DE BEERS
CANADA
GAHCHO KUÉ PROJECT

April 4, 2012

File: S110-01-08

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

Dear Mr. Hubert:

Gahcho Kué Panel - Information Request Responses
Gahcho Kué Project Environmental Impact Review

De Beers is pleased to provide the Mackenzie Valley Environmental Impact Review Board with responses to Information Requests submitted by the Gahcho Kué Panel.

Sincerely,

Veronica Chisholm

Veronica Chisholm
Permitting Manager

Attachment

April 2012

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 1

Source: Gahcho Kué Panel

Subject: No assessment for sustainability of caribou populations.

EIS Section: Section 7.8

Preamble

The Developer uses the term ‘persistence’ throughout the Environmental Impact Statement and does not clearly relate ‘sustainability’ to ‘persistence’. The Developer concludes that the persistence of caribou populations will not be significantly changed (Section 7.8.2) but does not define ‘persistence’ until late in the Caribou Key Line of Inquiry (p. 134) and then only as a probability output from the population model. The model estimates the *likelihood* of persistence [reviewer’s emphasis] as the projected final abundance year 30 of the simulation and the probability that the number of caribou will be below a range of abundances at the end of the simulation (Section 7.5.4 specifies that “It is emphasized that the models are not used to predict the number of caribou in 5 years, 10 years, or 30 years from now.”).

The Environmental Impact Statement also refers to persistence of populations in the context of continued opportunity for traditional and non-traditional use of caribou but the Environmental Impact Statement does not describe how population persistence as an endpoint in an assessment will be monitored and incorporated into Adaptive Management. In Section 7.5 (Effects on population), the Environmental Impact Statement refers to habitat quantity and quality, survival, and reproduction as using measurement endpoints for determining the residual effects on caribou but does not relate these to population persistence. Additionally, the DAR does not discuss the limitations of methods used to monitor caribou habitat quantity and quality, survival, and reproduction. In particular, the Developer does not discuss at what level are effects detectable: for example is a 5% change in survival rates detectable? This also raises questions about the linkage between mitigation, residual effects and persistence.

Request

1. Please explain the relationship between persistence and sustainability.
2. Please define and explain more precisely how population persistence and continued opportunity for traditional and non-traditional uses of caribou can be measured and monitored.
3. Please provide a summary including a flowchart linking how the other measurement endpoints (such as habitat quantity and quality, survival, and reproduction) will be related to population persistence and harvest opportunities in the context of the mitigation, monitoring and adaptive management.

Response

1. Feedback from several groups (Tlicho Government, Yellowknife Dene First Nation, and Gahcho Kué Panel) suggests that the term "population persistence" may have different interpretations, and create a stumbling block for the assessment process and evaluation of significance. For example, many people may interpret a persistent population as a population that is not able to support the harvesting of animals by people and predators in the ecosystem (i.e., is not ecologically functional). Several reviewers have suggested that the use of abundance and distribution or sustainability of the population for harvest provides a more meaningful assessment endpoint to evaluate the significance of effects on wildlife.

   In the interest of clarifying the interpretation of assessment endpoints and the evaluation of significance on wildlife, the term persistence will no longer be used. Instead it is proposed that the evaluation of significance be determined from the predicted effects to the maintenance of the abundance and distribution (or sustainability) of populations, and the related impacts on the continued opportunities for traditional and non-traditional use of wildlife (e.g., availability of animals for harvesting). Assessment endpoints were intended to incorporate sustainability (De Beers 2010, Section 6.3.2, pg. 6-6).

   The maintenance of abundance and distribution of populations is similar in concept and application to population persistence, and does not change the classification and determination of the significance of impacts in the

Environmental Impact Statement (EIS). A sustainable population is one where caribou abundance and distribution will be maintained (or persist) into the future such that there will be continued opportunities for traditional and non-traditional use by people (e.g., Hooper et al. 2005). The summary table for the classification of residual impacts (De Beers 2010, Section 7, Table 7.7-2) links the five primary pathways to effects on the population size and distribution of caribou (De Beers 2010, Section 7.7).

