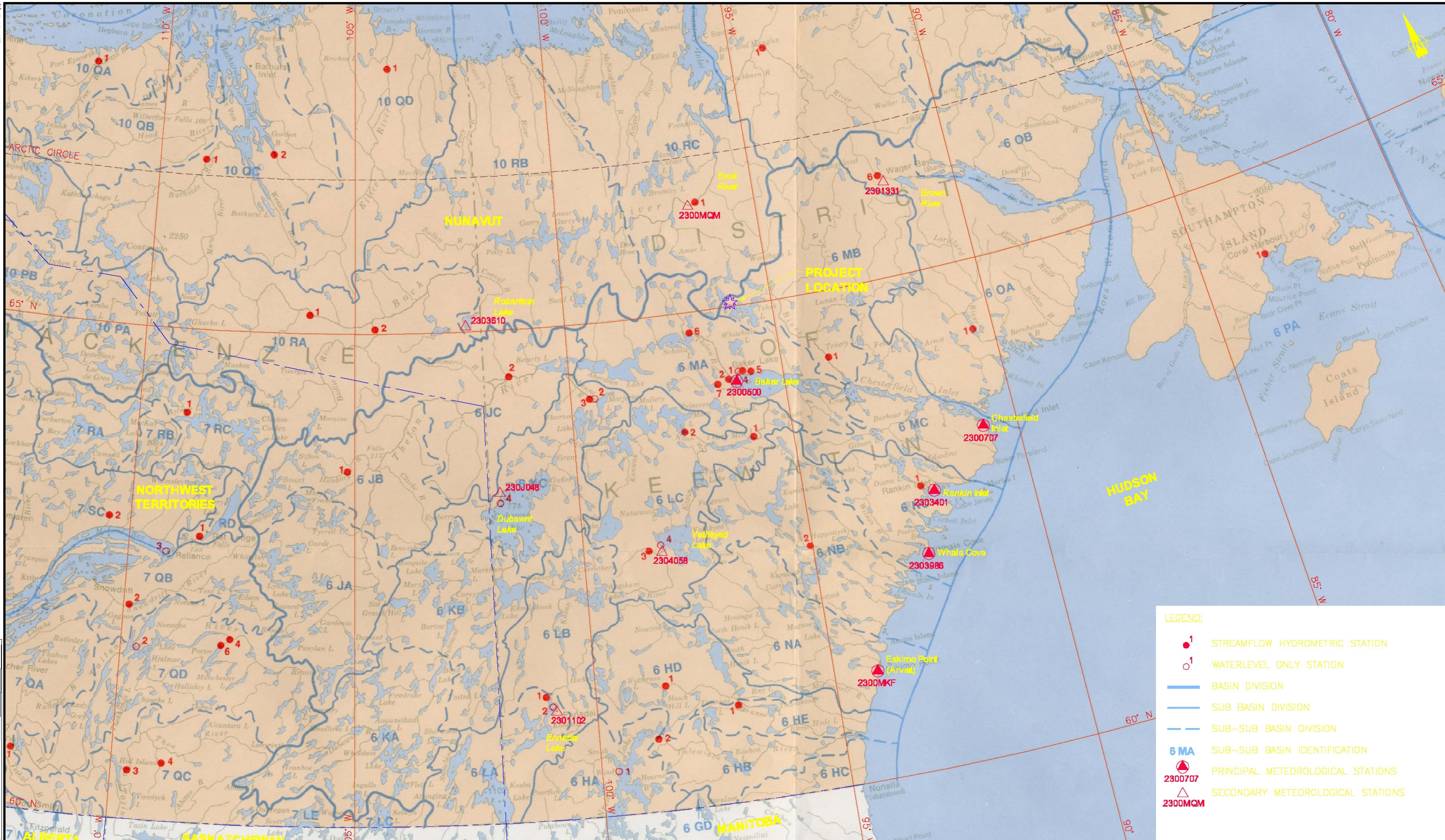
VEC	Action	RSA	Duration	Rational	Overlap with MGP
Ungulates Habitat	MGP	Mainland Nunavut (Figure 3.3)	Construction, Operation, Closure and Post Closure (2007-2049)	Caribou individuals from several herds, including Ahiak, Boothia Peninsula, Beverly, Qamanirjuak, Lorillard, and Wager Bay are known to occur in winter Muskox are wide-ranging and have been thought to be moving northeast out of the Thelon River valley	
	Cullaton Lake / Shear Lake		Post Closure monitoring		No spatial overlap
	Nanisivik		Closure and Post Closure, 2002-2010		No spatial overlap
	Hamlet of Baker Lake	Mainland Nunavut (Figure 3.3)	Indefinite	Caribou individuals from several herds, including Ahiak, Boothia Peninsula, Beverly, Qamanirjuak, Lorillard, and Wager Bay are known to occur in winter Muskox are wide-ranging and have been thought to be moving northeast out of the Thelon River valley	Possible spatial overlap

