

**De Beers Canada Inc.  
Gahcho Kué Project**

**Conceptual Caribou Monitoring Plan**

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# 1 INTRODUCTION

At the Technical Sessions in May 2012, De Beers Canada Ltd. (De Beers) circulated the Environmental Monitoring and Management Framework (EMMF; De Beers 2012a), which outlined the functional application of environmental monitoring within a collaborative adaptive management approach for the Gahcho Kué Project (Project). One of the programs that will provide input into the Adaptive Management Response Framework is the Wildlife Monitoring Plan (WMP). The Conceptual Caribou Monitoring Plan (CCMP) is intended to provide further detail on the caribou monitoring component of the WMP. The CCMP also incorporates feedback from interested agencies and communities, some of which was provided to De Beers at a meeting on May 25, 2012 with representatives of the Government of the Northwest Territories, the Tlicho Government, the Yellowknives Dene First Nation, the Łutsel K'e Dene First Nation, and Aboriginal Affairs and Northern Development Canada (De Beers 2012b). This document is also intended to initiate further discussion regarding caribou monitoring to be undertaken for the Project. Detailed procedures and data sheets for wildlife monitoring will be developed in later versions of the Wildlife Monitoring Plan.

Considered as a whole, the WMP should meet the following objectives:

- to review the environmental design features and mitigation intended to reduce the risks and disturbance to wildlife and wildlife habitat;
- to incorporate local traditional and ecological knowledge, where applicable and available;
- to review results and provide recommendations regarding study designs and sampling methods (e.g., frequency and duration of sampling), and possible changes to components of the WMP;
- to propose adaptive management actions that can be used in implementing additional wildlife mitigation practices when required;
- to design studies and data collection protocols that are consistent with other programs in the region; and
- to consider elements of existing regional and collaborative programs, such as the Northwest Territories (NWT) Cumulative Impact Monitoring Program and the NWT Environmental Stewardship Framework.

Documents reviewed in the preparation of this CCMP included:

- the Snap Lake Wildlife Monitoring Plan (De Beers 2004);
- the Snap Lake Wildlife Management Plan (De Beers 2007);

- the Jericho Diamond Project Wildlife Mitigation and Monitoring Plan (Tahera 2005);
- the Diavik Diamond Mine Wildlife Monitoring Report (DDMI 2010);
- the Ekati Diamond Mine Wildlife Monitoring Report (BHP Billiton 2010);
- reports of the diamond mine monitoring workshops (Marshall 2009; Handley 2010);
- standardized protocols for the NWT Cumulative Impact Monitoring Program (IMG-Golder Corp. 2008); and
- Data Collection Protocols for the Northwest Territories Cumulative Impact Monitoring Program (Kavik-AXYS Inc. 2008).



## **2 STUDY AREAS**

It is necessary to define and use ecologically relevant spatial boundaries for monitoring that can accurately describe potential effects from the Project. The study area should include:

- the physical Project footprint;
- the temporal and spatial extent of sensory disturbances from the Project as well as possible sources of contamination and on-site hazards; and
- consideration of potential effects caused by hunter access from the MacKay Lake road (Gahcho Kué Panel 2007).

With these effects in mind, studies are proposed within the following spatial boundaries:

- the annual range of the Bathurst Caribou Herd (Figure 1);
- the regional study area (RSA), including the winter access road corridor (Figure 2); and
- the local study area (LSA) (Figure 2).

In the 2010 Environmental Impact Statement (EIS), the wildlife LSA (about 200 square kilometres [km<sup>2</sup>]) was selected to assess the immediate direct and indirect effects of the Project on individual animals and wildlife habitat.

The wildlife RSA of approximately 5,600 km<sup>2</sup> (75 km by 75 km) was initially selected to capture Project-related effects that may extend beyond the LSA and influence the abundance and distribution of populations. This area was intended to capture the maximum spatial extent (or zone of influence) of changes in caribou movement and behaviour from the Project, which includes the physical footprint and sensory disturbance. Changes in movement and behaviour can result in effects to the local abundance and distribution of caribou.

In the 2010 EIS, the zone of influence (ZOI) was conservatively assumed in the modelling to extend approximately 15 km around the Project footprint perimeter, as estimated from studies at the Ekati-Diavik mine complex (Boulanger et al. 2011; Golder 2011). Thus, as the ZOI is considerably smaller than the RSA used as part of the baseline in the EIS, the regional study area for monitoring into the future will be reduced to increase the spatial coverage of the survey area and the accuracy and precision of ZOI estimates. Also, the winter access road corridor

from MacKay Lake to the Project site should be included as part of the RSA to identify potential harvesting activity that may occur from the road.

Baseline studies predict that the most common seasons for caribou to encounter the Project are during the summer dispersal and fall migrations, extending from early July to late October. Subsequently, the summer and fall migration seasons will be the focal period for monitoring caribou.



## LEGEND

- Gahcho Kué Project
- Existing Mine
- Territorial Capital
- Populated Place
- Highway
- Existing Winter Road
- Tibbitt-to-Contwoyto Winter Road
- Winter Access Road
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Treeline
- Annual Range of the Bathurst Caribou Herd
- Regional Study Area

## NOTES

Base data source: The Atlas of Canada  
Bathurst caribou range derived from collar data provided by GNWT

## GAHCHO KUÉ PROJECT

### Annual Range of the Bathurst Caribou Herd

PROJECTION:  
Canadian Lambert Conf. Conic

DATUM:  
NAD83

Scale: 1:8,000,000

90 45 0 90

Kilometres



FILE NO:  
B2011-Wild-011-GIS

DATE:  
July 4, 2012

JOB NO:  
11-1365-0001

REVISION NO:  
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OFFICE:  
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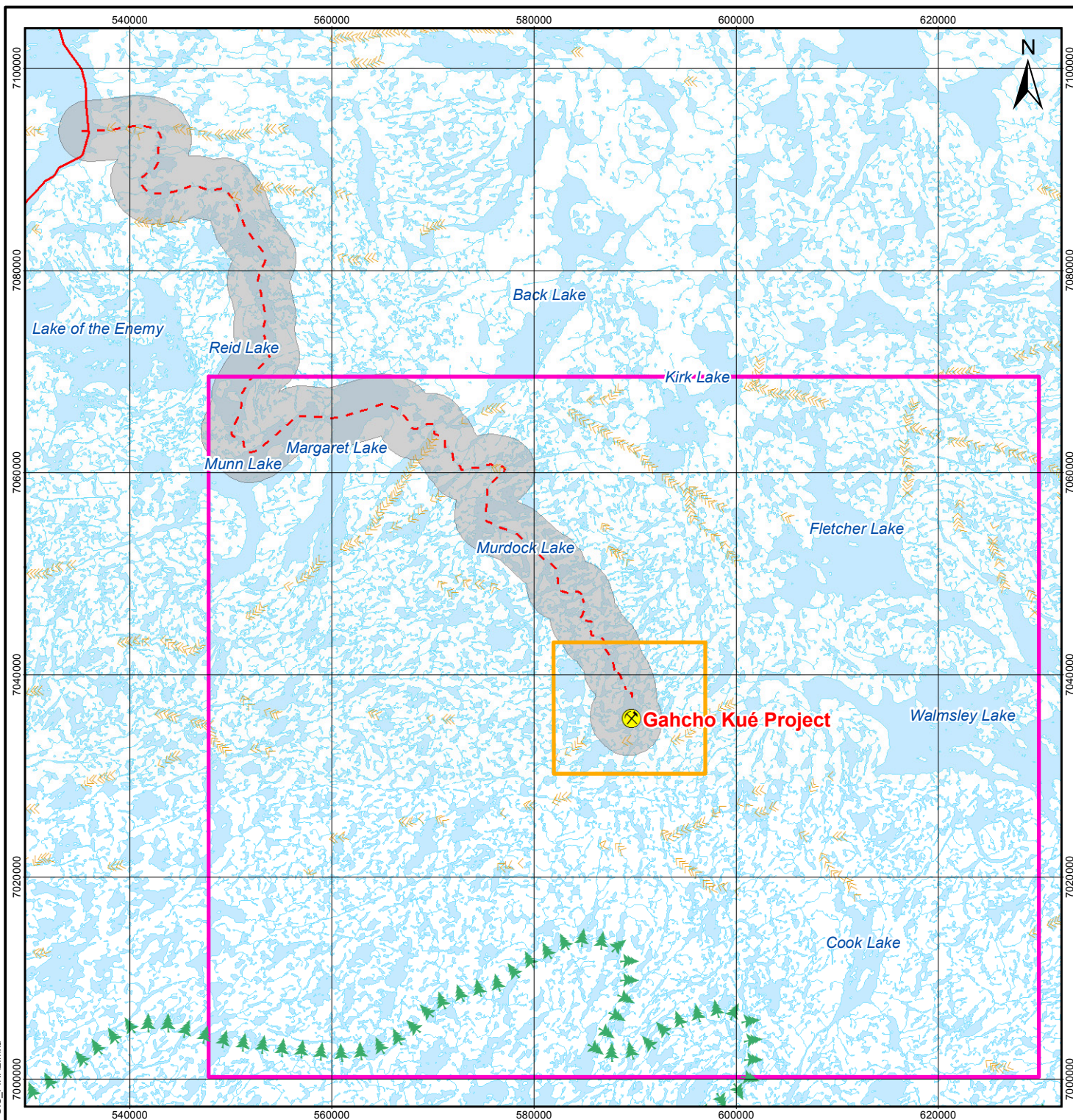
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**Figure 1**



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## LEGEND

- |                                  |                                     |
|----------------------------------|-------------------------------------|
| Gahcho Kué Project               | Local Study Area                    |
| Tibbitt-to-Contwoyto Winter Road | Regional Study Area                 |
| Winter Access Road               | Winter Access Road Study Area (3Km) |
| Watercourse                      |                                     |
| Waterbody                        |                                     |
| Esker                            |                                     |
| Treeline                         |                                     |

## NOTES

Base data source: National Topographic Base Data (NTDB) 1:250,000

## GAHCHO KUÉ PROJECT

### Local and Regional Study Areas for Wildlife

PROJECTION:  
UTM Zone 12

DATUM:  
NAD83

Scale: 1:550,000  
10 5 0 10  
Kilometres



FILE No:  
B2011-Wild-010-GIS

DATE:  
July 4, 2012

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11-1365-0001

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**Figure 2**

### **3 MITIGATION**

Policies and procedures to mitigate effects to wildlife are described in the Wildlife Effects Mitigation and Management Plan (2010 EIS Appendix 7.1 [De Beers 2010]). The proposed mitigation followed a review of best practices from other similar operating mines in the region, including Snap Lake, Ekati and Diavik (De Beers 2007; BHP Billiton 2010; DDML 2010). Many of the policies and procedures are of general applicability to all wildlife such as:

- limiting the area of the mine footprint;
- progressively reclaim disturbed areas where practical;
- reduce noise, dust and odours from the mine;
- containment of toxic chemicals; and
- deterrent actions to reduce harm to wildlife at the site.

Mitigation is proposed that is specific to caribou. It is anticipated that caribou will interact with the Project. In other words, some caribou will be present within close proximity to the mine during the summer and fall seasons. The following policies, practices, and procedures are specifically related to caribou protection.

- All incidents involving interactions, deterrents, or injury of caribou will be documented and evaluated.
- All sightings of caribou will be reported to environmental staff on-site.
- Drivers will be notified when caribou are present at site.
- If caribou are crossing Project roads, traffic will stop and wait for them to cross (i.e., caribou have the right-of-way).
- Caribou will only be herded away from roads or the airstrip in specific circumstances, such as when there are incoming flights or emergencies.
- Blasting will be temporarily suspended if caribou are within the exclusion area for workers around the blast site.

Actions may be required to move caribou away from areas where they may be at risk. The appropriate level of action for a situation is one that removes the risk with the least disturbance to the caribou. The decision to use deterrent actions for caribou should consider the number of animals, and the potential for risk to caribou and human safety.

## 4 EFFECTS PATHWAYS AND MONITORING THEMES

During the technical workshop meeting among De Beers, agencies, and communities (De Beers 2012c), it was asked that relationships and connections be made for the effects pathways investigated in the EIS, the effects predictions made in the EIS, and the proposed monitoring. Monitoring should be designed to test the effects predictions, where possible. Table 1 includes all the effects pathways investigated in the EIS, their assessment (primary, secondary, or no linkage), a summary of the predicted effects, and monitoring themes for testing the predicted effects.

Project pathways assessed as no linkage and secondary were predicted to have no detectable and negligible influences on valued components (VCs), respectively, and would not combine with similar pathways from previous, current, and reasonably foreseeable developments to cause significant effects. The changes from most secondary pathways occur within the physical Project footprint. However, the combination of these pathways (additive, synergistic or multiplicative) is not producing incremental or cumulative effects beyond the local scale that are not already captured by the primary pathways. In other words, the cumulative interaction of secondary pathways from the Project and other developments is captured in the more detailed analysis and assessment of the primary pathways.

As many of the effects pathways are related or overlap, and do not explicitly include a monitoring objective, the effects pathways have been grouped into five 'Monitoring Themes'. These themes will be used to create monitoring objectives and specific monitoring tasks.

**Table 1 Effects Pathways to Caribou identified in the Environmental Impact Statement**

Effects Pathways	Pathway Assessment	Effect Prediction Summary	Magnitude of the Incremental Effect	Monitoring Themes
Direct loss and fragmentation of wildlife habitat from the physical footprint of the Project may alter caribou movement and behaviour	primary	movement and behaviour will be affected	negligible to low	habitat loss and alteration change in distribution
Dewatering may result in newly established vegetation on the exposed lakebed sediments and increase habitat quantity, which may alter caribou movement and behaviour	secondary	limited change to movement and behaviour	negligible	habitat loss and alteration change in distribution

**Table 1 Effects Pathways to Caribou identified in the Environmental Impact Statement (continued)**

Effects Pathways	Pathway Assessment	Effect Prediction Summary	Magnitude of the Incremental Effect	Monitoring Themes
Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from dewatering of Kennady lake may affect the quantity of riparian habitat, which could alter caribou movement and behaviour	secondary	limited change to movement and behaviour	negligible	habitat loss and alteration
				change in distribution
Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from the refilling of Kennady lake may affect the quantity of riparian habitat, which could alter caribou movement and behaviour	secondary	limited change to movement and behaviour	negligible	habitat loss and alteration
				change in distribution
Road footprint decreases habitat quantity and may cause fragmentation, which can alter caribou movement and behaviour	primary	movement and behaviour will be affected	negligible to low	habitat loss and alteration
				change in distribution
Road footprint may cause changes to the amount of different quality habitats (e.g., degradation to vegetation), and alter caribou movement and behaviour	secondary	movement and behaviour will be affected	negligible	habitat loss and alteration
				change in distribution
Increased access for traditional and non-traditional harvesting may alter caribou movement and behaviour, which can affect survival and reproduction	primary	limited public use of winter access road	negligible to low	access
				survival and reproduction
Physical hazards from the Project may increase the risk of injury/mortality to individual animals, which can affect caribou population size	secondary	mortality will be negligible	negligible	direct mine-related mortality or injury
Aircraft/vehicle collisions may cause injury/mortality to individual animals	secondary	mortality will be negligible	negligible	direct mine-related mortality or injury
Attractants to site (e.g., food waste, oil products) may increase predator numbers and increase predation risk	secondary	mortality will be negligible	negligible	direct mine-related mortality or injury
Injury or mortality to individual animals getting trapped in sediments	secondary	mortality will be negligible	negligible	direct mine-related mortality or injury
Sensory disturbance (e.g., presence of buildings, people, lights, smells, and noise) changes the amount of different quality habitats, and alters movement and behaviour, which can influence survival and reproduction	primary	movement and behaviour will be affected	negligible to low	change in distribution
				survival and reproduction
Dust deposition may cover vegetation and change the amount of different quality habitats, and alter caribou movement and behaviour	primary	movement and behaviour will be affected	negligible to low	habitat loss and alteration
				change in distribution
Dust deposition and air emissions may change the amount of different quality habitats (through chemical changes in soil and vegetation), and alter caribou movement and behaviour	secondary	movement and behaviour will be affected	negligible	habitat loss and alteration
				change in distribution
Dust deposition may cover vegetation and decrease abundance of forage for caribou (i.e., habitat quantity)	secondary	movement and behaviour will be affected	negligible	habitat loss and alteration

**Table 1 Effects Pathways to Caribou identified in the Environmental Impact Statement (continued)**

Effects Pathways	Pathway Assessment	Effect Prediction Summary	Magnitude of the Incremental Effect	Monitoring Themes
Leaching of mine rock may change the amount of different quality habitats, and alter caribou movement and behaviour.	no linkage	movement and behaviour will not be affected	nil	habitat loss and alteration change in distribution
Release of seepage and surface water runoff (including erosion) from the Coarse PK Pile, Fine PKC Facility and mine rock piles may change the amount of different quality habitats, and alter caribou movement and behaviour	no linkage	movement and behaviour will not be affected	nil	habitat loss and alteration change in distribution
Long-term seepage from the Coarse PK Pile and mine rock piles may cause local changes to habitat quality, and alter caribou movement and behaviour	no linkage	no change to movement and behaviour	nil	habitat loss and alteration change in distribution
Ingestion of soil, vegetation, and water, or inhalation of air that has been chemically altered by air emissions or dust deposition, may affect caribou survival and reproduction	no linkage	no caribou mortality	nil	direct mine-related mortality or injury
Chemical spills (including de-icing fluid run off) may cause negative changes to health or mortality of individual animals	no linkage	no caribou mortality	nil	direct mine-related mortality or injury
Ingestion of seepage and surface water runoff from the Coarse PK Pile, Fine PKC Facility and mine rock piles, or ingestion of soil, vegetation, or water that has been chemically altered by seepage and runoff, may affect caribou survival and reproduction	no linkage	no caribou mortality	nil	direct mine-related mortality or injury
Ingestion of soil, vegetation, or water that has been chemically altered by leaching of PAG mine rock may affect caribou survival and reproduction.	no linkage	no caribou mortality	nil	direct mine-related mortality
Ingestion of exposed sediments and riparian/aquatic vegetation in the dewatered lakebed of Kennady Lake may affect caribou survival and reproduction	no linkage	no caribou mortality	nil	direct mine-related mortality or injury
Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from dewatering Kennady lake may cause injury/mortality to individual animals	no linkage	no caribou mortality	nil	direct mine-related mortality or injury
Changes in the timing of freeze and break-up downstream may alter caribou movement and behaviour, and could cause injury/mortality to individual animals	no linkage	no caribou mortality	nil	direct mine-related mortality or injury

PK = processed kimberlite; PKC = processed kimberlite containment.