Although not explicitly explained in the wildlife assessment sections of the EIS, Section 6.3.2 (De Beers 2010) provides an example, using caribou, of the relationship between measurement endpoints (e.g., habitat quantity and quality), population abundance and distribution, and assessment endpoints (persistence, and continued opportunities for use of wildlife). The following paragraph is from Section 6.3.2 of the EIS (De Beers 2010, Section 6, page 6-6).

"The overall significance of Project impacts on Valued Components (VCs) is predicted by linking residual changes in measurement endpoints to impacts on the associated assessment endpoint. For example, changes to habitat quantity and quality are used to assess the significance of effects from the Project on the abundance and distribution of caribou, which influence the persistence of the population (assessment endpoint). Effects to caribou abundance and distribution are then used to predict impacts on the accessibility and availability of the population for traditional and non-traditional use of caribou (also an assessment endpoint)."

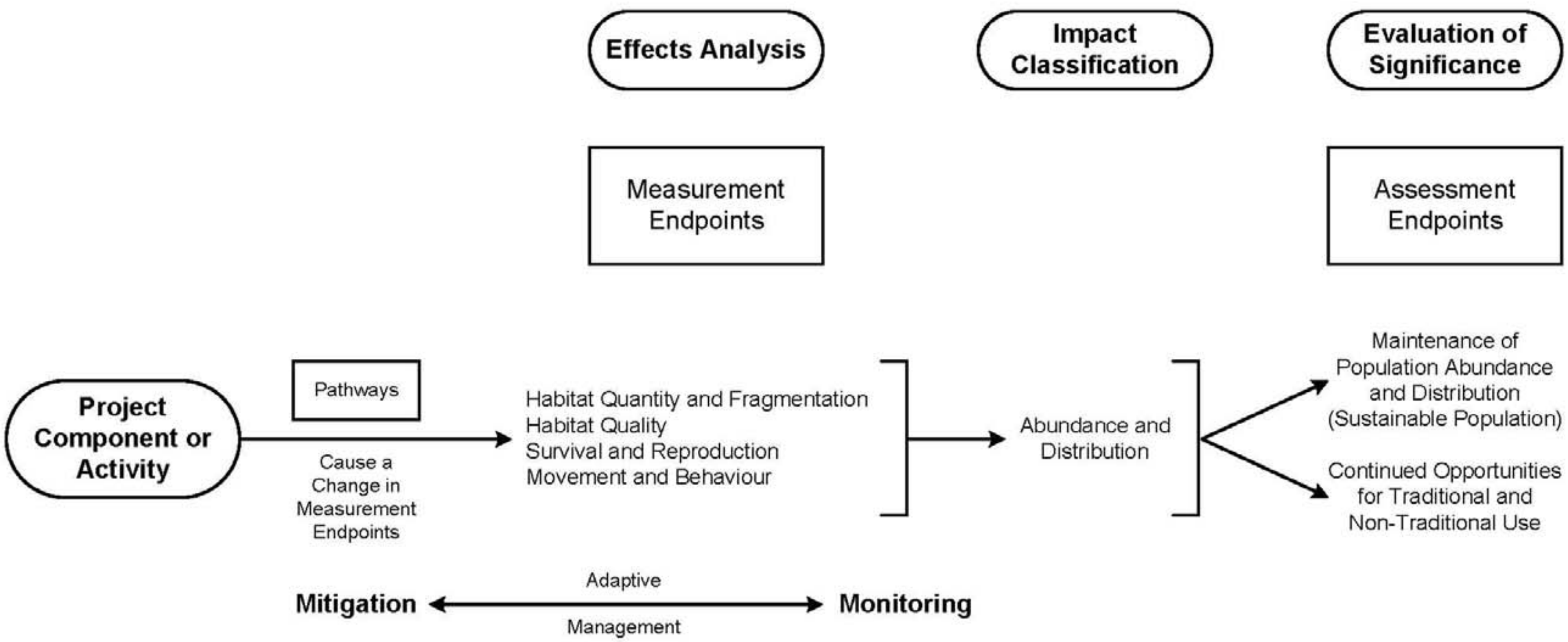
2. The definitions and use of measurement and assessment endpoints in the EIS was explained in Section 6.3.2 (De Beers 2010). Assessment endpoints are general statements about the valued component (e.g., caribou) that should be protected for future human generations. Assessment endpoints are typically not quantifiable (except perhaps the protection of water quality, which may have numerical assessment endpoint). Measurement endpoints are defined as quantifiable (i.e., measurable) expressions of changes to assessment endpoints (e.g., changes to chemical concentrations, rates, habitat quantity and quality, and number of organisms) (De Beers 2010, Section 6.3.2). Measurement endpoints also provide the primary factors for