Based on the information presented in Table 5.6 only those actions with a spatial overlap where a linkage is present between the combined effect of other actions and those of MGP on each VEC assessed were considered further in this CEA

The actions carried forward in this CEA and VECs for which the cumulative effects of these actions will be assessed are included and identified as those containing a 'X' mark in Table 5.7 below.

Table 5.7: Summary of Actions & VECs Considered in the Cumulative Effects Assessment

VEC	Cullaton Lake / Shear Lake property	Nanisivik mine	Baker Lake
Water Quality			
Surface Water Quantity and Distribution			
Fish Population			
Fish Habitat			
Ungulates			X
Ungulates Habitat			X



SCALE
1: 4 000 000
0 20 40 60 80 km

MAP REFERENCE:
"ACTIVE HYDROMETRIC STATIONS - YUKON AND NORTHWEST TERRITORIES"
WATER RESOURCES BRANCH, INLAND WATERS DIRECTORATE, OTTAWA, 1988.

CUMBERLAND RESOURCES LTD.

PROJECT: MEADOWBANK GOLD PROJECT

TITLE: FIGURE 5.1
REGIONAL HYDROMETRIC & METEOROLOGIC STATIONS

DATE:

SECTION 6 • CUMULATIVE ENVIRONMENTAL EFFECTS ASSESSMENT

6.1 CRITERIA & RANKING

The criteria and ranking for evaluating significance of residual impacts included below are modified from Section 2.5 - Describing and Classifying Impacts of the Terrestrial Ecosystem Impact Assessment Report (CRL 2004) and Section 4.2 - Assessment Criteria of the Aquatic Ecosystem/Fish Habitat Assessment report (CRL 2004) for the purpose of evaluating significance of residual impacts resulting from cumulative environmental effects.

6.2 DESCRIBING & CLASSIFYING IMPACTS

6.2.1 Approach

The CEAA defines environmental effects as "any change that the project may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources …". The magnitude of this effect is related to "the capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future". To define a "significant effect" we have incorporated the principals of the above statements stated in the *Act* and followed guidance in the NIRB Terms of Reference for this project. Simply stated, any project-related residual effect (i.e., effects remaining after appropriate mitigation has been applied) that in combination with residual effects of another action cumulate and cause adverse effects to an ecological resource to such a degree that the resource is measurably impaired within a local or regional context, or whose function is measurably impaired over the long-term, is significant.

The assessment of significance of cumulative residual impacts is made after mitigation is applied. For example, implementation of a no-fishing policy for the project and implementation of jointly coordinated and implemented aquatic resource management measures involving government, proponents and public.

6.2.2 Assessment Criteria

Criteria for evaluating the significance of impacts resulting from cumulative effects have been developed for this project based on best practice, professional judgment and experience on other impact assessments for similar projects. The intent of this process is to be transparent and to document decision pathways so that others can review the process that was used to determine the likelihood of predicted impacts, how mitigation has avoided or reduced an impact, and the significance of impacts, particularly residual impacts. This section presents the definition for each criterion used to determine significance.

To determine whether or not an impact may have a significant adverse cumulative effect on a VEC component, we have assessed in order of importance, the magnitude, spatial extent, duration, frequency and timing of effects for each project-related activity. How each of these criteria influence significance is discussed below and summarized in Table 6.1.

Table 6.1: Evaluation Criteria to Determine Cumulative Residual Effects.