## 4.1 MONITORING THEMES

Monitoring themes and associated study objectives, scales, and tasks are presented in Table 2. A description of each theme is provided below.



**Table 2 Monitoring Themes and Associated Study Objectives, Scale, and Tasks**

Monitoring Theme	Objectives	Scale	Tasks
Habitat Loss and Alteration	To confirm that the amount of total direct terrestrial landscape alteration does not exceed predictions To determine changes in vegetation surrounding the Project (indirect habitat loss)	Local Study Area	Direct Habitat Loss Monitoring Vegetation Monitoring Dust Monitoring
Access	To determine the amount and type of public use of the Winter Access Road	Winter Access Road corridor	Winter Access Road Use Monitoring
Direct Mine-related Mortality	To identify instances where the Project presents direct physical hazards to caribou	Project footprint	Wildlife Surveillance Monitoring Waste Management Monitoring
Change in Distribution	To determine whether the zone of influence changes in relation to mine activity and is similar to that at the Diavik-Ekati mine complex	Regional Study Area Population	Caribou ZOI Monitoring Vegetation Monitoring Dust Monitoring
Survival and Reproduction	To contribute to the Bathurst Caribou Management Plan	Population	Contributions to the Bathurst Caribou Management Plan

ZOI = zone of influence.

### **Habitat Loss and Alteration**

The loss and alteration of caribou habitat will occur from several components of the Project, infrastructure and dust deposition. The monitoring objectives include the loss and alteration of habitats on the landscape (including vegetated and non-vegetated areas). Although caribou often use frozen lakes in winter and during the spring migration, monitoring will focus on habitat use during the summer and fall seasons when caribou are travelling and foraging in the area with calves. Habitat loss will be calculated through monitoring the size of the Project footprint (Section 5.1), while habitat alteration (e.g., from changes to vegetation resulting from dust or downstream flows) will be monitored through the Soil and Vegetation Monitoring Program (which includes monitoring dust deposition). This monitoring theme is also relevant to all wildlife.

### **Access**

The theme of access is intended to address concerns regarding a possible increase in caribou harvesting as a result of the Winter Access Road spur to the Project from the Tibbitt-to-Contwoyto Winter Road junction at MacKay Lake. Although this road is not a new feature to the landscape, it will come into regular and more intensive use with the construction and operation of the Project. Monitoring of access and evidence of wildlife harvest will include the entire length of the 120 km road. This monitoring is largely specific to caribou, and proposed monitoring tasks are described in Section 5.4.

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### **Direct Mine-related Mortality**

The theme of direct mine-related mortality includes investigated pathways related to physical hazards from the Project, exposure to toxic substances, vehicle collisions, changes to risk of predation (particularly if carnivores are attracted to the Project), and some effects stemming from changes to hydrology. The monitoring objective proposed in Table 2 is intended to guide the identification of such risks, so that they can be promptly managed. The effects of site hazards are expected to operate and be detectable within the Project footprint area, and the surrounding landscape near the Project. This monitoring theme is relevant to all wildlife. The proposed Wildlife Surveillance Monitoring to identify such hazards is described in Section 5.2, while the proposed Waste Management Monitoring is described in Section 5.3.

### **Change in Distribution**

Changes to caribou distribution from alterations in movement are anticipated to occur as caribou respond to habitat loss, changes to vegetation, dust deposition, sensory disturbance and roads. The monitoring objective proposed in Table 2 has two components:

- to determine if the distribution of caribou changes in relation to mine activity (change in the spatial extent of the ZOI through time); and
- to determine if the Project ZOI is similar to that described at other mine sites (Boulanger et al. 2011).

Based on the results of monitoring at other mines in the region, these effects are anticipated to operate within the scale of the RSA, and provide data for use by the Government of the Northwest Territories and predicting cumulative habitat effects at the population level. The proposed monitoring tasks are largely specific to caribou and are described in Section 5.5.

### **Survival and Reproduction**

Measurable changes to caribou survival and reproduction are not predicted to result from the Project. The pathways investigated represent changes that operate at a population level and likely result from the cumulative effects of numerous developments and natural factors rather than from the Project alone. Caribou survival and reproduction are influenced by natural factors throughout their range, such as insect harassment and range conditions affected by climate and herd density, making it difficult to separate Project-related effects from natural factors. For example, a population viability analysis was completed in the

EIS and expanded in an addendum. The results of the analyses showed that disturbance to caribou habitat and energetics from the Project had a statistically non-measurable effect on the population. Also, increases in insect harassment and harvest rate had a much stronger effect on final abundance and risk curve projections, relative to the incremental and cumulative effects from the Project and other developments. Therefore, monitoring effects to caribou survival and reproduction are most meaningful at the population scale and requires collaboration with government, communities, and industry. As one of many land users, options in which De Beers could consider contributing to population-level monitoring are described in Section 5.6.

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## **5 PROPOSED MONITORING TASKS**

The specific monitoring tasks corresponding to each of the five monitoring themes are described in Sections 5.1 to 5.6 below. Some of these monitoring tasks are specific to caribou, whereas other tasks will be used to monitor all wildlife.

### **5.1 HABITAT LOSS AND ALTERATION MONITORING**

Construction of the Project will lead to the loss and alteration of vegetation and landscape features that currently provide wildlife habitat, such as tundra vegetation, shallow ponds, and riparian zones. These local changes in habitat can influence the local abundance and distribution of wildlife.

Landscape alteration will predominantly occur in phases throughout construction and operation. Following initial construction of the Project, there will be several distinct phases of operation as each ore body is mined, the rock piles and processed kimberlite containment facilities expand, and areas of Kennady Lake are hydrologically isolated. It will be necessary to maintain a record of the actual sequence of operations to document habitat loss and alteration.

As-built drawings of the Project footprint and facilities will be prepared, and compared against existing vegetation maps to estimate vegetation classes disturbed as a measure of actual habitat loss for wildlife. The comparison will be quantitative. Habitat alteration, resulting from factors such as dust deposition on vegetation, will be monitored through the Soil and Vegetation Monitoring Program (which include monitoring dust deposition).

### **5.2 WILDLIFE SURVEILLANCE MONITORING**

Wildlife will continue to be present in the vicinity of the Project during construction, operation, and closure phases. Some wildlife species are attracted to human activity. Thus, interactions between the Project and wildlife are anticipated. Incidents are defined here as any wildlife interaction that requires a response by Project personnel. Species that are often attracted to industrial developments in the NWT include gulls, ravens, fox, wolverine, and bears.

Wildlife surveillance monitoring is proposed to identify the species, number, and location of wildlife incidents, and identify risks to wildlife. Surveillance monitoring also includes systematically recording the presence of all wildlife (i.e., common and uncommon species, and species at risk) within and around the Project

footprint. The program is intended to provide direct feedback on Project mitigation to site operations, particularly regarding the effectiveness of waste management and wildlife management practices.

Surveillance monitoring of wildlife presence and movements within and around the Project will help to keep environment staff apprised of wildlife activity and the potential for problems, and measure the effectiveness of mitigation. Regular inspections for wildlife and fresh wildlife sign around the Project, and regular communication with all staff will provide early warning of wildlife presence on-site before issues arise. This survey will consist of an inspection of areas within the Project site, scanning observations of wildlife, and records of recent wildlife sign (e.g., tracks, scat). A survey protocol with a targeted surveillance route and locations will be developed. The survey will be completed on foot and by truck, and environment staff will record the area surveyed, and the nature and location of all observations. The survey protocol will be adjusted as needed based on observations of wildlife in other areas at site.

Project staff and contractors will be required to report all observations of large mammals to environment staff, both at the Project site, and along the Winter Access Road. Environment staff will respond to, investigate, and record the presence and incidents involving deterrent actions, injury, or mortality of animals, and complete follow-up procedures or management actions as necessary. Wildlife sighting logs will be maintained at various areas around the Project site for staff to record observations of wildlife. If wildlife injury or mortality occurs, environment staff will conduct an investigation to determine the cause, collect photographs, and store the carcass until further direction from the department of Environment and Natural Resources (ENR) and complete the follow-up procedures or management actions as necessary. All wildlife sightings, deterrent actions, injuries, and mortalities will be reported in the annual Wildlife Monitoring Report.

Surveys for wildlife presence within and around the Project will occur systematically at least once per week. Investigation and reporting of incidents will be completed as they occur. Monitoring will be continuous throughout the construction, operation, and closure phases of the Project. Environment staff may at any time suggest changes to environmental design features, mitigation and management practices and policies, or the need for additional training for staff, as a result of their investigations.

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### **5.3 WASTE MANAGEMENT MONITORING**

Good waste management practices and staff education are key to decreasing the availability of attractants for predators at mine sites, and associated predation risk to caribou. The Wildlife Monitoring Program will include environmental design features, mitigation, and management plans to limit the attraction of wildlife, and the associated increased risks of wildlife interactions and wildlife mortality. These mitigation strategies will be similar to proven management practices and policies used at other mines, including Snap Lake, in the NWT and Nunavut (e.g., De Beers 2008).

### **5.4 WINTER ACCESS ROAD MONITORING**

A 120-km Project winter access road, beginning at km 271 (MacKay Lake) of the Tibbitt-to-Contwoyto Winter Road, is proposed. The winter access road is currently permitted and has been used occasionally to bring supplies to the exploration site. Should the Project proceed, it would require that the existing winter access road be used annually until closure. Concerns regarding the access road relate to the potential for increased harvesting of caribou.

A suite of options are being considered to monitor road use by non-Project vehicles.

- Regular and frequent inspections of the road undertaken by De Beers Protective Services personnel. Inspections would be completed by driving the length of the winter access road between the Project site and MacKay Lake (i.e., km 271 of the Tibbitt-to-Contwoyto Winter Road). All observations of non-Project vehicles or evidence of wildlife harvest would be recorded and provided in annual reports. This information will be provided immediately to ENR if a concern is identified. A standardized reporting form would be developed in consultation with ENR.
- Station a community monitor at a rest stop along the road. Check in by non-Project road users would be voluntary. Observations of non-Project vehicles would be recorded and provided in annual reports, and immediately to ENR in the event a concern is noted. A standardized reporting form would be developed in consultation with ENR.
- ENR may pursue the establishment of another monitoring location along the Tibbitt-to-Contwoyto Winter Road.

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## **5.5 CARIBOU DISTRIBUTION MONITORING**

In the EIS, it was assumed that the distribution of caribou would be negatively influenced within the zone of influence (ZOI) of the Project. This ZOI was attributed to a decrease in habitat quality from sensory disturbance associated with mining activity. The ZOI of approximately 15 km around the Project perimeter was assumed based on studies at the Diavik-Ekati diamond mine complex (Boulanger et al. 2011; Golder 2011). Under the current level of development, these local changes in the distribution of animals around the Project and other previous, existing and reasonably foreseeable developments were predicted to have no significant effect on the abundance and movement of caribou across their seasonal ranges. Research on the ZOI around the Project is not likely to provide information helpful to adaptively manage mining operations. However, monitoring caribou distribution around the Project could increase confidence in future environmental assessments and for the assessment and management of cumulative effects under different development scenarios. In other words, estimating a ZOI for the Project provides information at the population level if government develops the necessary modelling tools to use the information.

As the predicted ZOI is considerably smaller than the RSA used for baseline studies, a new study area will be established so that efforts can be better allocated across space and time. The monitoring study area will consider both the geographic extent of indirect effects from the Project, and the trade-off of actual sampling coverage versus study area size. In other words, a larger study area may result in proportionately less sampling coverage, which could generate ZOI estimates with poor accuracy and precision.

While monitoring caribou distribution at existing diamond mines has included aerial transect surveys and use of collared caribou data, questions continue to be raised about the efficacy of these methods and the potential disturbance to caribou from aerial surveys in particular. The result is a need to carefully consider study methods measured against the added value of the data collected.

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## **5.6 CONTRIBUTIONS TO THE BATHURST CARIBOU MANAGEMENT PLAN**

Concerns have been raised regarding possible cumulative effects of harvesting, development, and climate change to caribou (ENR 2011). De Beers may contribute to population level monitoring of the Bathurst caribou herd, the strategy of which is outlined in the Barren-ground Caribou Management Strategy (ENR 2011). Although the details of this contribution have not yet been defined, discussions between ENR and De Beers continue. Possible monitoring activities and contributions by De Beers towards the Caribou Management Strategy include:

- Support for collaborative studies on wolves in the Bathurst caribou range to investigate wolf abundance and predation, which is an area of importance for communities during the decline of the Bathurst caribou.
- Support of GPS collar deployment, which could also provide information to assess habitat use in the RSA.
- Support of meetings, workshops, or other studies indicated in the Caribou Management Strategy.
- Monitoring of factors that are linked to caribou energetics such as snow melt, plant green-up and senescence phenology, mosquito and black-fly activity, weather and climate.



## **6 REPORTING AND ADAPTIVE MANAGEMENT**

The CCMP, and the eventual WMP, will be components of the larger framework of the Adaptive Management Response Framework, a concept described in the Environmental Monitoring and Management Framework (De Beers 2012a). The exact definition of adaptive management varies among monitoring components, but typically adheres to having four themes as follows (WLWB 2010):

1. learning in order to reduce management uncertainties;
2. using what is learned to change policy and practice;
3. focusing on improving management; and
4. doing the above in a formal, structured and systematic way.

The Adaptive Management Response Framework will be implemented collaboratively by an Adaptive Management Advisory Committee (AMAC) coordinated by De Beers. The committee will be responsible for reviewing monitoring reports and providing input on areas of study and management actions. The draft Terms of Reference for the AMAC were submitted to the public registry on June 29, 2012.

Each year, a monitoring report will be completed by De Beers for review by the AMAC. The annual report will contain a summary of methods, current data collected, results and a record of wildlife observations, interactions, deterrent actions, and incidents (including mortalities). The report will also suggest changes for future years, if required. The report will describe contributions to the Bathurst Caribou Management Plan, and ENR would be asked to report on outcomes of the Bathurst Caribou Management Plan for a given year. Where TK studies are undertaken, communities would be asked to share as well.

Due to the large degree of natural variation inherent in ecosystems, it is often difficult to detect indirect effects until several years of data have been collected. Therefore, a comprehensive analysis and discussion of all data from the monitoring program could be completed every 5 years. The comprehensive report will provide a full analysis of data collected, an assessment of effects that are detected, an assessment of the effectiveness of mitigation, and recommendations for future monitoring.

If changes to caribou (or other wildlife) are determined to be greater than the predictions in the EIS, or if monitoring of the Project operation identifies potential hazards to wildlife, then the options available to De Beers include the following:

- modify monitoring effort;
- implement new monitoring programs or special studies (i.e., studies that occur outside the scope of the WMP and have defined (shorter) timeline) to further understand the effects; or
- implement additional mitigation to reduce the effects.

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## **Gahcho Kué Diamond Mine Wildlife Surveillance Monitoring – DRAFT for REVIEW**

### **Technical Procedures**

#### **Objective**

To inform adaptive management at site to prevent wildlife incidents from occurring and record the species, number and location of wildlife interacting with the Gahcho Kué mine site.

#### **Field Procedures**

Wildlife observations and sign monitoring surveys will be completed at least once a week. Each survey should take about 2 to 3 hours. Observers will travel to different areas / sites within the mine footprint (see monitoring site list below) to record all wildlife or wildlife sign.