discussions concerning the uncertainty of impacts to wildlife, and subsequently, are the key variables for study in monitoring programs.

The EIS used several measurement endpoints to analyze changes from the Project (pathways) on the physical environment (e.g., habitat quantity and quality) and attributes of the population (e.g., survival and behaviour) (Figure GKP_1-1). Some measurement endpoints are quantitative such as habitat quantity and fragmentation, and habitat quality, and survival (e.g., direct mine-related mortality). Other measurement endpoints may be quantitative and/or qualitative depending on the type of information available. Changes in movement and behaviour are usually predicted qualitatively from the numerical analyses of habitat quantity, quality and fragmentation, and results from the available scientific literature and monitoring studies. In other words, qualitative expressions of effects are based on several lines of evidence, which included calculated changes in landscape variables and the current understanding of wildlife ecology and responses to these changes. If numerical data are available (e.g., long-term information from collared caribou, aerial and ground surveys), then changes in movement and behaviour can be more quantitative at certain spatial scales.

Changes in measurement endpoints (effects analysis) are used to predict effects on the abundance and distribution of the population, which is related to the continued opportunities for traditional and non-traditional use of caribou (Figure GKP_1-1). In other words, the assessment of availability of caribou for human use is based on the predicted effects to abundance and distribution, which is determined by examining the lines of evidence from the quantitative and qualitative analyses of measurement endpoints. Subsequently, the classification of effects (impact classification) from different pathways on population abundance and distribution (and availability of animals for human use) is used to determine environmental significance on the assessment endpoints (Figure GKP_1-1).

Figure GKP_1-1 Model of the Assessment Approach Showing the Relationship Between Pathways and Measurement and Assessment Endpoints, and Mitigation and Monitoring



3. As mentioned above, measurement endpoints are used to predict effects to population abundance and distribution, and evaluate the significance of impacts on assessment endpoints. Thus, measurement endpoints represent the key variables in project-specific monitoring programs. For example, the effectiveness of mitigation to limit effects to caribou (and other wildlife) from the Gahcho Kué Project is monitored with measurement endpoints, which provides feedback to operations and the implementation of adaptive management, if required (Figure GKP_1-1). Measurement endpoints (which may also include abundance and distribution) are used to test predicted effects from the Project, and may also be used in larger regional monitoring programs to assess and manage cumulative effects.

References

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

Hooper, D.U., F.S. Chapin, J.J. Ewel, A. Hector, P. Inchausti, S. Lavorel, J.H. Lawton, D.M. Lodge, M. Loreau, S. Naeem. B Schmid, H. Setala, A.J. Smstad, J. Vandermeer and D.A. Wardle. 2005. *Effects of biodiversity on ecosystem functioning: a consensus of current knowledge*. Ecological Monographs 75:3-35.

Information Request Number: GKP 2

Source: Gahcho Kué Panel

Subject: Missing ecological risk assessment for caribou exposure to contaminants.

EIS Section: Sections 7 and 10

Preamble

Two Key Lines of Inquiry (De Beers 2010, Section 7 – Caribou and Section 10 - Long-Term Biophysical Effects, Closure, and Reclamation) refer to an ecological risk assessment. Pages 7.63 and 7.141 (De Beers 2010, Section 7) state that an ecological risk assessment was completed [to examine the effects of caribou being exposed to chemicals from run-off and dust]. However, there are no citations or details provided as to where the reviewers can find any details about the risk assessment.

Request

Please provide the caribou ecological risk assessment.