Criteria	Levels/Ranks of Criteria	Definition of Level/Rank of Criteria	VEC-specific?
Magnitude	High	Residual effect within the project lake, the direct impact zone of Baker Lake by the Hamlet of Baker Lake activities; and the intermixing zone where water affected by MGP activities flows into Chesterfield Inlet and interacts with water affected by actions associated with the Hamlet of Baker Lake is >25% change from baseline conditions, are easily detectible and have a high certainty of occurring.	Yes
	Medium	Residual effect within project lake, the direct impact zone of Baker Lake by the Hamlet of Baker Lake activities; and the intermixing zone where water affected by MGP activities flows into Chesterfield Inlet and interacts with water affected by actions associated with the Hamlet of Baker Lake is >10% and <25% change from baseline conditions, are moderately difficult to detect and have a moderate to high certainty of occurring.	
	Low	Residual effect within project lake, the direct impact zone of Baker Lake by the Hamlet of Baker Lake activities; and the intermixing zone where water affected by MGP activities flows into Chesterfield Inlet and interacts with water affected by actions associated with the Hamlet of Baker Lake is <10% change from baseline conditions, are very difficult to detect and have a low to moderate certainty of occurring.	
Spatial Extent	Regional	Residual effects extend beyond the project lakes to the mouth of Chesterfield Inlet.	No
	Local	Residual effects are restricted to project lakes; the direct impact zone of Baker Lake by the Hamlet of Baker Lake activities; and the intermixing zone where water afected by MGP activities flows into Chesterfield Inlet and interacts with water affected by actions associated with the Hamlet of Baker Lake.	
Duration	Permanent	Residual effects to VECs continue into foreseeable future, well beyond mine life during operation and post-closure.	Yes
	Long-term	Residual effects to VECs occur over a time period similar to the lifespan of the VEC during operations and post-closure.	
	Medium-term	Residual effects to VECs occur over a time period shorter than the VEC lifespan (25 – 100% of lifespan).	
	Short-term	Residual effects to VECs occur over a time period <25% of lifespan of the VEC.	
Frequency & Timing	Frequent	Residual effects to VECs occur very regularly (daily or weekly) and overlaps with sensitive periods.	Yes
	Infrequent	Residual effects to VECs occur infrequently (monthly to yearly) and may/may not overlap with sensitive periods.	
	Rare	Residual effects to VECs occur rarely (yearly or less frequently) and typically do not overlap with sensitive periods.	

Magnitude – is a measure of the intensity or severity of the cumulative effect of a mine-related activity and another activity relative to a change from background conditions. Magnitude is a relative term, as the specific definition is dependent on the VEC. Magnitude is somewhat subjective and takes into consideration such factors as: ecological relevance, degree of change from baseline conditions, certainty of occurrence, and ecological resilience (defined as the rate of ecosystem recovery to a stable state, following disturbance or stress). The certainty with which we are able to quantify the magnitude of an effect has a strong influence on whether magnitude is ranked as high, medium or low.

- **High** magnitude impacts are obvious, easily detectable with a minimum of effort, as well as having a high certainty of occurring. If residual impacts on the VEC results in a change of 25% or more (e.g., to fish populations abundance, reduction in condition, loss of fish habitat, reduction in benthic diversity), the impact magnitude is high.

- **Medium** magnitude impacts may not immediately be apparent, and some degree of effort is required to demonstrate a departure from baseline conditions, over and above natural changes. Medium magnitude effects have a moderate certainty of occurring and residual impacts to the VEC results in a 10% to 25% change relative to baseline.

- **Low** magnitude impacts can be very difficult to detect, require considerable effort to demonstrate a departure from baseline and usually have a low probability of occurrence. Residual impacts to VEC abundance, diversity or condition of less than 10% from baseline conditions are generally low magnitude changes.

Spatial Extent – is a measure of the geographic boundary of cumulative residual effects and has been divided into local and regional zones.

- **Local** effects occur over narrow spatial bounds and, for the purposes of this assessment, are restricted to the zone where water impacted by MGP actions flows into Chesterfield Inlet and interacts with water impacted by actions associated with the Hamlet of Baker Lake.

- **Regional** effects occur over a larger spatial scale, and, in this assessment, would extend from project lakes to the mouth of Chesterfield Inlet basin. This assessment is consistent across VECs such as lake trout spawning habitat or productivity of benthic habitats.

Duration – is the length of time in weeks, months or years that a cumulative residual effect is expected to persist. The endpoint is recovery or return to baseline of the ecological component (e.g., fish populations or habitat) and is linked to reversibility and ecological resilience (i.e., likelihood of the potential for recovery from a cumulative residual effect), providing an indication of when/if the cumulative residual impact will diminish. Duration is described for each project activity, such as dewatering of impoundments (short-term) or effluent discharge and its relative influence on particular VECs. Some activities, such as dike installation during construction, may occur over limited time frames, but may cause cumulative impacts with other actions that persist for time periods equivalent to or greater than the life span of the VEC. On the other hand, the duration of impact during installation of a water withdrawal system may only persist for the amount of time it takes to install the facility.