Record if wildlife or wildlife sign was or was not observed at each site. Collect the following information:

- Time upon arrival at location / monitoring site
- Did you observe any wildlife or sign (Yes or No)
- Location or monitoring site
- Species observed
- Number of individuals
- Sex / group composition (Male, Female, Female with Young, Male and Female with Young, Unknown)
- Behaviour or activity (Feeding, Lying, Standing, Walking, Trotting, Running, Alert)
- Photo number (if photo taken)
- Any relevant comments about the sighting

If wildlife sign is observed then record the following:

- Time observed
- Location of sign
- Species (if possible)
- Type of sign observed (e.g. tracks, scat, digs, den)
- Number of sign
- Photo number (if photo taken)
- Any relevant comments about the sign

Any reports of sign or observations of species from mine staff working in the area shall be recorded on the data sheets in the additional comments section on the reverse side of the data sheet. Photos of sign and wildlife should be taken where possible to help in identification of species after completion of the survey. Record the photo number on the data sheet and download and file the photos by date.

Wildlife observations or sign observed en route between systematic monitoring sites should also be recorded in the same manner as described above.

If no wildlife is observed, no sign seen and no reports of wildlife from staff, then an “N” should be recorded on the data sheet and in the database for that monitoring site / location.

Consult with the environmental leader before each survey to see if there are any staff reports to be aware of during the survey and make sure to record the staff observations in the database. Get the environmental lead to identify individuals at the mine site to talk to about wildlife observations.

### **Areas for Systematic Monitoring**

The following areas / sites should be visited at least once a week.

- Accommodations building (entire perimeter)
- Waste transfer area (entire perimeter)
- Incinerator building (entire perimeter)
- Emulsion plant
- Airstrip building
- Truck shop
- Fuel storage
- Mill
- Power plant
- Sewage treatment plant
- Fine processed kimberlite containment area
- Others as defined by the environmental lead

### **Equipment and Materials**

- Binoculars
- Radio
- Personal Protective Equipment
- Field Guides (Suggested)
- Digital Camera
- Map of project site
- Data Sheets

### **Follow Up**

After the data have been collected, entered into the database, and checked for errors, the results should be shared with the environmental lead. Any concerns with wildlife sightings and the mine operations should immediately be brought to the attention of the environmental lead so the appropriate action can be taken. The environmental lead for the site should sign and date the data sheet showing that they are aware of all the observations and comments. Any wildlife incidents observed or reported during this survey should be reported in the Wildlife Incident Report Form (see

separate form). Reporting forms and a summary of findings are to be included in the Wildlife Monitoring Plan annual report top inform the need for adaptive management at site.

**DRAFT TEMPLATE FOR REVIEW**

<b>GAHCHO KUÉ - WILDLIFE INCIDENT REPORT</b>		Incident Report No. _____																	
<b>SPECIES:</b> <input type="checkbox"/> Black Bear <input type="checkbox"/> Grizzly Bear <input type="checkbox"/> Caribou <input type="checkbox"/> Fox <input type="checkbox"/> Wolverine <input type="checkbox"/> Wolf Other: (specify) _____      # of Animals Involved: _____																			
<b>SEX:</b> <input type="checkbox"/> M <input type="checkbox"/> F <input type="checkbox"/> Unknown <b>ESTIMATED AGE:</b> <input type="checkbox"/> Calf/Cub/Kit/Pup <input type="checkbox"/> Sub-adult <input type="checkbox"/> Adult <input type="checkbox"/> Unknown		<b>DATE:</b> <b>TIME:</b>																	
<b>LOCATION:</b>																			
<b>WEATHER :</b>																			
<b>ANIMALS BEHAVIOUR:</b> <input type="checkbox"/> FEARFUL <input type="checkbox"/> NOT FEARFUL <input type="checkbox"/> AGGRESSIVE   Cautious																			
<b>(Phased) DETERRENT ACTION</b> Time Start: <input style="width: 100px;" type="text"/> Time Finished: <input style="width: 100px;" type="text"/>		<b>REASON FOR DETERRENT:</b> <input type="checkbox"/> On Road or Airstrip <input type="checkbox"/> Investigating Camp / Equipment <input type="checkbox"/> Destroying Equipment / Property <input type="checkbox"/> Endangering Human Safety <input type="checkbox"/> Endangering Self Other (specify): _____																	
<b>TYPE:</b> ( Mark number used): 2 each	<b>SUCCESSFUL</b> (Provide detail on back)																		
<input type="checkbox"/> Approach w/ Vehicle <input type="checkbox"/> Approach on Foot <input type="checkbox"/> Shouting / Yelling <input type="checkbox"/> Air Horn <input type="checkbox"/> Pen Launched Bangers * <input type="checkbox"/> 15 mm Bangers * <input type="checkbox"/> 15 mm Screamers <input type="checkbox"/> Warning Shots <input type="checkbox"/> 12 Gauge Scare Cartridges <input type="checkbox"/> 12 Gauge Rubber Bullets OTHER (SPECIFY) Deterrent efficacy: _____	<table border="0" style="width: 100%;"> <tr> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> </tr> <tr> <td><input type="checkbox"/> Yes</td> <td><input type="checkbox"/> No</td> </tr> </table>	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
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		<b>FORM COMPLETED BY :</b> <b>REPORT SUBMITTED BY:</b> <b>DATE / TIME REPORTED TO ENR:</b> <b>FOLLOW WITH VEHICLE:</b> <input type="checkbox"/> ATV <input type="checkbox"/> Skidoo <input type="checkbox"/> Truck <input type="checkbox"/> Helicopter      Distance: _____																	
<b>DAMAGE by WILDLIFE</b> <input type="checkbox"/> Equipment / Supplies: Damage \$ _____ <input type="checkbox"/> Human Injured    Other (specify) _____		<b>WILDLIFE KILLED</b> <input type="checkbox"/> Yes <input type="checkbox"/> No ENR Contact: Contact No: _____																	
<b>Comments:</b> _____ _____ _____																			



## Gahcho Kué Diamond Mine Wildlife Surveillance Monitoring – DRAFT for REVIEW

Observer(s): \_\_\_\_\_ Date (M/D/Y): \_\_\_\_\_ Page \_\_\_\_ of \_\_\_\_

### Wildlife Observed or Wildlife Sign

Time	Wildlife Present? (Y/N)	Location	Species or Sign	Number	Sex / Group Composition <sup>a</sup>	Behaviour <sup>b</sup>	Photo #

<sup>a</sup> Sex / Group Composition = Male, Female, Female with Young, Female and Male with Young, Unknown

<sup>b</sup> Behaviour = Feeding, Lying, Standing, Walking, Trotting, Running, Alert

Record any additional comments on reverse page.

Additional Comments or Notes:

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Environmental Lead Approval (Signature): \_\_\_\_\_ Date: \_\_\_\_\_

## Gahcho Kué Project

### Wildlife Monitoring Plan Working Group – Meeting #1

August 7, 2012

#### MEETING SUMMARY

##### 1. ATTENDEES:

Stephen Lines	De Beers Canada
Todd Slack	Yellowknives Dene First Nation
Anne Gunn ( <i>by phone</i> )	Consultant for the Gahcho Kué Panel
Jan Adamczewski	Environment and Natural Resources (ENR)
John Nishi	Consultant for the Tlicho Government
Boyan Tracz	Cumulative Impacts Monitoring Program (AANDC)
John Virgil	Golder Associates (representing De Beers Canada)
Marc d'Entremont	Consultant for Deninu Kue First Nation
Earl Evans ( <i>by phone</i> )	Northwest Territories Metis Nation
Steven Ellis (p.m. only)	Akaitcho IMA Implementation Office
Mike Tollis (p.m. only)	Lutsel K'e Dene First Nation
Kate Witherly	Northern Projects Management Office (CanNor)

##### 2. INTRODUCTION:

Meeting began at 0900.

- De Beers welcomed everyone and thanked them for their participation.
- De Beers agreed to establish a wildlife working group and workshop following recommendations made at the technical sessions to provide input on the development of a wildlife monitoring plan for the Project. The working group is a smaller and more focused group, and the workshop (scheduled for September) will include a larger group of participants from government and communities.
- The Yellowknives Dene noted that they object to the fact that they were only allowed to select one representative for the working group while De Beers has both a company representative and expert consultant participating on the committee.
- The Tlicho also share the objection of the Yellowknives Dene, noting that their consultants do not speak for the government.

##### 3. CONCEPTUAL CARIBOU MONITORING PLAN:

- A draft conceptual caribou monitoring plan (CCMP) was distributed to the working group on July 25, 2012.

## Gahcho Kué Project

### Wildlife Monitoring Plan Working Group – Meeting #1

August 7, 2012

- This plan was developed by the proponent in an initial attempt to consider the concerns and recommendations heard throughout the EIR process, as well as additional sources of information from previous developments.
- The plan for caribou needs to fit within an overall monitoring plan for wildlife to be submitted to the Panel in draft form following the September workshop.

#### General discussion:

##### General discussion on concerns/issues with conceptual plan:

- This conceptual plan reads a bit like a finalized plan. It does not offer options or a good basis for discussion – *i.e.* providing variations or different wording for discussion.
- The draft conceptual plan should have included the ideas/discussion from the May meeting on caribou and should have been more detailed.
- With more specific details provided, it would be easier for parties to provide input
- Document looks a bit like a cut and paste from the EIS, so it's difficult to determine the goals and purpose of the plan
- Document is missing a comprehensive answer to the key questions of **what** should be monitored and, more importantly, **why**. What are the specific questions the monitoring plan is going to address?
- These big questions are the foundations of the monitoring objectives and they need to be asked properly. It is important to have clear language; monitoring shortfalls are often linked to poorly-worded objectives
- The group needs to understand why we monitor and then agree on the overall types of monitoring. Reasons for monitoring could potentially be listed in the front of the document, with information on how they link to Table 1.
- De Beers needs to be transparent about how documents and information are incorporated into the monitoring plan

##### *De Beers' response:*

- The conceptual plan is for discussion and it's important to use the working group and workshop to gain input on the monitoring plan, so were hesitant to include too much detail in the plan

## **Gahcho Kué Project**

### **Wildlife Monitoring Plan Working Group – Meeting #1**

**August 7, 2012**

before the first meeting. The conceptual plan responds to the feedback provided on May 25 technical session sidebar meeting and we are here to receive more input from more people.

- The purpose of the document is to be conceptual and to use it to determine the effects predictions most relevant to monitoring, highlight key areas that need to be monitored and then through the working group agree how the monitoring is going to be undertaken.
- De Beers was expecting working group feedback and discussion on what areas need to be monitored and how.
- De Beers is going to go back to bring out the lessons learned in monitoring at other mines, and is looking for feedback from the group on anything specific De Beers should consider based on the knowledge and experience around the table.

#### *Inclusion of community concerns and traditional knowledge*

- Need to have community involvement at an early stage to ensure that traditional knowledge is appropriately incorporated. Every step taken with technical experts should also involve the communities. AANDC has toolboxes for aquatic monitoring on their website, which includes information on working with communities, and there is additional academic information available.
- Traditional knowledge fits into all aspects of the monitoring so its development of the plan involves the inclusion of traditional knowledge holders throughout the process
- The issue is not the inclusion of TK into the 'development' but ensuring that TK plays a role in the monitoring – more so than what has occurred traditionally. Other than fish tasting, there is a distinct lack of resources for TK inclusion alongside 'scientific' monitoring
- Ensuring communities are provided the opportunity to ask questions would likely lead to additional or expanded monitoring objectives.
- In other projects proponents have done workshops with the communities: the first workshop is to listen to the issues and the second to go back with suggestions on how to deal with the issues
- Could be beneficial to have a detailed table of predicted effects cross-referenced with the community concerns; this would then link to how the effects require a type of monitoring.

## **Gahcho Kué Project**

### **Wildlife Monitoring Plan Working Group – Meeting #1**

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#### *De Beers' response:*

- Objectives for the monitoring program will not be finalized until the company holds the September workshop. De Beers has also funded traditional knowledge studies for communities that wanted to complete them.
- It is important to ask for input from communities, but there is also already a good understanding of their concerns given all of the participation in the EIR process, begin with the scoping for the terms of reference, so it may be more a matter of more clearly bringing out the concerns they have already expressed which was done in the assessment pathways. This could be clarified in the conceptual plan.

#### **Key considerations/Questions:**

Key considerations and questions were tracked for discussion and they are outlined below.

The answers to the question of why monitor are clarified through describing the types of monitoring.

Types of monitoring discussed:

1. Record range of natural variation in selected indicators to serve as a comparative reference or 'baseline'
2. Testing effects predictions developed in the EIS
3. Test assumptions of models used in the EIS
4. Test effectiveness of mitigation measures
5. Regulatory requirements

The key to monitoring is clarity of wording (and thinking) for the objectives. For example, the objective to measure effects has to include the range of natural variation (environmental 'noise' and the strength of the effect (signal). This then links the probability of detecting effects.

#### Key question:

WHY monitor? This question is asked so that people can understand the impacts of the project. How will this development change the way the LAND works?

WHAT should be monitored? Impacts to habitat, caribou, people (access) – these were then linked into the monitoring themes outlined in Table 2 (page 11):

## Gahcho Kué Project

### Wildlife Monitoring Plan Working Group – Meeting #1

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Using a hierarchical approach was suggested for clarity and structure – with tiers flowing from the level above. E.g. Why monitor ->What components ->Monitoring themes -> Monitoring objectives -> Criteria/study design (or something similar in structure).

#### Preliminary components and themes:

*Habitat* – habitat loss, alteration, disruption

*Caribou* – direct mine-related mortality, survival and reproduction

*People* – access

Recognizing the significant concerns with the rationale and structure, the company asked for specific comments on the sections of the conceptual caribou monitoring plan. The discussion that followed is all dependant on the establishment of the objectives and rationale, but feedback was presented on the text provided:

#### **1. Introduction**

- Introduction needs to be re-worked to set the stage for the monitoring and include the following information:
  - information on the success or failure of previous monitoring programs
  - different types of monitoring
  - goals of mitigation and monitoring
  - summary table of information cited from existing documents and lessons learned (report from the Wekeezhii Land and Water Board is a good source of information)
- Should be similar to an introduction to a scientific article, and should be kept short.
- Introduction should start broadly and then move the reader into specific goals and objectives.
- Comments on objectives listed (second paragraph of page 1):
  - Items listed are not objectives, but goals and principles
  - Second and fourth bullets are principles
  - Remaining bullet points are goals
  - Where possible use SMART objectives (specific, measurable, achievable, realistic, time-referenced)

## **Gahcho Kué Project**

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#### **2. Study Area**

- This section could be pushed to later in the document.
- First three bullets listed are unnecessary, and the project area considered should go beyond what is listed.
- Final two paragraphs are unnecessary.
- Need to include both spatial and temporal scales.
- Need to include cumulative effects.

#### **3. Mitigation**

- This section could come after Section 4.
- Need a clear description of mitigative actions and their objectives – should add a comprehensive table of mitigation measures, and link them to the three types of monitoring discussed.
- Include general information on how mitigation triggers monitoring, how the monitoring effectiveness is measured, and how the effectiveness of monitoring feeds back into the mitigation measure.

#### **4. Effects Pathways and Monitoring Themes**

- This section requires the biggest re-write, particularly because the plan goals and objectives need to be established based on outcomes of the “why” and “what” on monitoring.
- Clarify how the types of monitoring fit with the components and themes discussed
- How are people/access incorporated as a component? Increased access by people is generally measured in terms of harvesting effects, so does that make it an impact to caribou?
  - People, access, caribou and habitat are all related components.
  - Clear objectives will clarify

Both Tables 1 and 2 need to be expanded and reorganized, potentially into additional tables with possible appendices.

#### Table 1:

- Additional detail required that incorporates the initial discussion at the beginning of the meeting around the key questions to be addressed in the plan.
- Consider adding flow charts to link components to monitoring.



## **Gahcho Kué Project**

### **Wildlife Monitoring Plan Working Group – Meeting #1**

**August 7, 2012**

- Effects pathways could be more specific.
- All pathways seem to lead to the same monitoring.
- Should add types of monitoring.

#### Table 2:

##### Monitoring Themes:

- Need to relate the themes back the key questions of why monitor, and what type of monitoring does this fit into?
- These themes are not final, and flexibility will be required to make them more clear
- Additional themes suggested: caribou health, behaviour, road impediments to movement, dust.
- The themes are very broad so virtually everything could be encompassed under them; this points again to the need for clearly-worded objectives.
- There can be multiple studies and objectives associated with each monitoring theme.
- Specific comments on Table 2:
  - Access: objectives and tasks listed do not capture all of the issues around the winter road.
  - Survival and reproduction: single objective to contribute to the Bathurst Caribou Management Plan is not adequate.
  - Survival and reproduction: population scale is probably not the appropriate scale to use. Could be refined to individual animal, group, and population scale.
  - Table should be ranked to organize the themes in terms of order of importance.

The next draft of the monitoring plan will have an emphasis on the categories of monitoring.

There was a discussion on thresholds and adaptive management.