Response

The Wildlife Risk Assessment, which includes an assessment of caribou, is anticipated to be available in August 2012.

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 3

Source: Gahcho Kué Panel

Subject: Incomplete assessment of the lessons learned from the other diamond mines

EIS Section: Section 7

Preamble

Section 4.1.1. Terms of Reference specify that, “Discrepancies exist between some impact predictions in previous diamond mine assessments and the real or perceived outcomes. The EIS needs to address this by explaining how it incorporated lessons learned. To this end, the developer is required to include a summary of caribou research and caribou related monitoring activities and their results for the potentially affected herds since the first diamond mine was permitted, to the extent that relevant information is publicly available”.

Information on lessons learned from other diamond mines with respect to caribou appears to be scattered in the submitted Environmental Impact Statement materials. The developer refers to four sections within the Caribou Key Line of Inquiry as a response to lessons learned (Sections 7.3.3.2, 7.6, 7.8.2, 7.9). However, while those sections emphasize the Zone of Influence and that few caribou have been accidently killed at the three diamond mines, those sections do not provide a consistent or clear account of all the predicted impacts for caribou relative to the observed impacts. There is a reliance on categorical statements rather than concise assessment of the evidence and analyses using tables and diagrams. Only for Diavik mine, does the DAR specifically mentioned that the ZOI exceeded the original (1998) prediction.

Thus the review would benefit from a consolidation of information to understand the predicted impacts at the other diamond mines and the effectiveness of their mitigation and monitoring. This includes any impacts that were either not predicted or were under or over-estimated and how monitoring was used to describe the residual impacts relative to the predicted endpoints. It should also include an appraisal of any shortcomings in mitigation and monitoring.

Request

Using tables and a flowchart format:

> For each of the four diamond mines (Ekati, Diavik, Snap Lake and Jericho) list the predictions for impacts on caribou at the time of the environmental assessments and summarize the linkage between the effects mitigation, monitoring and subsequent level of impact relative to the initial prediction.

Response

The Gahcho Kué Panel has requested that impact predictions from the four existing diamond mines be reviewed, and compared to the actual impacts. Several practical problems arise in addressing this request, and include the following.

- The primary objective of an Environmental Impact Assessment (EIS) is to predict the significance of environmental effects from a project. The evaluation of significance is determined from an effects analysis of quantitative and qualitative measurement endpoints, which can generate specific impact predictions. However, in the EIS documents for the existing four diamond mines, the effects analyses were largely qualitative and based on references to other developments, the scientific literature, logic, and professional opinion (except for direct habitat loss, and indirect habitat changes and associated energetic costs for the Diavik EIS). As a result, for most predicted effects, specific and quantitative impact predictions were not provided in the EIS.
- Effects are often deliberately overestimated in an EIS to limit the risk of not identifying a potentially significant effect.
- Impact predictions are typically required by the Terms of Reference, irrespective of whether they are verifiable. For example, predictions regarding energetic costs (i.e., changes in body condition) to caribou were required in the Gahcho Kué Project EIS, but there is little practical way to directly test these predictions on wild caribou.
- The Gahcho Kué Project 2010 EIS was prepared with the benefit of over a decade of monitoring data from the other diamond mines, information

which was not available during the assessment of the other diamond mines.

There are also practical problems with assessing the efficacy of mitigation. For example, studies have detected changes to caribou behaviour near mines (see De Beers 2010, Section 7.3.3.2.2), but it is unknown whether these behavioural changes are in response to mine-related noise, smells, movement, dust, vibration, or other sensory disturbance. Thus, there is uncertainty about how to mitigate this effect. The approach used at other mines and applied to the Project is to mitigate all potential mechanisms.

Another consideration is the possibility of learned behaviour of caribou near mines, such as habituation to sensory disturbance from a mine, or the intentional avoidance of a mine regardless of the actual sensory disturbance. This may further complicate the ability to assess the efficacy of mitigation, as changes to mitigation may not lead to immediate and detectable changes in caribou behaviour.

In the 2010 EIS, De Beers used the following three measurement endpoints to analyze Project-related changes in the environment and the population to predict effects on the abundance and distribution of caribou and other wildlife.