Frequency & Timing – is a measure of how frequently residual effects will be felt by the VEC, using standard measures (e.g., weeks, months, years) and whether or not the impact overlaps with the sensitive period of a VEC, such as during spawning by lake trout, or during emergence of fish larvae. Frequency and timing are specific to particular VECs. For example, blasting may take place on a daily basis and, depending on setback from fish bearing waters, may occur frequently and affect fish on a year-round basis. Discharge of effluent also occurs frequently, but is scheduled to occur only during open water periods and thus has a distinct seasonal component. Given that egg incubation of all species occurs during winter, restricting the timing of effluent discharge to avoid spawning and egg incubation by fish is noteworthy. We then considered whether certain activities overlapped with particularly sensitive life history periods of fish. For example, if a particular activity is predicted to occur or extend over the spawning period for lake trout and Arctic char and has the potential to adversely affect spawning success or egg survival, this was taken into account when assessing significance.

6.2.3 Final Assessment of Significance

Measures of magnitude, spatial extent, duration and frequency are individually evaluated and ranked (e.g., high, medium low; frequent, infrequent, rare) for each project-related activity to assess whether the cumulative residual impact is predicted to be significant or not. To determine significance, we have established a transparent, step-wise process combining the outcome of individual criteria to arrive at an overall conclusion. Significance is determined depending on the particular combination of magnitude, spatial extent, duration and frequency and timing (Table 6.2). Following is an overall summary of the distinction between *significant* and *non-significant* impacts.

- All high magnitude impacts to VECs, regardless of spatial extent, duration and frequency, with the exception of short-term, rare events within the local area, are considered significant.
- All medium magnitude impacts within the regional area are also considered significant, again, regardless of duration or frequency.
- Low magnitude impacts within the regional area of a long-term to permanent nature that occur frequently are significant.
- Medium magnitude impacts within the local area of medium to permanent duration that occur frequently and overlap with a sensitive period to the VEC (e.g., spawning by fish) are significant.
- Medium magnitude impacts of a short to medium-term duration that occur infrequently or less and do not overlap with sensitive periods of VECs are not significant.
- Low magnitude impacts within the local area which are not at least long-term, regardless of duration, frequency or timing, are not significant.

Construction, operation and post-closure are assessed independently for each major project activity in interaction with other actions, creating a temporal phased approach to the impact assessment. The magnitude, duration and frequency of project activities differ among temporal phases and the significance of these are determined separately.

Table 6.2: Significance Evaluation Matrix for Project Cumulative Impacts

Magnitude	Spatial Extent	Frequency	Duration	Timing	Conclusion About Significance
High	Regional	Any	Any	Any	Yes
	Local	Any	Permanent	Any	Yes
		Any	Long-term	Any	Yes
		Frequent to Continuous	Medium-term	Any	Yes
		Rare to Continuous	Short-term to Medium-term	Any	No
Medium	Regional	Any	Medium to Permanent	Any	Yes
		Frequent to Continuous	Short-term	Any	Yes
	Local	Frequent to Continuous	Long-term to Permanent	Any	Yes
		Rare to Infrequent	Long-term to Permanent	Any	No
		Continuous	Short-term to Medium-term	Any	Yes
		Rare to Frequent	Short-term to Medium-term	Any	No
Low	Regional	Frequent to Continuous	Long-term to Permanent	Any	Yes
		Rare to Infrequent	Long-term to Permanent	Any	No
		Any	Short-term to Medium-term	Any	No
	Local	Any	Any	Any	No

During assessment of construction related impacts, the duration of impacts is restricted to a medium-term assessment because the activity of installing infrastructure components is not expected to exceed the life span of the VEC species. In terms of fish habitat, the life span of the VEC is approximately 2 years, which is the average life span of most aquatic invertebrate species. In terms of impacts to fish, the duration of construction relative to the average life span of lake trout (at least 25 to 30 years) is assessed as a short-term impact.

The Meadowbank project has three distinct spatial components: the Portage development; Vault development; and Baker Lake development. The Portage and Vault developments share similar activities, dominated by dike installation, dewatering of impoundments, dike operation, and effluent discharge. Developments at Baker Lake are entirely different from those of the project lakes and consist of a barge unloading and storage facility, access road, tank farm and a staging facility.