De Beers discussed a need to move forward with the discussion and development of the plan by building on collective past experience, the EIS, and EIR process.

Lots of feedback was provided on the process of arriving at objectives and monitoring tasks, and De Beers will incorporate the feedback received to the extent helpful in clarifying and structuring the plan.

## **Gahcho Kué Project**

### **Wildlife Monitoring Plan Working Group – Meeting #1**

**August 7, 2012**

De Beers committed to provide a revised conceptual plan to the working group for further review and input.

#### **Remaining Sections:**

The remaining sections of the conceptual plan were not discussed as they will be updated based on the changes to the front end of the document.

#### **4. SURVEILLANCE MONITORING DOCUMENTS**

- Prior to the meeting De Beers distributed three documents related to the site surveillance monitoring plan: technical procedure protocol, surveillance data form, and an incident report template
- The general consensus among the group was that it is difficult to provide feedback on the protocol before the specific goals and objectives of the monitoring program are set. The details of the specific surveillance and monitoring actions are linked to the overall monitoring scheme.
- A few specific comments on the documents were provided:
  - Having standard wording/options etc. between all of the incident reports is helpful. Objectives and questions should line up across all of the forms.
  - Concern with the note that ‘environment staff can make changes’ – this gives the impression that changes can be made without appropriate consultation
  - There is opportunity to incorporate traditional knowledge in the documents. Traditional knowledge holders could provide additional types of questions that should be asked or behaviours that should be noted on the data sheets.
  - If objectives are organized by species it could help inform the relevant information required for data collection.

#### **5. ACTIONS AND NEXT STEPS**

<b>ACTION</b>	<b>RESPONSIBILITY</b>	<b>DATE</b>
1. Send out documents and links referenced during meeting	Ann Gunn	August 7
2. Draft meeting minutes	Kate Witherly	August 10

## Gahcho Kué Project

### Wildlife Monitoring Plan Working Group – Meeting #1

August 7, 2012

3. Update draft conceptual plan based on discussion	De Beers	August 17
4. Comments on updated draft plan	All parties	August 28
5. Next working group meeting	De Beers and all parties	<del>September 4</del> Revised to Sept 5
6. Submission of meeting note to MVEIRB	Stephen Lines and Jan Adamczewski to sign	Revised for all to sign at next meeting
7. Proposed workshop dates	De Beers	September 18-21

Additional notes for next meeting and workshop:

- For the next meeting, participants would appreciate being able to participate remotely with more ease.
- Should track key discussion and actions as the meeting progresses.
- De Beers offered that a facilitator could be used to facilitate the larger workshop group.

Meeting adjourned at 15:35.

Working Group meeting participant signatures:

Stephen Lines

Jan Adamczewski

Marc d'Entremont

Mike Tollis

Stephen Ellis

Todd Slack

John Nishi

Earl Evans

Anne Gunn

Boyan Tracz

NSMA delegate absent

# **Conceptual Caribou Monitoring Plan**

**Version 2**

**August 21, 2012**

**From:** [Lines, Stephen](#)  
**To:** [Todd Slack](#); [Mike Tollis](#); [John Nishi](#); [Kerri Garner](#); [Emilie Rose Bjornson](#); [mdentremont@lgl.com](#); [rcc.nwtmn@northwestel.net](#); [emevans@northwestel.net](#); [scellis@eastarm.com](#); [Boyan.Tracz@aandc-aadnc.gc.ca](#); [Jan Adamczewski](#); [Gavin More](#); [Nicole McCutchen](#); [gunnan@telus.net](#); [Chuck Hubert](#); [billenge@nsma.net](#); [hughmcswain@hotmail.com](#); [president.nwtmn@northwestel.net](#)  
**Cc:** [Kate Witherly](#)  
**Bcc:** [GahchoKue, Regulatory](#); [NWT Community Engagement](#)  
**Subject:** Working Group Meetin #2 and revised CCMP  
**Date:** August-21-12 11:57:00 AM  
**Attachments:** [120820-GK\\_Concept\\_CaribouMonitoringPlan-V2F.pdf](#)  
[120821-WMP\\_WG\\_Meeting\\_2\\_draft\\_details.pdf](#)

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Dear Working Group,

In follow-up to our first meeting on August 7, and based on the feedback received, I'm pleased to attach two working documents:

1. The revised Conceptual Caribou Monitoring Plan (CCMP); and
2. Draft meeting details for meeting #2 on Sept 5.

For the revised CCMP, we've worked hard to capture the vision expressed by participants for the background and clarity of the document. Once you've had time to consider all the changes and information, feel free to provide additional written feedback by email. We'll also have another opportunity to examine the CCMP at the workshop with additional participants.

For the meeting #2 details, please note that the meeting is scheduled for Sept 5 (instead of the 4<sup>th</sup>) so that people can enjoy the long weekend and not have to travel on the holiday Monday. Please let me know if you have any comments on the agenda.

I have booked the explorer hotel for the workshop on September 18. Please start thinking of who your additional participants will be and please notify them of the workshop date.

Regarding the meeting #1 notes, many thanks to Kate for her good work. For sign-off on the notes, I'll incorporate the comments received to date and we can approve them as a group at the next meeting Sept 5. I'll distribute the final version of the notes along with the carnivore and bird meeting materials for meeting #2 by Monday Aug 27.

If you have any questions please call me any time.

Thanks for your feedback and cooperation,

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**De Beers Canada Inc.  
Gahcho Kué Project**

**Conceptual Caribou Monitoring Plan**

**Version 2**

**August 2012**

**11-1365-0012**

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## **LIST OF APPENDICES**

- Appendix A Complete List of Caribou Effects Pathways Assessed in the EIS and Expected Types of Monitoring and Applicable Monitoring Programs
- Appendix B Linkage Diagrams for Proposed Effects from the Gahcho Kué Project Generated During Technical And Community Scoping Sessions (MVEIRB 2006)
- Appendix C Comments on Caribou Monitoring from the Diamond Mine Wildlife Monitoring Workshops, 2009 and 2010

# 1 INTRODUCTION

At the Technical Sessions in May 2012, De Beers Canada Ltd. (De Beers) circulated the Environmental Monitoring and Management Framework (EMMF; De Beers 2012a), which outlined the functional application of environmental monitoring within a collaborative adaptive management approach for the Gahcho Kué Project (Project). One of the programs that will provide input into the Adaptive Management Response Framework is the Wildlife Monitoring Program (WMP). The Conceptual Caribou Monitoring Plan (CCMP) is intended to provide further detail on the caribou monitoring component of the WMP. The CCMP also incorporates feedback from interested agencies and communities, some of which was provided to De Beers at a meeting on May 25, 2012 with representatives of the Government of the Northwest Territories, the Tlicho Government, the Yellowknives Dene First Nation, the Łutsel K'e Dene First Nation, and Aboriginal Affairs and Northern Development Canada (De Beers 2012b). This document is also intended to initiate further discussion regarding caribou monitoring options for the Project. Detailed study designs, sampling methods and procedures and data sheets for wildlife monitoring will be developed in later versions of the draft Wildlife Monitoring Program and submitted to the Panel.

Considered as a whole, the WMP is guided by the following principles:

- to provide a set of achievable goals and measurable objectives based on input from communities, government, and other people interested in the Project;
- to use the results from monitoring for adaptive management actions (e.g., additional mitigation practices, modify objectives or study designs, or special studies to better understand effects) when required (WLWB 2010);
- to incorporate local and Traditional Knowledge; and
- to design studies and data collection protocols that are consistent and standardized with other programs in the region so that data can be used by government to assess and manage cumulative effects.

The principles are linked to the adaptive management framework for monitoring caribou, and other wildlife. As discussed by the Wek'èezhii Land and Water Board (WLWB 2010), some management actions may not be identified initially, but likely determined in response to the outcome of monitoring programs. Therefore, adaptive management can be considered as the process of 'learning by doing'.

Importantly, the process of adaptive management is collaborative and requires input from communities, local and traditional knowledge, government, and other people interested in the Project (Figure 1). The framework is based on three questions, which are related to the goals of the monitoring program.

1. Why do we monitor?
2. What components should we monitor?
3. How do we monitor the selected components?

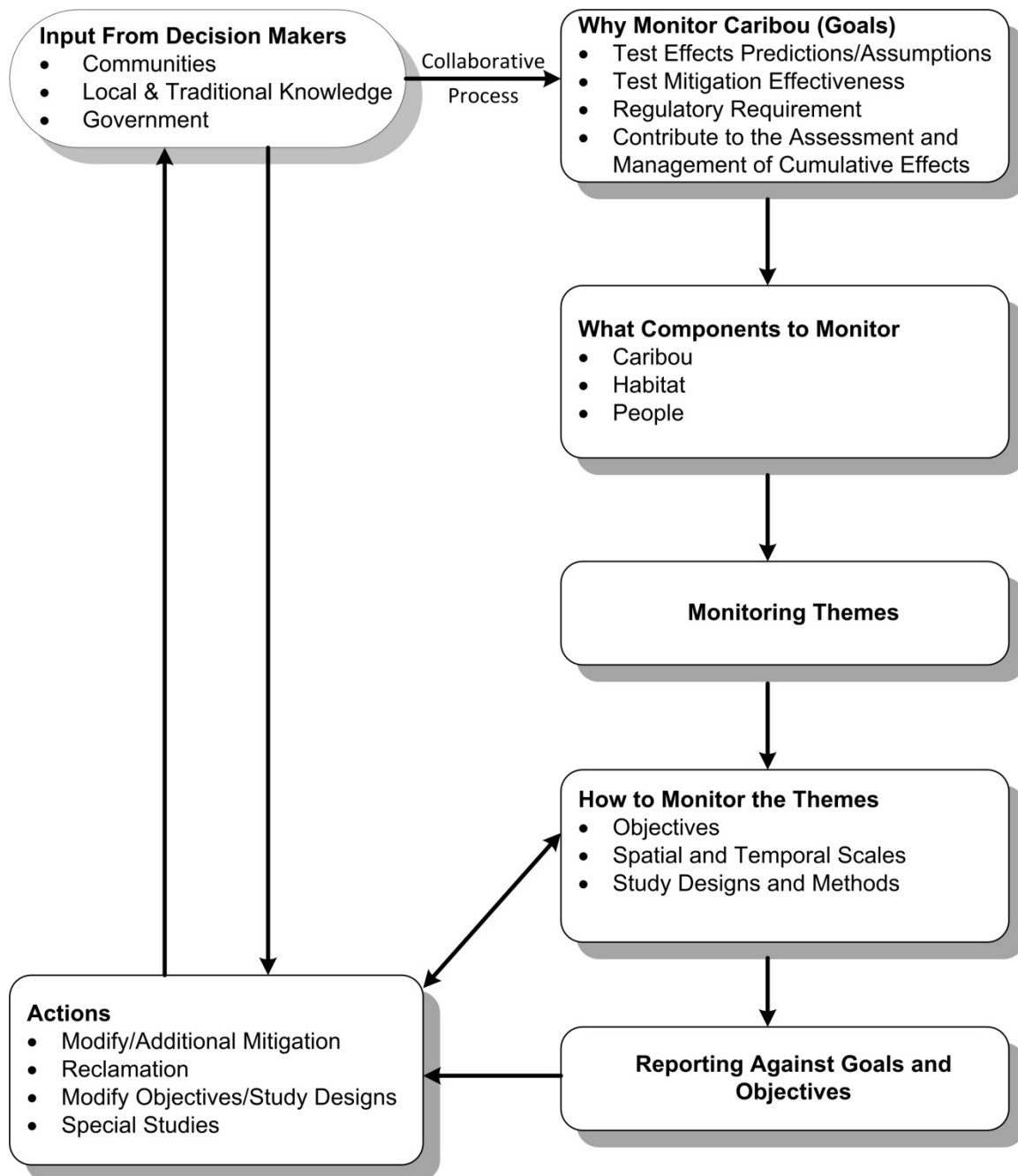
The overall reason why we should monitor caribou is for follow-up on the concerns that communities, government and regulators have with respect to how the Project will influence the ecosystem.

More specifically, the first goal (question) is related to the different types of monitoring that are typically completed at a project such as:

- testing effects predictions, which can be related to measuring the response of the environment or population (i.e., monitoring component) to project stressors, and/or testing the assumptions associated with the predictions;
- testing the effectiveness of environmental design features and mitigation policies, practices, and procedures; and
- meeting and fulfilling regulatory requirements.

The information collected through the different types of monitoring is used to provide recommendations regarding study designs and sampling methods (e.g., frequency and duration of sampling), and possible changes to components of the WMP (another element of adaptive management). The results from monitoring can be used to increase the confidence of impact predictions in future environmental assessments. Another type of monitoring is contributing to the assessment and management of cumulative effects by government. The WMP for the Project will use appropriate and standardized study designs and methods so that the data from the Project and existing diamond mines can be used to measure cumulative effects on caribou and other wildlife.

**Figure 1      Conceptual Adaptive Management Framework for Monitoring Caribou**



The second goal is to determine what components of the environment and population should be monitored. Monitoring components for caribou are based on the effects pathways evaluated in the Environmental Impact Statement (EIS) (Appendix A), which originate from the areas of public concern identified by communities and interveners during the EIR scoping sessions (MVEIRB 2006; Appendix B). Monitoring components also consider the issues and direction given in the EIS Terms of Reference (Gahcho Kué Panel 2007).

Monitoring components broadly include the caribou, habitat and people (Figure 1). To clarify the people aspect, people would be included as a component related to the effects pathway of hunter use of the winter access road. For each of the three broad components there could be one or more monitoring themes. After determining the monitoring themes that will be completed for each component and the type of monitoring each theme falls under (e.g., testing predictions or verifying mitigation), a set of clear and measurable objectives need to be defined. The objectives will inform the appropriate spatial and temporal scales of the monitoring, and the study designs and sampling methods (Figure 1).

The objectives must be achievable and linked to the different types of monitoring. The ability to achieve objectives is often related to the limitations in associated measurement endpoints or variables, which should have the following attributes:

- good knowledge of the variable to provide confidence in interpreting the results;
- accessibility and repeatability of collecting robust monitoring data (i.e., practical and cost-effective measurement endpoints);
- high signal to noise ratio (can separate mine-related changes in the variable relative to natural factors); and
- provide reliable information for adaptive management.

Results from the monitoring studies are used to provide feedback to mine operations to determine if the goals and objectives are being met (Figure 1). Depending on the results, actions may be considered such as modifying and/or implementing additional mitigation. Similarly, changes to the objectives and/or study methods may be required if it is determined that the measurement variable has a low sensitivity to detect mine-related changes or that the scale of the response does not match the objective. The results are shared with the communities, government, and other people interested in the Project through annual monitoring and comprehensive analyses reports, and meetings. As part of the adaptive management framework, any changes to the monitoring program would need to include input from the communities and government (Figure 1).

In accordance with the concept of adaptive management, it is important to point out that the set of monitoring themes and objectives proposed here are presented as options. Based on a principle of the WMP, the number of monitoring objectives should be focused to be manageable, and is related to the predicted level or risk of effects (magnitude, duration, and spatial extent of effects). The initial selection of monitoring components, themes, objectives and studies for caribou considered the following information:

- the Terms of Reference and community scoping sessions (Appendix B);
- analysis and assessment of effects pathways for the Project, and associated degree of uncertainty (De Beers 2010);
- level of confidence in proposed mitigation and environmental design features for the Project (De Beers 2010);
- wildlife monitoring and management programs for the Snap Lake and Jericho mines (De Beers 2004; Tahera 2005; De Beers 2007);
- results of long-term monitoring from the Ekati, Diavik, and Snap Lake mines (De Beers 2008; BHPB 2010; DDMI 2010);
- results from the Diamond Mine Monitoring Workshops in 2009 and 2010 (see Appendix C);
- standardized protocols for the NWT Cumulative Impact Monitoring Program (IMG-Golder Corp. 2008); and
- Data Collection Protocols for the Northwest Territories Cumulative Impact Monitoring Program (Kavik-AXYS Inc. 2008).

For example, the impacts to caribou predicted to be caused by mining was summarized in the Diamond Mine Wildlife Monitoring Workshop (Marshall 2009) as:

- direct habitat loss;
- indirect habitat loss due to sensory disturbances;
- alterations to caribou movement and avoidance of mine infrastructure (the zone of influence);
- behavioural disturbances;
- roads acting as barriers; and
- mine-related mortalities.

The information available in the above documents will also inform, from a lessons learned perspective, how to optimize the specific study designs.

## **2 SPATIAL AND TEMPORAL SCALES**

Spatial and temporal scales are highly correlated because processes that operate on large spatial scales typically occur at slower rates and have longer time lags (Wiens 1989; Chapin et al. 2004; Folke et al. 2004). Examples of large spatial scale processes that occur at slow rates include changes in the quality and quantity of lichens on caribou seasonal ranges, and the northern and southern extents of the boreal forest. Alternately, processes that occur at faster rates such as plant transpiration rates and caribou foraging behaviour typically occur within more localized areas. Thus, caribou populations and life history traits exhibit multiple patterns across a number of spatial (daily, seasonal and annual ranges) and temporal (daily, seasonal, annual and decadal cycles) scales.