6.2.4 Closure & Post-closure

The closure/post-closure environment will be considerably different than the environment during operation. Dikes will be breached and pits will be flooded, roads will be decommissioned, infrastructure facilities will be removed and waste rock and tailings facilities will be capped. Any residual impacts of the post-closure environment may persist for time periods that exceed the life span of the VEC species by a considerable amount and for all intents and purposes, may be considered permanent. Cumulative residual impacts during closure and post-closure will be assessed in exactly the same fashion as cumulative residual impacts during construction and operation, although the confidence or certainty of the assessment is reduced because of the time frame involved and the potential for mine development and operation to change over time.

SECTION 7 • SUMMARY OF CUMULATIVE ENVIRONMENTAL EFFECTS

As discussed above identified VECs include: air quality, water quality, surface water quantity and distribution, permafrost, wildlife and wildlife habitat (including caribou calving grounds), and fish and fish habitat. Based on Table 5.7 of these VECs ungulates and ungulate habitat were assessed to have spatial overlap between MGP and the Hamlet of Baker Lake. However, while the local disturbance of caribou habitat is measurable at each site, the cumulate total is a very small fraction of the total area occupied by the herds and thus measurable effects are not expected to extend beyond the local area and thus no measurable cumulative effects would occur.

In summary there are no measurable cumulative effects on air quality, water quality, surface water quantity and distribution, permafrost, wildlife and wildlife habitat (including caribou calving grounds), expected to occur within the Western Churchill geologic province or the Chesterfield Inlet basin from actions related to the development of the MGP in addition to actions related to the Hamlet of Baker Lake. As discussed above the impacts on fish and fish habitat are expected to be below identified thresholds. The potential for measurable regional cumulative effects on VECs to result from MPG and Hamlet of Baker Lake related actions is summarized in Table 7.1 below.

Table 7.1: Measurable Regional Cumulative Effects Potential between MPG and Baker Lake

VEC	Measurable Regional Cumulative Effects Potential
Air Quality[1]	No
Water Quality[2]	No
Surface Water Quantity and Distribution [3]	No
Permafrost[4]	No
Wildlife Habitat[5]	No
Wildlife[7]	No
Aquatic Habitat[6]	No
Fish/Aquatic Organisms[6]	No

Notes: 1. Excepting green house gases, principally CO^2. Cumulative contribution from all projects would be a small fraction of that of Nunavut and NWT communities and even smaller fraction of Canadian contribution. **2.** All are in entirely separate drainage systems. **3.** See water quality note. **4.** By its nature not subject to regional effects from mining. **5.** While the local disturbance of caribou habitat is measurable at each site, the cumulate total is a very small fraction of the total area occupied by the herds and is thus not significant. **6.** Since effects on aquatic habitat are measurable for the basin, but are not significant given the very small area of disturbance compared to the total area of the drainage basin. **7.** Diavik and Ekati have shown that local effects on caribou could occur because of the presence of the proposed and existing, respectively, mines. Assuming the other actions listed would have a lesser effect than the two large diamond mines (because the actions are smaller), measurable effects could not be expected to extend beyond the local area and thus no measurable cumulative effects would occur.

SECTION 8 • MONITORING ENVIRONMENTAL EFFECTS

Industrial development in the area must be balanced with other local activities to ensure that the long-term preservation and conservation objectives are achieved. On-going consultation with local representatives will ensure that community concerns are identified and adequately addressed.

Mining involves the removal of a non-renewable resource from the land. The objective for Cumberland is to implement appropriate methods during construction and operations that facilitates the use of the area for other purposes following mine closure. For the Meadowbank project this will be accomplished by minimizing disturbance and by thorough and progressive reclamation of the site (Cumberland, 2003). During the life of the mine, environmental monitoring will focus on identifying potential cumulative affects associated with other activities that may occur in the area. The early detection of potential cumulative effects and implementation of appropriate mitigation measures will limit long-term impacts and improve the sustainability of the affected area.

Requirements for monitoring the aquatic resources throughout the mine life will be part of the terms and conditions appended to the project's water licence and land leases.

As part of the EIA submission, three supporting environmental management system (EMS) documents provide supporting documentation and further elaboration of key issues. These are the Aquatic Effects Management Program (AEMP, 2005), No Net Loss (NNL, 2005) report, and Metal Mining Effects Regulations report (MMER, 2005).

- The AEMP (2005) report is an umbrella document that delineates that relationship between a project activity, mitigation, and residual effects and provides a detailed description of the monitoring design that will be implemented during construction and operation phases. The AEMP describes what will be monitored, where, when, and how often.

- The MMER (2005) framework document addresses specific monitoring requirements for mine effluent as part of the Metal Mining Effluent Regulations including Environmental Effects Monitoring (EEM) under the Fisheries Act. The AEMP (2005) considers and incorporates monitoring requirements of MMER.

- The NNL report (2005) quantifies specific impacts affecting the productive capacity of fish habitat. For example, it indicates how diking and dewatering of lakes, crossing streams, and constructing a barge-landing facility will destroy or alter fish. The NNL report (2005) quantifies the amount and value of affected habitat, and specifies how habitat will be replaced to compensate for this.

These reports provide important information and documentation of mitigation and management to support conclusions drawn as a result of this cumulative effects assessment.

SECTION 9 • SCOPE OF SOCIOECONOMIC CUMULATIVE EFFECTS

Following is a list of the valued socio-economic components (VSECs) in the project area as identified by the scientific and traditional knowledge gathered to date. With respect to a cumulative effects assessment at the regional and territorial levels, these are all equally valued.

- employment, training and business opportunities
- traditional ways of life
- individual and community wellness
- infrastructure and social services
- sites of heritage significance.

As the Cumberland project will have negligible effects on infrastructure and social services and on sites of heritage significance, it is primarily the first three VSECs that are considered in terms of cumulative effects.

SECTION 10 • SUMMARY OF RESIDUAL SOCIOECONOMIC EFFECTS

Cumberland's intent is to put in place measures to maximize the benefits from the project for Baker Lake specifically, and to Kivalliq Region and Nunavut more generally, and to contribute to its sustainable development beyond the life of the mine.

However, socio-economic impacts are unpredictable and depend not only on the implementation of undertakings by Cumberland but also on decisions and actions of individuals, communities and their governments. It is the case that Baker Lake, as well as Kivalliq Region and Nunavut more generally, presently experience the full range of social and economic challenges that have proven difficult in other contexts to reverse in even the medium term. It is anticipated that in maximizing local, regional and territorial direct and indirect economic benefits through employment, business and education and training initiatives, one of the most effective tools – increasing income – for improving quality of life will in fact be effective.

At the same time, because not everyone will benefit from the economic effects of the project and because increased incomes can have a range of negative side impacts, additional measures will be required, as outlined above, to address the specific concerns expressed by the residents of Baker Lake (where most negative impacts have the potential to occur) about the project. These measures will be negotiated and agreed with the KIA, and will be based on best practice and on community consultations. They are therefore expected to effectively address potential negative project impacts.

The extent to which any of these measures do not produce the hoped for results is the extent to which the balance between positive and negative effects may shift towards the negative. It is unlikely in any case that any measure will fail, but rather be more or less successful on a continuum. Also, the interrelationships between socio-economic effects suggest that comparative lack of success with one measure, if compensated by success with another, may not be of consequence. For example, people in Baker Lake might respond more energetically to employment than to business enhancement measures, without any overall negative or less positive effect than if the response was the reverse.

Finally, effectiveness of mitigation and enhancement measures in face of unpredictability will be determined by monitoring that will allow KIA and Cumberland to identify evolving project effects and address theses on an iterative basis. Should monitoring demonstrate at any point in project development that the potential for negative impact is being realized, Cumberland and the KIA would work towards adapting mitigation and/or enhancement measures to address new concerns.

SECTION 11 • CUMULATIVE SOCIOECONOMIC EFFECTS ASSESSMENT

Many of the project impacts have been discussed in general and potential terms. Until the detail of an IIBA is worked out to better know what mitigation and benefit enhancement measures may be agreed specific to the Cumberland project and until the dynamic of change that is released as a result of the project can be understood through social monitoring, extending the socioeconomic impact assessment to an estimation of cumulative effects is a fairly theoretical exercise. As there are such unknowns around this project, there are equally unknowns about future developments. Finally public sector initiatives, in a territory as new and changing as Nunavut, will have relevance to cumulative socio-economic impacts, as socio-economic status and responses are so influenced by public policy and service delivery.

What follows therefore is a list of observations on potential cumulative effects. The forces at work behind some of these observations are more fully described in the socio-economic impact assessment.