Effects from development on caribou change over time and space. The EIS used a range of applicable spatial and temporal scales to assess the effects from the Project (and other developments) on caribou (De Beers 2010). Effects are related to the changes in both the magnitude of the stressor from the Project and the response by caribou, which can be related to a particular phase of the Project (construction, operation, and decommissioning) and caribou population cycle (increasing, decreasing, and stable).

For example, the effect from direct loss of habitat from the Project on caribou is likely strongest during construction and is mostly limited to the physical footprint, which influences individuals. Alternately, the spatial scale of indirect effects to caribou habitat extends further into the local area around the physical footprint (i.e., zone of influence) and can influence several groups of individuals causing a change in local distribution. However, the magnitude of the effect from sensory disturbance on caribou likely depends on the level of activity associated with different Project phases, the number of animals that encounter the zone of influence, and the phase of the population cycle.

Because caribou have large seasonal and annual ranges, providing data that can be used to analyze and manage cumulative effects should also be considered in the design of caribou monitoring studies. Subsequently, studies are proposed within the following spatial boundaries:

- the annual range of the Bathurst Caribou Herd by government (Figure 2);
- the regional study area (RSA), including the winter access road corridor (Figure 3); and
- the local study area (LSA) (Figure 3).

In the EIS, the wildlife LSA (about 200 square kilometres [km<sup>2</sup>]) was selected to assess the immediate direct and indirect effects of the Project on individual animals and wildlife habitat. The wildlife RSA of approximately 5,600 km<sup>2</sup> (75 km by 75 km) was initially selected to capture Project-related effects that may extend beyond the LSA and influence the abundance and distribution of populations. This area was intended to capture the maximum spatial extent (or zone of influence) of changes in caribou movement and behaviour from the Project, which includes the physical footprint and sensory disturbance. Changes in movement and behaviour can result in effects to the local abundance and distribution of caribou.

Temporal scales for monitoring consider the four phases of mine development and decommissioning. These include construction (two years), eleven years of operation, decommissioning (two years), and post-decommissioning.

Baseline studies predict that the most common seasons for caribou to encounter the Project are during the summer dispersal and fall migrations, extending from early July to late October. Subsequently, the summer and fall migration seasons will be the focal period for monitoring caribou.





## LEGEND

- Gahcho Kué Project
- Existing Mine
- Territorial Capital
- Populated Place
- Highway
- Existing Winter Road
- Tibbitt-to-Contwoyto Winter Road
- Winter Access Road
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Treeline
- Annual Range of the Bathurst Caribou Herd
- Regional Study Area

## NOTES

Base data source: The Atlas of Canada  
Bathurst caribou range derived from collar data provided by GNWT

## GAHCHO KUÉ PROJECT

### Annual Range of the Bathurst Caribou Herd

PROJECTION:  
Canadian Lambert Conf. Conic

DATUM:  
NAD83

Scale: 1:8,000,000  
80 40 0 80  
Kilometres



FILE No:  
B2011-Wild-011-GIS

DATE:  
July 4, 2012

JOB NO:  
11-1365-0001

REVISION NO:  
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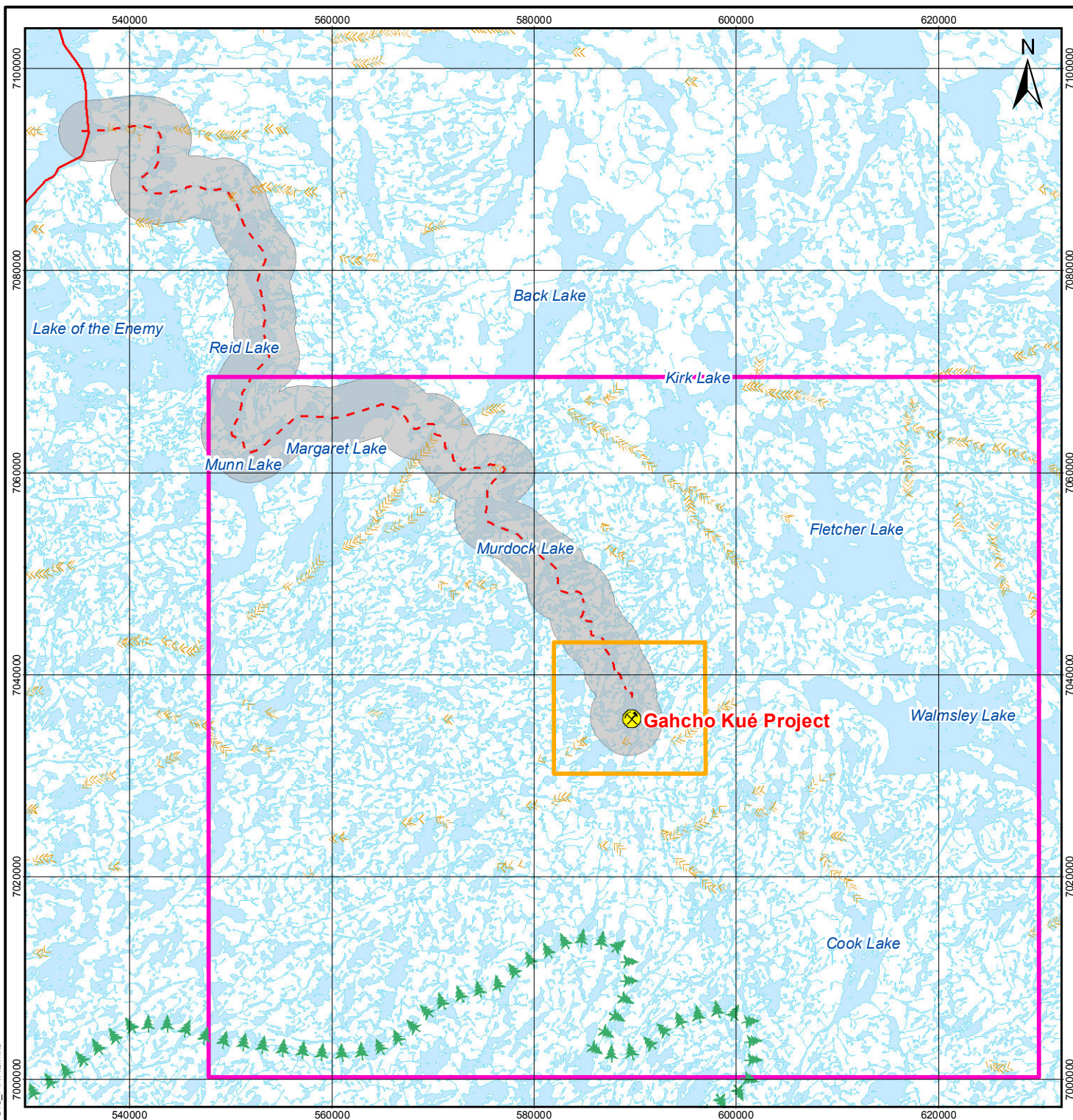
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**Figure 2**





### LEGEND

- |                                  |                                     |
|----------------------------------|-------------------------------------|
| Gahcho Kué Project               | Local Study Area                    |
| Tibbitt-to-Contwoyto Winter Road | Regional Study Area                 |
| Winter Access Road               | Winter Access Road Study Area (3Km) |
| Watercourse                      |                                     |
| Waterbody                        |                                     |
| Esker                            |                                     |
| Treeline                         |                                     |

### NOTES

Base data source: National Topographic Base Data (NTDB) 1:250,000

## GAHCHO KUÉ PROJECT

### Local and Regional Study Areas for Wildlife

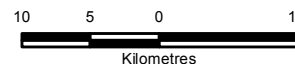
PROJECTION:

UTM Zone 12

DATUM:

NAD83

Scale: 1:550,000



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**Figure 3**

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### **3 EFFECTS PATHWAYS AND MONITORING THEMES**

During the technical workshop meeting among De Beers, agencies, and communities (De Beers 2012b), De Beers was advised that the monitoring program should consider the effects pathways investigated in the EIS, and the effects predictions made. Monitoring should be designed answer the three key questions – why, what, and how to monitor (Section 1, Figure 1).

All of the effects pathways assessed in the EIS are presented in Table A-1 (Appendix A). The effects pathways were developed from the Project technical and community scoping sessions in the spring of 2006 (i.e., Report of Environmental Assessment [MVEIRB 2006]). Thus, the pathways integrate the concerns of communities, government, and other people interested in the Project. Pathways identified during these scoping sessions are provided in Appendix B (Figures B-1 to B-5). Pathways were also developed from the Terms of Reference (Gahcho Kué Panel 2007) and knowledge from operating diamond mines (Section 1).

Table A-1 (Appendix A) also describes the pathway assessment, assumptions, effects predictions and magnitude of effect from the 2010 EIS (De Beers 2010). The types of monitoring and applicable monitoring programs associated with each pathway are provided. Table 1 provides a compilation of all the effects pathways in Table A-1 into seven general effects pathways. A summary of the monitoring components, an overall effects prediction for each general effects pathway, and the associated types of monitoring, and monitoring themes is also provided.

For some pathways, supporting information will be collected by other monitoring programs within the EMMF. Linkages to these other monitoring programs are also provided in Table 1. For example, the effects to wildlife from habitat loss and alteration will be monitored through the Wildlife Monitoring Program, with supporting information provided by the Vegetation and Soils Monitoring Program. Data gathered through these other monitoring programs will help to test key effects predictions, assumptions, and mitigation for each pathway (Appendix A, Table A-1).



**Table 1 Summary of Monitoring Components, Effects Pathways, Effects Predictions, Types of Monitoring and Monitoring Themes**

Monitoring Components	General Pathways	Effects Predictions	Types of Monitoring	Monitoring Themes	Applicable Monitoring Programs
Habitat	Direct and indirect habitat loss	Negligible to low	Testing effects	Habitat loss and alteration Change in distribution Change in behaviour	Wildlife Monitoring Program Vegetation and Soil Monitoring Program
People	Access	Negligible to low	Testing effects Testing mitigation effectiveness	Access Change in survival and reproduction	Wildlife Monitoring Program
Habitat Caribou	Sensory disturbance	Negligible to low	Testing effects	Habitat loss and alteration Change in distribution Change in behaviour Change in survival and reproduction	Wildlife Monitoring Program
Habitat Caribou	Dust deposition	Nil to low	Testing effects	Habitat loss and alteration Change in distribution Change in behaviour Caribou health	Wildlife Monitoring Program Vegetation and Soil Monitoring Program Air Quality Monitoring Program Surveillance Network Program Aquatic Effects Monitoring Program
Habitat Caribou	Dewatering and changes to downstream flows	Nil to negligible	Testing effects Regulatory requirement <sup>(a)</sup>	Habitat loss and alteration Change in distribution Change in behaviour Direct mine-related mortality	Wildlife Monitoring Program Vegetation and Soil Monitoring Program Surveillance Network Program
Caribou	Physical and chemical hazards	Nil to negligible	Testing effects Testing mitigation effectiveness Regulatory requirement <sup>(a)</sup>	Direct mine-related mortality Caribou health	Wildlife Monitoring Program Vegetation and Soil Monitoring Program Wildlife Mitigation and Management Plan Waste Management Plan Emergency Response Plan Surveillance Network Program Aquatic Effects Monitoring Program
Habitat	Seepage and leaching from Fine PKC Facility and Coarse PK and mine rock piles	Nil	Testing effects Regulatory requirement <sup>(a)</sup>	Habitat loss and alteration Change in distribution Change in behaviour	Wildlife Monitoring Program Surveillance Network Program Aquatic Effects Monitoring Program Decommissioning Monitoring

<sup>(a)</sup> Potential permitting requirement (e.g., Aquatic Effects Monitoring Program).

PK = processed kimberlite; PKC = processed kimberlite containment.

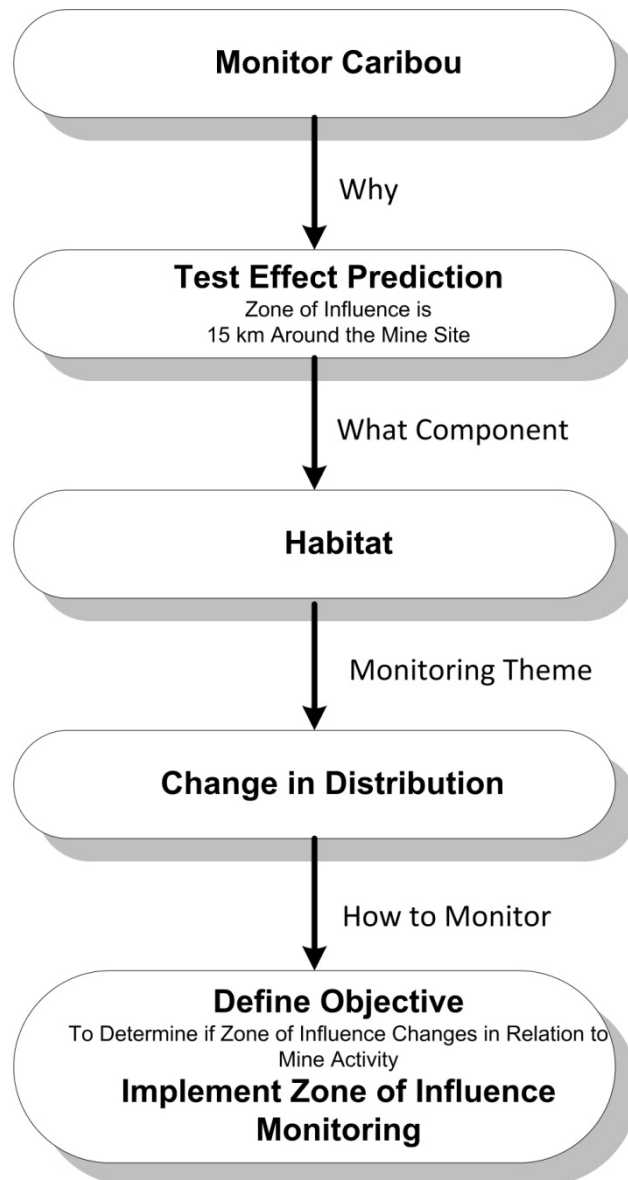
Project pathways assessed as no linkage and secondary were predicted to have no detectable effects and negligible influences on monitoring components, respectively, and would not combine with similar pathways from previous, current, and reasonably foreseeable developments to cause significant effects. The changes from most secondary pathways occur within the physical Project footprint. However, the combination of these pathways (additive, synergistic or multiplicative) is not producing incremental or cumulative effects beyond the local scale that are not already captured by the primary pathways. In other words, the cumulative interaction of secondary pathways from the Project and other developments is captured in the more detailed analysis and assessment of the primary pathways.

Monitoring components, and associated general effects pathways, were further described by the following monitoring themes (Table 1):

- habitat loss and alteration
- access
- direct mine-related mortality
- caribou health;
- change in distribution;
- change in behaviour; and
- change in survival and reproduction.

Monitoring components can be represented by several monitoring themes that capture a number of effects pathways. These themes will be used to design specific monitoring objectives and studies associated with each monitoring component (i.e., caribou population, habitat, and people [Section 1]). Using the example of a change in caribou distribution from the Project (i.e., zone of influence), Figure 4 shows the connection between the type of monitoring, the monitoring component and theme, and the monitoring objectives and study. There may be one or more objectives (and studies) related to each monitoring theme and component.

**Figure 4**      **Example of the Process for Developing Specific Monitoring Objectives and Study Designs and Methods**



## **4 MONITORING THEMES, OBJECTIVES AND STUDIES**

As discussed in Section 1 and shown in Figure 2, monitoring themes are used to determine the objectives of monitoring. A set of clear and measurable objectives need to be defined as the objectives will inform the appropriate spatial and temporal scales of the monitoring, and the study designs and sampling methods. The monitoring themes from Table 1 are presented again in Table 2 with proposed objectives and studies, and further details on each theme are provided in the following sections.

**Table 2 Monitoring Themes and Associated Objectives, Spatial Scale, Temporal Scale and Studies**

Monitoring Theme	Objectives	Spatial Scale	Temporal Scale	Studies
Direct mine-related mortality	To identify instances where the Project presents direct physical hazards to caribou	Project footprint Individuals	Construction Operation Decommissioning	Wildlife Surveillance Monitoring Waste Management Monitoring
Caribou health	To identify and mitigate risks to the safety and health of caribou	Project footprint Individuals	Construction Operation Decommissioning	Soil and Vegetation Monitoring Wildlife Surveillance Monitoring Air Quality and Dust Monitoring
Habitat loss and alteration	To confirm that the amount of total direct terrestrial landscape alteration does not exceed predictions To confirm that changes in vegetation surrounding the Project does not exceed predictions	Local Study Area Individuals	Construction Operation	Direct Habitat Loss Monitoring Vegetation and Soil Monitoring Air Quality and Dust Monitoring
Access	To determine the amount and type of public use of the Winter Access Road	Winter Access Road corridor Population	Construction Operation Decommissioning	Winter Access Road Use Monitoring
Change in distribution	To determine whether the zone of influence changes in relation to mine activity (Handley 2010)	Regional Study Area Population	Construction Operation Decommissioning	Caribou ZOI Monitoring Vegetation and Soil Monitoring Air Quality and Dust Monitoring
Change in behaviour	To determine if caribou behaviour changes with distance from the mine (Handley 2010)	Regional Study Area Population	Construction Operation Decommissioning	Caribou Activity Budget Monitoring Vegetation and Soil Monitoring Air Quality and Dust Monitoring
Change in survival and reproduction	To contribute to the Bathurst Caribou Management Plan <sup>(a)</sup>	Annual Range Population	Construction Operation	Contributions to the Bathurst Caribou Management Plan

<sup>(a)</sup> To be determined through discussions with ENR.