- The training and job experience of Nunavut workforces and businesses with mining sector work on the project will enhance local capacity to realize economic benefits of any new mining sector projects in the Kivalliq, or elsewhere in Nunavut. Much of this enhanced capacity is relevant to participation in other parts of the formal wage economy as well.

- Although there are challenges associated with increased income, formal economy employment, transition to alternative livelihoods, and economic opportunity associated with mining and other resource extraction sector projects are expected to have effects on improving quality of life in Nunavut.

- Shortages of qualified labour and of business capacity to supply are evident, which in the absence of careful sequencing of new projects coming on stream, in relation to Nunavut capacity to supply, can result in competition for the same resources. Results can include inflationary pressures, and leakage of economic benefits to non Nunavut labour and business.

- Whereas the effects of the Cumberland project on traditional land use areas are negligible, and it is expected that impacts on traditional ways of life can be minimized, there are real constraints to how much land can be released to resource extraction development and how much of such types of economic activity can be supported without such effects accumulating and becoming significant.

- Participation in the formal wage economy has a range of unpredictable effects on individual and community wellness that can be both positive and negative. As best practice develops and communities gain experience on how best to manage their participation in such projects, choices that are made will be better informed. Increased integration into the formal economy will however have irreversible effects on the social and cultural fabric, including on traditional ways of life.

- Economic development in the north generally is increasingly being planned in a context of improved understanding of impacts, respect for Inuit culture, community self determination, sharing of industry learning and resources, and improvement of government services. Capacity to ensure that non renewable resource extraction benefits local communities increases with every implemented project.

SECTION 12 • MITIGATION OF POTENTIAL SOCIOECONOMIC EFFECTS

With respect to VSEC the primary vehicle for mitigation and enhancement for Baker Lake will be the Inuit Impact Benefit Agreement (IIBA) to be negotiated between Cumberland and the KIA. The detail of impact mitigation and benefit enhancement will not be confirmed until agreement is reached. Therefore only general terms are presented below for the mitigation and enhancement measures that are broadly consistent with impact agreement best practice and could be discussed during negotiations for the IIBA for this project. It is to be noted in this context that different and/or additional measures to those below could be proposed and agreed during the negotiations.

Socioeconomic mitigation and benefit enhancement measures are being discussed during the IIBA negotiations consistent with the following principles:

- Consultative and participatory approaches will be used throughout, in the definition of priority needs and preferences, and in decisions on how mitigation and enhancement measures will be implemented.

- The development and implementation of mitigation and enhancement measures will be undertaken in partnership with not only communities but with a range of organizations, from government and civil society, that are able to bring culturally appropriate experience and knowledge to maximizing net socio-economic benefit.

- Implementation of both the terms of the IIBA and project operations will be conducted in an environment of accountability and transparency.

- Sustainability criteria will be incorporated through an emphasis on enabling local and territorial participation in employment and business opportunities, training, partnerships with government and community and productivity of any social investments.

The objectives of the IIBA include:

- mitigation of impacts and the enhancement of benefits that will result from project development
- creation of opportunities for the people of Baker Lake specifically and of Kivalliq more generally to participate in the project, towards enhancing self determination
- participation of Cumberland in the sustainable development of Baker Lake, as an active member of the community
- maintenance of goodwill and good relations with communities and their governments.

The Nunavut Land Claims Agreement sets out matters considered appropriate for Inuit benefits of a project. Matters relevant to the potential socio-economic impacts of the Meadowbank project include:

- Inuit training at all levels
- Inuit preferential hiring

- employment rotation reflecting Inuit needs and preferences
- labour relations
- business opportunities for Inuit including
- provision of expert advice
- notification of business opportunities
- preferential contracting practices
- housing, accommodation and recreation
- safety, health and hygiene
- language of workplace
- identification, protection and conservation of archaeological sites and specimens
- Inuit access to facilities constructed for the project such as airfields and roads;
- information flow and interpretation, including liaison between Inuit and proponent regarding project management and Inuit participation and concerns
- co-ordination with other developments
- arbitration and amendment provisions
- obligations of subcontractors.

SECTION 13 • MONITORING

No monitoring of potential socio-economic cumulative effects at the regional or territorial levels by Cumberland is proposed at this time. Given the interdependence of socio-economic parameters and the difficulty of separating out individual causes of socio-economic change, any socioeconomic monitoring in Baker Lake that is agreed as part of the IIBA is likely to capture cumulative effects.

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