ZOI = zone of influence.

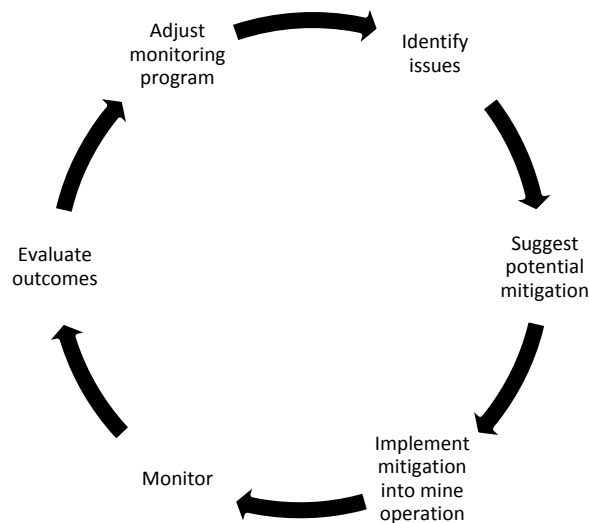


## 4.1 DIRECT MINE-RELATED MORTALITY

The incidence of direct mine-related mortality at diamond mines has been extremely low. Marshall (2009) reports that there only two mine-related caribou mortalities have occurred since 1996. To clarify, there have been instances where caribou have died near mines, but only rarely has the cause of death been attributed to mining activity. At the Diamond Mine Wildlife Monitoring Workshop (Marshall 2009), participants did not provide any substantive comments with respect to mine-related caribou mortalities, or suggestions for improvements. Mitigation appears to have been successful at avoiding impacts.

Mitigation refers to policies and procedures taken to control, reduce eliminate or avoid or adverse environmental impacts (WLWB 2010). Mitigation may be the form of actions (such as deterring wildlife from hazardous areas), prevention (such as continually monitoring and managing food waste), or environmental design features that are incorporated into the Project (such as skirting buildings). Mitigation is an essential component of the adaptive management cycle (Figure 5). In the context of wildlife monitoring, the goals of mitigation include keeping people safe, keeping wildlife safe, and limiting Project-related effects to wildlife and wildlife habitat.

**Figure 5**      **Diagram of the Adaptive Management Cycle (adapted from WLWB 2010)**



Policies and procedures to mitigate effects to wildlife are described in the Wildlife Effects Mitigation and Management Plan (2010 EIS Appendix 7.1 [De Beers 2010]). The proposed mitigation followed a review of best practices from other similar operating mines in the region, including Snap Lake, Ekati and Diavik (De

Beers 2007; BHP Billiton 2010; DDMI 2010). Many of the policies and procedures are of general applicability to all wildlife such as:

- limiting the area of the mine footprint;
- progressively reclaim disturbed areas where practical;
- reduce noise, dust and odours from the mine;
- containment of toxic chemicals; and
- deterrent actions to reduce harm to wildlife at the site.

Mitigation is proposed that is specific to caribou. It is anticipated that caribou will interact with the Project. In other words, some caribou may be present within close proximity to the mine during the summer and fall seasons. The following policies, practices, and procedures are specifically related to caribou protection.

- All incidents involving interactions, deterrents, or injury of caribou will be documented and evaluated.
- All sightings of caribou will be reported to environmental staff on-site.
- Drivers will be notified when caribou are present at site.
- If caribou are crossing Project roads, traffic will stop and wait for them to cross (i.e., caribou have the right-of-way).
- Caribou will only be herded away from roads or the airstrip in specific circumstances, such as when there are incoming flights, safety concerns or emergencies.
- Blasting will be temporarily suspended if caribou are within the exclusion area for workers around the blast site.

Actions may be required to move caribou away from areas where they may be at risk. The appropriate level of action for a situation is one that removes the risk with the least disturbance to the caribou. The decision to use deterrent actions for caribou should consider the number of animals, and the potential for risk to caribou and human safety.

Monitoring will be implemented to identify hazards to caribou, and prevent mine-related caribou mortalities at the Project. Wildlife Surveillance and Waste Management monitoring are proposed to evaluate the effectiveness of mitigation throughout all phases of the Project (Table 2).

Wildlife will continue to be present in the vicinity of the Project during construction, operation, and decommissioning phases. Some wildlife species are

attracted to human activity. Thus, interactions between the Project and wildlife are anticipated. Incidents are defined here as any wildlife interaction that requires a response by Project personnel. Species that are often attracted to industrial developments in the NWT include gulls, ravens, fox, wolverine, and bears.

Wildlife surveillance monitoring is proposed to identify the species, number, and location of wildlife incidents, and identify risks to wildlife. Surveillance monitoring also includes systematically recording the presence of all wildlife (i.e., common and uncommon species, and species at risk) within and around the Project footprint. The program is intended to provide direct feedback on Project mitigation to site operations, particularly regarding the effectiveness of waste management and wildlife management practices.

The effectiveness of mitigation may be judged based on concordance of predicted and observed responses (WLWB 2010). At any time, if the mitigation appears to be ineffective, the Adaptive Management Response Framework will be initiated.

Monitoring to track environmental response following mitigation will already be in place as part of routine monitoring programs. As such, the monitoring that is in place to track the reduced biological effects following the implementation of new mitigation may be recorded through the WMP or other environmental monitoring programs (WLWB 2010). However, it is rarely possible to directly test the effectiveness of mitigation, as the data are affected by both the impacts from the development and the mitigation. Ultimately, the effectiveness of mitigation will be considered by the Adaptive Management Advisory Committee.

Surveillance monitoring of wildlife presence and movements within and around the Project will help to keep environment staff apprised of wildlife activity and the potential for problems, and measure the effectiveness of mitigation. Regular inspections for wildlife and fresh wildlife sign around the Project, and regular communication with all staff will provide early warning of wildlife presence on-site before issues arise.

Surveillance monitoring provides one of the few opportunities to immediately implement mitigation, and directly observe the effectiveness of that mitigation. To use a common example from other mines; surveillance monitoring may detect that a wolverine has gained access and is taking shelter beneath a building. The common mitigation is to block the access through improved skirting, and follow up surveillance monitoring will confirm whether the mitigation was successful, or if further action is required.

This survey will consist of an inspection of areas within the Project site, scanning observations of wildlife, and records of recent wildlife sign (e.g., tracks, scat). A survey protocol with a targeted surveillance route and locations will be developed. The survey will be completed on foot and by truck, and environment staff will record the area surveyed, and the nature and location of all observations.

Project staff and contractors will be required to report all observations of large mammals to environment staff, both at the Project site, and along the Winter Access Road. Environment staff will respond to, investigate, and record the presence and incidents involving deterrent actions, injury, or mortality of animals, and complete follow-up procedures or management actions as necessary. Wildlife sighting logs will be maintained at various areas around the Project site for staff to record observations of wildlife. If wildlife injury or mortality occurs, environment staff will conduct an investigation to determine the cause, collect photographs, and store the carcass until further direction from the department of Environment and Natural Resources (ENR) and complete the follow-up procedures or management actions as necessary. All wildlife sightings, deterrent actions, injuries, and mortalities will be reported in the annual Wildlife Monitoring Report.

Surveys for wildlife presence within and around the Project will occur systematically at least once per week. Investigation and reporting of incidents will be completed as they occur. Monitoring will be continuous throughout the construction, operation, and decommissioning phases of the Project. Environment staff may at any time suggest changes to environmental design features, mitigation and management practices and policies, or the need for additional training for staff, as a result of their investigations.

## **4.2 CARIBOU HEALTH**

The theme caribou health includes pathways related to physical and chemical hazards from the Project (e.g., exposure to toxic substances), and some effects from changes in soil and vegetation chemistry due to dust deposition. The monitoring objective proposed in Table 2 is intended to guide the identification of such risks, so that they can be promptly managed. Monitoring potential risks to caribou health will be completed through studies designed to measure changes in water, soil, and vegetation chemistry. These studies would include the Vegetation and Soil Monitoring Program, Surveillance Network Program and Aquatic Effects Monitoring Program (Tables 1 and 2). The ecological risk assessment for the Project demonstrates that health risks to caribou spending time around the mine is negligible. The concern for caribou health is then cumulative in nature. Therefore, the data from these programs could be provided

to government and used at their discretion to complete a screening level ecological risk assessment to determine cumulative potential health risks to caribou. Monitoring would be carried out through all phases of the Project.

### **4.3 HABITAT LOSS AND ALTERATION**

The loss and alteration of caribou habitat will occur from several components of the Project, infrastructure and dust deposition. Construction of the Project will lead to the loss and alteration of vegetation and landscape features that currently provide wildlife habitat, such as tundra vegetation, shallow ponds, and riparian zones. These local changes in habitat can influence the local abundance and distribution of caribou, and other wildlife.

The monitoring objectives include the loss and alteration of habitats on the landscape (including vegetated and non-vegetated areas) (Table 2). Although caribou often use frozen lakes in winter and during the spring migration, monitoring will focus on habitat use during the summer and fall seasons when caribou are travelling and foraging in the area.

Habitat loss will be calculated through monitoring the size of the Project footprint, while habitat alteration will be monitored through the Vegetation and Soil Monitoring Program (which includes monitoring dust deposition). Most habitat loss occurs during the construction phase with the development of the Project infrastructure. Habitat loss during operations will be less and at a slower rate, mainly associated with the expansion of mine rock piles. Monitoring will thus be initiated during construction, and continue into operations. This monitoring theme is also relevant to all wildlife.

Landscape alteration will predominantly occur in phases throughout construction and operation. Following initial construction of the Project, there will be several distinct phases of operation as each ore body is mined, the rock piles and processed kimberlite containment facilities expand, and areas of Kennady Lake are hydrologically isolated. It will be necessary to maintain a record of the actual sequence of operations to document habitat loss and alteration.

As-built drawings of the Project footprint and facilities will be prepared, and compared against existing vegetation maps to estimate vegetation classes disturbed as a measure of direct habitat loss for wildlife. The comparison will be quantitative. Habitat alteration, resulting from factors such as dust deposition on vegetation, will be monitored through the Vegetation and Soil Monitoring Program (which include monitoring dust deposition).

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## **4.4 ACCESS**

The theme access is intended to address concerns regarding a possible increase in caribou harvesting as a result of the Winter Access Road spur to the Project from the Tibbitt-to-Contwoyto Winter Road junction at MacKay Lake. The objective of the proposed monitoring is to determine the amount and type of public use of the Winter Access Road (Table 2). Although this road is not a new feature to the landscape, it will come into regular and more intensive use with the construction and operation of the Project. Monitoring of access and evidence of wildlife harvest will include the entire length of the 120 km road. Monitoring will be undertaken in each year that the winter road is open, from construction through to decommissioning, and is largely specific to caribou harvest.

A suite of options are being considered to monitor road use by hunters and other non-Project vehicles.

- Regular and frequent inspections of the road undertaken by De Beers Protective Services personnel. Inspections would be completed by driving the length of the winter access road between the Project site and MacKay Lake (i.e., km 271 of the Tibbitt-to-Contwoyto Winter Road). All observations of non-Project vehicles or evidence of wildlife harvest would be recorded and provided in annual reports. This information will be provided immediately to ENR if a concern is identified. A standardized reporting form would be developed in consultation with ENR.
- Station an ENR or community monitor at a rest stop along the road. Check in by non-Project road users would be voluntary. Observations of non-Project vehicles would be recorded and provided in annual reports, and immediately to ENR in the event a concern is noted. A standardized reporting form would be developed in consultation with ENR.
- ENR may pursue the establishment of another monitoring location along the Tibbitt-to-Contwoyto Winter Road.

## **4.5 CHANGE IN DISTRIBUTION**

Changes to caribou distribution from alterations in movement are anticipated to occur as caribou respond to habitat loss and sensory disturbance. The monitoring objective is to determine if the zone of influence (ZOI) changes in relation to mine activity (i.e., there is a change in the spatial extent of the ZOI through time) (Table 2). The objective is based on recommendations during the Diamond Mine Monitoring Technical Workshop in September 2010 (Handley

2010). It was assumed in the EIS for habitat modelling purposes that the ZOI at the Project will be similar to that observed at other mines in the region (see Boulanger et al. 2012; Golder 2011). Because the monitoring objective includes estimating the zone of influence in relation to mine activity, monitoring should be undertaken during the construction, operation, and decommissioning of the Project, and is largely specific to caribou habitat quantity.

In the EIS, it was assumed that the distribution of caribou would be negatively influenced within the ZOI of the Project. This ZOI was attributed to a decrease in habitat use from sensory disturbance associated with mining activity. The ZOI of approximately 15 km around the Project perimeter was assumed based on studies at the Diavik-Ekati diamond mine complex (Boulanger et al. 2012; Golder 2011). Under the current level of development, these local changes in the distribution of animals around the Project and other previous, existing and reasonably foreseeable developments were predicted to have no significant effect on the abundance and movement of caribou across their seasonal ranges.

Research on the ZOI around the Project is not likely to provide information helpful to adaptively manage mining operations. However, monitoring caribou distribution around the Project could increase confidence in future environmental assessments and for the on-going assessment and management of cumulative effects by government under different development scenarios. In other words, estimating a ZOI for the Project provides habitat information at the population level if government develops the necessary modelling tools to use the information. As suggested during the Diamond Mine Wildlife Monitoring Workshop (Marshall 2009; Appendix C), the aerial surveys may not necessarily be undertaken annually if no new information is being gathered (i.e., caribou are infrequently in the study area).

As the predicted ZOI is considerably smaller than the RSA used for baseline studies, a new study area will be established so that efforts can be better allocated across space and time. The monitoring study area will consider both the geographic extent of indirect effects from the Project, and the trade-off of actual sampling coverage versus study area size. In other words, a larger study area may result in proportionately less sampling coverage, which could generate ZOI estimates with poor accuracy and precision.

While monitoring caribou distribution at existing diamond mines has included aerial transect surveys and use of collared caribou data, questions continue to be raised about the efficacy of these methods and the potential disturbance to caribou from aerial surveys in particular. The result is a need to carefully consider study methods measured against the added value of the data collected.

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## **4.6 CHANGE IN BEHAVIOUR**

Studies at Ekati and Diavik have observed that in some cases there are minor behavioural changes in caribou near the mines (BHP Billiton 2010; Golder 2011). These changes were detected with broadly defined behaviours by grouping observations into feeding/resting and moving categories, and for caribou groups divided into those with or without calves. However, ENR has cautioned that it is difficult to separate the effects associated with the mines from natural factors that affect caribou such as weather and insect harassment (Marshall 2009; Appendix C). There have also been consistent difficulties in collecting sufficient data for analysis, as behavioural studies can only be undertaken when there are sufficient caribou present in the study area, and when staff are available to respond immediately (Marshall 2009; BHP Billiton 2011). Due to the variability introduced by natural factors, a large amount of data is required before conclusions can be made. In many years, there have been insufficient numbers of caribou in the study area (or for too short a duration) for sufficient data to be collected. The current population size further hampers the likelihood of collecting sufficient data, as there are fewer caribou on the landscape.

The objective for monitoring changes in caribou behaviour is based on recommendations from the Diamond Mine Wildlife Monitoring Workshop (Marshall 2009) (Table 2). The objective is largely related to testing the assumption of the energetic model used in the EIS. For example, it could be confirmed that 55% of caribou groups show a behavioural response to sensory disturbances and that when disturbed, groups run away from the source for 15 minutes. The data collected would also be provided to ENR to further develop caribou behaviour and energetic models. As noted for caribou distributions, monitoring caribou behaviour around the Project could increase confidence in future environmental assessments and for the assessment and management of cumulative effects by government under different development scenarios.

The study design and sampling methods would be consistent with data collections procedures used at Ekati and Diavik, and with input from the working group, communities, and local and traditional knowledge (Figure 1). For example, at the working group meeting (August 7, 2012), it was stated that Elders may have important knowledge on the differences in behavioural categories for solitary males versus females with calves.

Based on the results of monitoring at other mines in the region, these effects are anticipated to operate within the scale of the RSA (Table 2). Based on studies undertaken at existing mines, effects to behaviour are difficult to detect, vary from year to year, and appear to be largely driven by factors other than the mine (Marshall 2009). Thus, monitoring would be proposed during all phases of the



Project, but only in years when caribou numbers are sufficient to provide adequate data for analyses.

## **4.7 CHANGE IN SURVIVAL AND REPRODUCTION**

Measurable changes to caribou survival and reproduction are not predicted to result from the Project. The pathways investigated represent changes that operate at a population level result from the cumulative effects of numerous developments and natural factors rather than from the Project alone. Caribou survival and reproduction are influenced by natural factors throughout their range, such as insect harassment and range conditions affected by climate and herd density, making it difficult to separate Project-related effects from natural factors. For example, a population viability analysis was completed in the EIS and expanded in an addendum. The results of the analyses showed that disturbance to caribou habitat and energetics from the Project had a statistically non-measurable effect on the population. Also, increases in insect harassment and harvest rate had a much stronger effect on final abundance and risk curve projections, relative to the incremental and cumulative effects from the Project and other developments. Therefore, monitoring effects to caribou survival and reproduction are most meaningful at the population scale and requires collaboration between government, communities, and industry.

Concerns have been raised regarding possible cumulative effects of harvesting, development, and climate change to caribou (ENR 2011). De Beers recognizes that they are one of the many land users on the Bathurst annual range. De Beers may contribute to population level monitoring of the Bathurst caribou herd, the strategy of which is outlined in the Barren-ground Caribou Management Strategy (ENR 2011). Although the details of this contribution have not yet been defined, and may change from year to year, discussions between ENR and De Beers continue. Possible monitoring activities and contributions by De Beers towards the Caribou Management Strategy include:

- Support for collaborative studies on wolves in the Bathurst caribou range to investigate wolf abundance and predation, which is an area of importance for communities during the decline of the Bathurst caribou.
- Support of GPS collar deployment, which could also provide information to assess habitat use in the RSA.
- Support of meetings, workshops, or other studies indicated in the Caribou Management Strategy.
- Monitoring of factors that are linked to caribou energetics such as snow melt, and weather.

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## **5 REPORTING AND ADAPTIVE MANAGEMENT**

The CCMP, and the eventual WMP, will be components of the larger framework of the Adaptive Management Response Framework, a concept described in the Environmental Monitoring and Management Framework (De Beers 2012a). The exact definition of adaptive management varies among monitoring components, but typically adheres to having four themes as follows (WLWB 2010):

1. learning in order to reduce management uncertainties;
2. using what is learned to change policy and practice;
3. focusing on improving management; and
4. doing the above in a formal, structured and systematic way.

The Adaptive Management Response Framework will be implemented collaboratively by an Adaptive Management Advisory Committee (AMAC) coordinated by De Beers. The committee will be responsible for reviewing monitoring reports and providing input on areas of study and management actions. The draft Terms of Reference for the AMAC were submitted to the public registry on June 29, 2012.

Each year, a monitoring report will be completed by De Beers for review by the AMAC. The annual report will contain a summary of methods, current data collected, results and a record of wildlife observations, interactions, deterrent actions, and incidents (including mortalities). The report will also suggest changes for future years, if required. The report will describe contributions to the Bathurst Caribou Management Plan, and ENR would be asked to report on outcomes of the Bathurst Caribou Management Plan for a given year. Where Traditional Knowledge studies are undertaken, communities would be asked to share as well.

Due to the large degree of natural variation inherent in ecosystems, it is often difficult to detect indirect effects until several years of data have been collected. Therefore, a comprehensive analysis and discussion of all data from the monitoring program could be completed every 5 years. The comprehensive report will provide a full analysis of data collected, an assessment of effects that are detected, an assessment of the effectiveness of mitigation, and recommendations for future monitoring.

If changes to caribou (or other wildlife) are determined to be greater than the predictions in the EIS, or if monitoring of the Project operation identifies potential hazards to wildlife, then the options available to De Beers include the following:

- modify monitoring effort to verify confidence in observed trend;
- implement new monitoring programs or special studies (i.e., studies that occur outside the scope of the WMP and have defined (shorter) timeline) to further understand the effects; or
- implement additional mitigation to reduce the effects.

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## **7 GLOSSARY AND ABBREVIATIONS**

### **7.1 ACRONYMS AND ABBREVIATIONS**

AMAC	Adaptive Management Advisory Committee
CCMP	Conceptual Caribou Monitoring Plan
EIS	Environmental Impact Statement
EMMF	Environmental Monitoring and Management Framework
LSA	Local study area
RSA	Regional study area
WMP	Wildlife Monitoring Program
ZOI	Zone of Influence

### **7.2 GLOSSARY**

Adaptive Management	<p>The exact definition of adaptive management varies among monitoring components, but typically adheres to having four themes as follows (WLWB 2010):</p> <ol style="list-style-type: none"><li>1. learning in order to reduce management uncertainties;</li><li>2. using what is learned to change policy and practice;</li><li>3. focusing on improving management; and</li><li>4. doing the above in a formal, structured and systematic way.</li></ol>
Effects Pathways	<p>Interactions between the Project and the environment. For example, the possible effects of dust on vegetation is considered to be a pathway.</p>
Effects Predictions	<p>Predictions of the degree of environmental effect that may result from each effects pathway. The degree of the effect considers magnitude (strength), duration (length of time) and geographic extent (distance or area). Derived from the analysis and assessment in the EIS.</p>
General Pathways	<p>A term used to describe the broad categories of similar effects pathways</p>

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Monitoring Components	<p>A term used to broadly describe the aspect of the environment and population that may be impacted and monitored. Monitoring components used here included:</p> <p>Habitat</p> <p>Caribou</p> <p>People</p>
Monitoring Themes	<p>A term used to describe the broad categories of possible caribou monitoring. The monitoring themes used here included:</p> <ul style="list-style-type: none"><li>• habitat loss and alteration</li><li>• access</li><li>• direct mine-related mortality</li><li>• caribou health;</li><li>• change in distribution;</li><li>• change in behaviour; and</li><li>• change in survival and reproduction</li></ul>
Negligible	<p>A change to the environment that is difficult to notice or measure when compared to natural changes</p>
Terms of Reference	<p>The document issued by the Mackenzie Valley Review Board Gahcho Kué Panel, which outlined the issues that De Beers must address in the environmental assessment.</p>
ZOI	<p>Zone of Influence. Defined as the area surrounding a development that changes the behaviour, movement and distribution of wildlife.</p>



## **APPENDIX A**

### **COMPLETE LIST OF CARIBOU EFFECTS PATHWAYS ASSESSED IN THE EIS AND EXPECTED TYPES OF MONITORING AND APPLICABLE MONITORING PROGRAMS**

**Table A-1 Monitoring Components, Effects Pathways, Effects Assumptions and Predictions, and Types of Monitoring**

Monitoring Components	Effects Pathways	General Pathway	Pathway Assessment	Assumptions	Effect Prediction Summary	Magnitude of the Incremental Effect	Type of Monitoring	Applicable Monitoring Programs
Habitat	Direct loss and fragmentation of wildlife habitat from the physical footprint of the Project may alter caribou movement and behaviour	Direct and indirect habitat loss	Primary	Modelling of direct effects to caribou habitat accurately reflected the level of disturbance to herd range Best practices will limit effects to vegetation	Movement and behaviour will be affected	Negligible to low	Testing effects	Wildlife Monitoring Program Vegetation and Soil Monitoring Program
Habitat	Road footprint decreases habitat quantity and may cause fragmentation, which can alter caribou movement and behaviour	Direct and indirect habitat loss	Primary	Modelling of direct effects to caribou habitat accurately reflected the level of disturbance to herd range Best practices will limit effects to vegetation	Movement and behaviour will be affected	Negligible to low	Testing effects	None
Habitat	Road footprint may cause changes to the amount of different quality habitats (e.g., degradation to vegetation), and alter caribou movement and behaviour	Direct and indirect habitat loss	Secondary	Best practices will limit effects to vegetation	Movement and behaviour will be affected	Negligible	Testing effects	None
People	Increased access for traditional and non-traditional harvesting may alter caribou movement and behaviour, which can affect survival and reproduction	Access	Primary	Use of the Winter Access Road for harvesting will be low, as observed at Snap Lake	Limited public use of winter access road	Negligible to low	Testing effects Testing mitigation effectiveness	Wildlife Monitoring Program
Habitat Caribou	Sensory disturbance (e.g., presence of buildings, people, lights, smells, and noise) changes the amount of different quality habitats, and alters movement and behaviour, which can influence survival and reproduction	Sensory disturbance	Primary	Energetics modelling incorporated numerous conservative assumptions, and accurately reflects impacts to caribou	Movement and behaviour will be affected	Negligible to low	Testing effects	Wildlife Monitoring Program

**Table A-1 Monitoring Components, Effects Pathways, Effects Assumptions and Predictions, and Types of Monitoring (continued)**

Monitoring Components	Effects Pathways	General Pathway	Pathway Assessment	Assumptions	Effect Prediction Summary	Magnitude of the Incremental Effect	Type of Monitoring	Applicable Monitoring Programs
Habitat	Dust deposition may cover vegetation and change the amount of different quality habitats, and alter caribou movement and behaviour	Dust deposition	Primary	Dust modelling is accurate, indicating that dust will be largely confined to the Project footprint	Movement and behaviour will be affected	Negligible to low	Testing effects	Wildlife Monitoring Program Vegetation and Soil Monitoring Program Air Quality Monitoring Program
Habitat	Dust deposition and air emissions may change the amount of different quality habitats (through chemical changes in soil and vegetation), and alter caribou movement and behaviour	Dust deposition	Secondary	Dust modelling is accurate, indicating that dust will be largely confined to the Project footprint	Movement and behaviour will be affected	Negligible	Testing effects	Wildlife Monitoring Program Vegetation and Soil Monitoring Program Air Quality Monitoring Program
Habitat	Dust deposition may cover vegetation and decrease abundance of forage for caribou (i.e., habitat quantity)	Dust deposition	Secondary	Dust modelling is accurate, indicating that dust will be largely confined to the Project footprint	Movement and behaviour will be affected	Negligible	Testing effects	Wildlife Monitoring Program Vegetation and Soil Monitoring Program Air Quality Monitoring Program
Caribou	Ingestion of soil, vegetation, and water, or inhalation of air that has been chemically altered by air emissions or dust deposition, may affect caribou survival and reproduction	Dust deposition	No Linkage	Ecological risk assessment results were accurate, indicating low risk Dust modelling results were accurate	No caribou mortality	Nil	Testing effects	Vegetation and Soil Monitoring Program Air Quality Monitoring Program Surveillance Network Program Aquatic Effects Monitoring Program
Habitat	Dewatering may result in newly established vegetation on the exposed lakebed sediments and increase habitat quantity, which may alter caribou movement and behaviour	Dewatering and changes to downstream flows	Secondary	Colonization of lakebed sediments will be slow, patchy and limited area within the mine footprint	Limited change to movement and behaviour	Negligible	Testing effects	Vegetation and Soil Monitoring Program Wildlife Monitoring Program

**Table A-1 Monitoring Components, Effects Pathways, Effects Assumptions and Predictions, and Types of Monitoring (continued)**

Monitoring Components	Effects Pathways	General Pathway	Pathway Assessment	Assumptions	Effect Prediction Summary	Magnitude of the Incremental Effect	Type of Monitoring	Applicable Monitoring Programs
Habitat	Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from dewatering of Kennady lake may affect the quantity of riparian habitat, which could alter caribou movement and behaviour	Dewatering and changes to downstream flows	Secondary	Dewatering will not cause water levels to exceed the high water mark	Limited change to movement and behaviour	Negligible	Testing effects Regulatory requirement <sup>(a)</sup>	Vegetation and Soil Monitoring Program Surveillance Network Program
Habitat	Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from the refilling of Kennady lake may affect the quantity of riparian habitat, which could alter caribou movement and behaviour	Dewatering and changes to downstream flows	Secondary	Refilling will not cause outflow to drop below a 1 in 5 year drought	Limited change to movement and behaviour	Negligible	Testing effects Regulatory requirement <sup>(a)</sup>	Vegetation and Soil Monitoring Program Surveillance Network Program
Habitat Caribou	Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from dewatering Kennady lake may cause injury/mortality to individual animals	Dewatering and changes to downstream flows	No Linkage	Dewatering will not cause water levels to exceed the high water mark	No caribou mortality	Nil	Testing effects Regulatory requirement <sup>(a)</sup>	Wildlife Monitoring Program Surveillance Network Program
Habitat Caribou	Changes in the timing of freeze and break-up downstream may alter caribou movement and behaviour, and could cause injury/mortality to individual animals	Dewatering and changes to downstream flows	No Linkage	Dewatering will end at freeze-up, which will mitigate changes to freeze and break-up	No caribou mortality	Nil	Testing effects Regulatory requirement <sup>(a)</sup>	Wildlife Monitoring Program Surveillance Network Program

**Table A-1 Monitoring Components, Effects Pathways, Effects Assumptions and Predictions, and Types of Monitoring (continued)**

Monitoring Components	Effects Pathways	General Pathway	Pathway Assessment	Assumptions	Effect Prediction Summary	Magnitude of the Incremental Effect	Type of Monitoring	Applicable Monitoring Programs
Caribou	Physical hazards from the Project may increase the risk of injury/mortality to individual animals, which can affect caribou population size	Physical and chemical hazards	Secondary	Frequency of mine-related mortalities at other mines is extremely low (Marshall 2009)	Mortality will be negligible	Negligible	Testing effects Testing mitigation effectiveness	Wildlife Monitoring Program Waste Management Plan
Caribou	Aircraft/vehicle collisions may cause injury/mortality to individual animals	Physical and chemical hazards	Secondary	Infrequent occurrence of wildlife collisions at other mines	Mortality will be negligible	Negligible	Testing effects Testing mitigation effectiveness	Wildlife Monitoring Program Wildlife Mitigation and Management Plan
Caribou	Attractants to site (e.g., food waste) may increase predator numbers and increase predation risk	Physical and chemical hazards	Secondary	Local increases in bears or wolves have not been observed at other mines Waste management will limit the availability of food to wildlife	Mortality will be negligible	Negligible	Testing effects Testing mitigation effectiveness	Wildlife Monitoring Program Waste Management Program Wildlife Mitigation and Management Plan
Caribou	Injury or mortality to individual animals getting trapped in sediments	Physical and chemical hazards	Secondary	Infrequent occurrence at other mines	Mortality will be negligible	Negligible	Testing effects	Wildlife Monitoring Program
Caribou	Chemical spills (including de-icing fluid run off) may cause negative changes to health or mortality of individual animals	Physical and chemical hazards	No Linkage	Spill response and clean-up will mitigate effects to wildlife	No caribou mortality	Nil	Testing effects Testing mitigation effectiveness Regulatory requirement <sup>(a)</sup>	Wildlife Monitoring Program Emergency Response Plan Waste Management Plan

**Table A-1 Monitoring Components, Effects Pathways, Effects Assumptions and Predictions, and Types of Monitoring (continued)**

Monitoring Components	Effects Pathways	General Pathway	Pathway Assessment	Assumptions	Effect Prediction Summary	Magnitude of the Incremental Effect	Type of Monitoring	Applicable Monitoring Programs
Caribou	Ingestion of seepage and surface water runoff from the Coarse PK Pile, Fine PKC Facility and mine rock piles, or ingestion of soil, vegetation, or water that has been chemically altered by seepage and runoff, may affect caribou survival and reproduction	Physical and chemical hazards	No Linkage	Seepage and runoff will be contained and managed Sequestering of acid generating rock will limit leeching Ecological risk assessment results were accurate, indicating negligible risk	No caribou mortality	Nil	Testing effects	Wildlife Monitoring Program Vegetation and Soil Monitoring Program Surveillance Network Program Aquatic Effects Monitoring Program
Caribou	Ingestion of soil, vegetation, or water that has been chemically altered by leaching of PAG mine rock may affect caribou survival and reproduction.	Physical and chemical hazards	No Linkage	Seepage and runoff will be contained and managed Sequestering of acid generating rock will limit leeching Ecological risk assessment results were accurate, indicating negligible risk	No caribou mortality	Nil	Testing effects	Wildlife Monitoring Program Vegetation and Soil Monitoring Program Surveillance Network Program Aquatic Effects Monitoring Program
Caribou	Ingestion of exposed sediments and riparian/aquatic vegetation in the dewatered lakebed of Kennady Lake may affect caribou survival and reproduction	Physical and chemical hazards	No Linkage	Ecological risk assessment results were accurate, indicating negligible risk	No caribou mortality	Nil	Testing effects	Wildlife Monitoring Program
Habitat	Leaching of mine rock may change the amount of different quality habitats, and alter caribou movement and behaviour.	Seepage and Leaching from Fine PKC Facility and Coarse PK and mine rock piles	No Linkage	Sequestering of acid generating rock will limit leeching Seepage and runoff will be contained and managed	Movement and behaviour will not be affected	Nil	Testing effects Regulatory requirement <sup>(a)</sup>	Wildlife Monitoring Program Surveillance Network Program Aquatic Effects Monitoring Program

**Table A-1 Monitoring Components, Effects Pathways, Effects Assumptions and Predictions, and Types of Monitoring (continued)**

Monitoring Components	Effects Pathways	General Pathway	Pathway Assessment	Assumptions	Effect Prediction Summary	Magnitude of the Incremental Effect	Type of Monitoring	Applicable Monitoring Programs
Habitat	Release of seepage and surface water runoff (including erosion) from the Coarse PK Pile, Fine PKC Facility and mine rock piles may change the amount of different quality habitats, and alter caribou movement and behaviour	Seepage and leaching from Fine PKC Facility and Coarse PK and mine rock piles	No Linkage	Sequestering of acid generating rock will limit leeching Seepage and runoff will be contained and managed	Movement and behaviour will not be affected	Nil	Testing effects Regulatory requirement <sup>(a)</sup>	Wildlife Monitoring Program Surveillance Network Program Aquatic Effects Monitoring Program
Habitat	Long-term seepage from the Coarse PK Pile and mine rock piles may cause local changes to habitat quality, and alter caribou movement and behaviour	Seepage and leaching from Fine PKC Facility and Coarse PK and mine rock piles	No Linkage	Decommissioning plans will consider seepage and erosion, and encourage formation of permafrost	No change to movement and behaviour	Nil	Testing effects	Decommissioning Monitoring

<sup>(a)</sup> Potential permitting requirement (e.g., Aquatic Effects Monitoring Program).

PK = processed kimberlite; PKC = processed kimberlite containment.

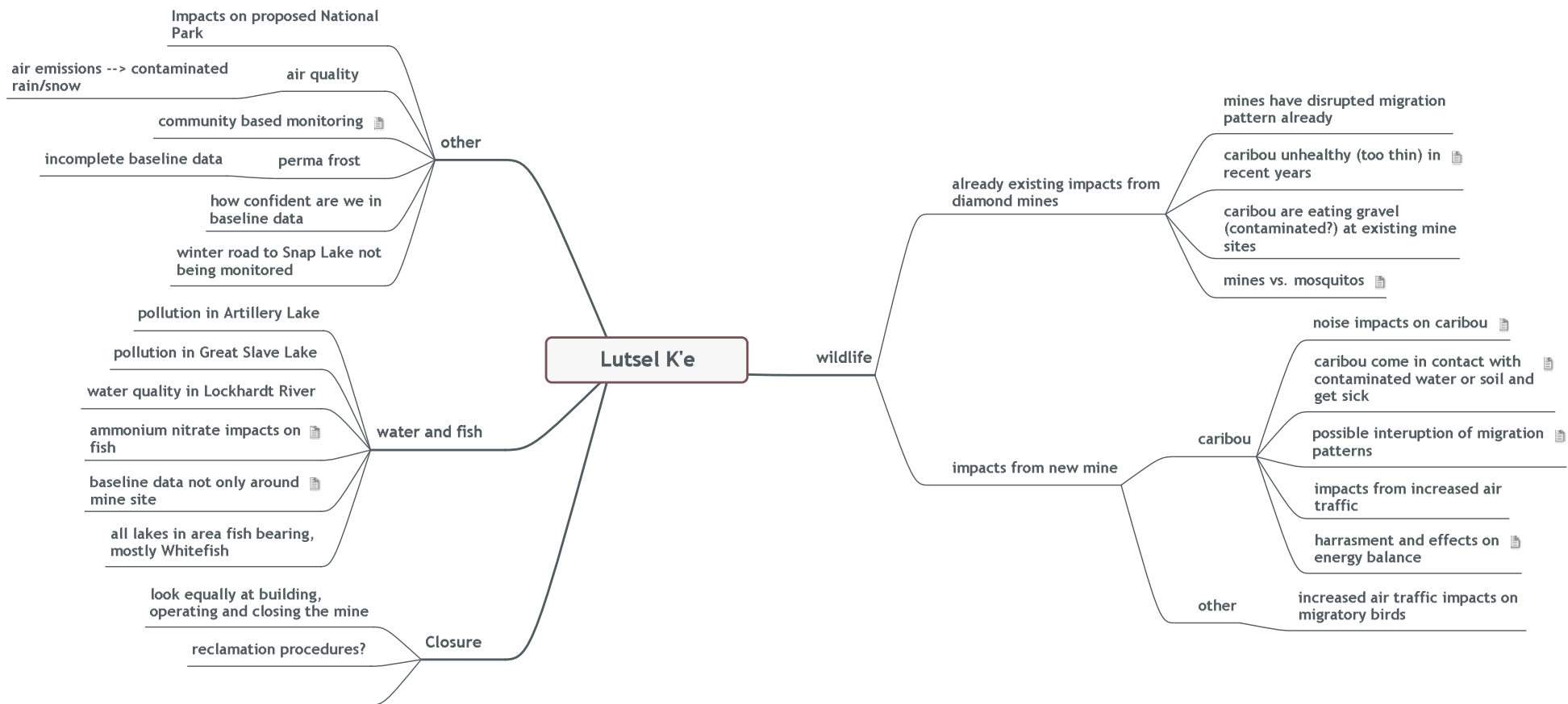
## **APPENDIX B**

**LINKAGE DIAGRAMS FOR PROPOSED EFFECTS FROM THE GAHCHO KUÉ  
PROJECT GENERATED DURING TECHNICAL AND COMMUNITY SCOPING  
SESSIONS (MVEIRB 2006)**



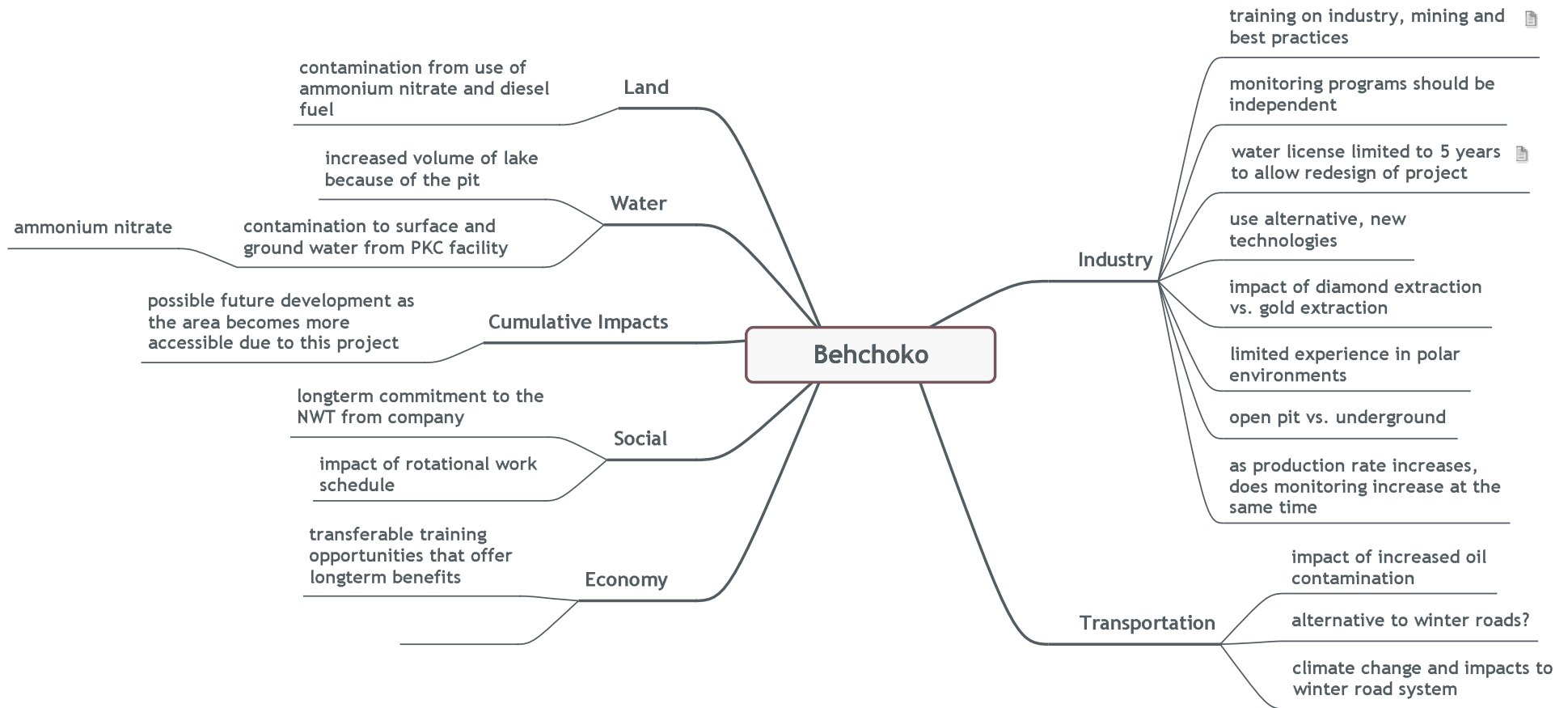
**Figure B-1**

**Issues Diagram from Gahcho Kué Project Scoping Session held in Łutsel K'e, 19 April  
2006**



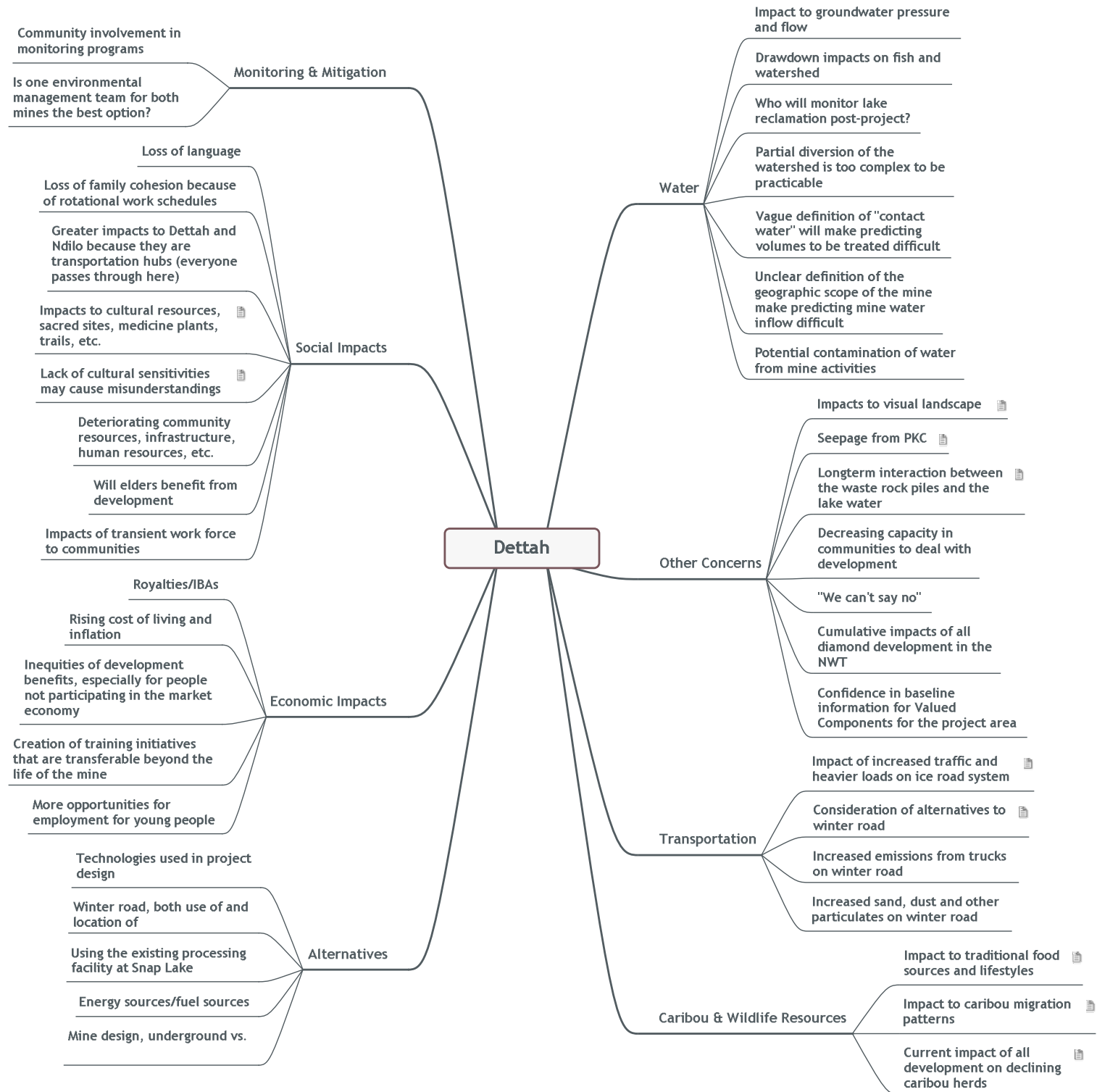
**Figure B-2**

**Issues Diagram from Gahcho Kué Project Scoping Session held in Behchoko, 19 April  
2006**



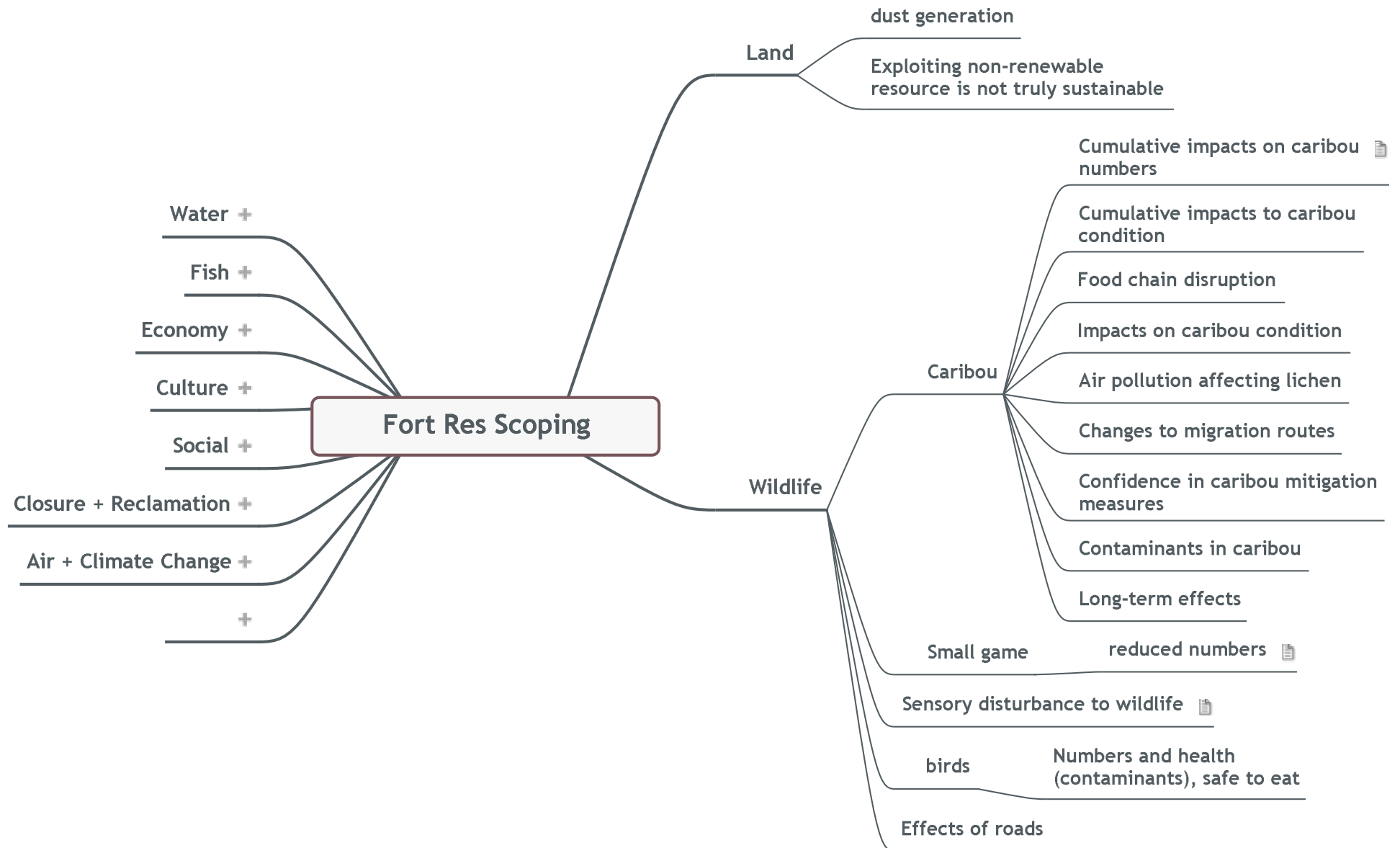
**Figure B-3**

**Issues Diagram from Gahcho Kué Project Scoping Session held in Dettah, 11 April 2006**



**Figure B-4**

**Issues Diagram from Gahcho Kué Project Scoping Session held in Fort Resolution, 24  
April 2006**





**Figure B-5**

**Issues Diagram from Gahcho Kué Project Technical Scoping Session held in Yellowknife,  
21 to 23 March 2006**