- Habitat loss and fragmentation, making habitat unavailable to caribou and causing changes in movement and behaviour.
- Changes to habitat quality, referring to changes in the value of a habitat that is not directly lost, likely by mechanisms such as noise, dust, and other sensory disturbances (also causing changes in movement and behaviour, and survival and reproduction).
- Direct mine-related mortality or changes in survival and reproduction.

Predictions and results from the monitoring programs at the other diamond mines relevant to these three measurement endpoints are summarized below.

Habitat Loss and Fragmentation

Effects of habitat loss and fragmentation have been minimal within the range of the Bathurst caribou herd. The cumulative direct disturbance to the landscape from the Project and other previous, existing, and future developments is predicted to be less than or equal to 1.7% of the seasonal ranges relative to reference conditions (De Beers 2010, Section 7.6.1).

Direct habitat loss from each mine has been within the limits predicted and permitted. At Ekati from 1997 to 2010, total landscape disturbance (including water) was 1,998 hectares (ha). A total predicted footprint area was not provided (Rescan 2011). At Diavik, total landscape disturbance has been 9.78 square kilometre (km^2) from 2000 to 2010, or 77.2% of the predicted maximum extent (Rio Tinto 2011). Between 2005 and 2006, the Jericho mine expanded to 149.5 ha, or 67% of the maximum predicted footprint area (221.9 ha [Golder 2008a]). Between 2002 and 2008, the Snap Lake Mine has caused 155.4 ha of disturbance to the landscape, or approximately 71% of the maximum predicted footprint area of 218.8 ha (Golder 2011).

Changes to Habitat Quality

Changes to habitat quality have been defined by the area around a development that caribou avoid, termed the zone of influence (ZOI). The ZOI of diamond mines on Bathurst caribou distribution may range from 10 to 30 km. More recent analyses have estimated the ZOI to be 11 to 14 km near the Ekati-Diavik mine complex during the operation phase (Boulanger et al. 2012). At the smaller Snap Lake Mine, a weaker ZOI of 6.5 km was detected (summarized from De Beers 2010, Section 7.6.2.2). A summary of the monitoring objectives and results for Ekati, Diavik and Snap Lake (the three mines for which sufficient data exists to draw conclusions) is provided below. Note that this summary does not present all of the monitoring objectives or conclusions from each mine that may be related to changes in habitat quality, only those most relevant to the Project.

Ekati

The following hypotheses were tested using data from 1996 to 2009 (Rescan 2010).

- Whether the probability of observing caribou was dependent on the distance from mine development.
- Whether the probability of observing caribou nursery groups during the post-calving migration was related to the distance from mine development.
- Whether the dominant behaviour of caribou groups varied with distance from the mine.
- Whether the intensity of caribou response to stressors varied with the type of stressor, distance to mine, and the presence or absence of calves.

When the data from 1997 to 2009 are combined, the probability of observing a caribou during an aerial survey (with a study area of approximately 30 kilometres (km) from the outer extent of the mine) increased at distances farther from the mine. This result is consistent with analyses conducted by Boulanger et al. (2012), suggesting a negative influence of mine sites on the probability of caribou occurrence during the post-calving season around the Ekati and Diavik mines (Rescan 2010).

Considering all data (1997 to 2009, but excluding 2007), the mean distance of caribou nursery groups was farther from mine infrastructure than non-nursery groups. In 2009, it appeared that the mine did not influence the distribution of caribou groups (Rescan 2010).

In 2009, a joint effort was made by both Ekati and Diavik to collect information on caribou activity budgets. Analysis of data collected in 2009 indicated that the proportion of caribou in nursery groups exhibiting alert/moving behaviours was higher closer to Ekati, while bedding behaviour in nursery groups was lower closer to Ekati. This might indicate the mine or mine-related activities may have an influence on bedding and alert/moving behaviour for caribou nursery groups.

Feeding behaviour was not affected by distance to mine infrastructure for either nursery and non-nursery groups (Rescan 2010).

Analysis of the same 2009 data to determine the effect of stressors indicated that nursery groups responded more strongly to nearby disturbances, while the responses of non-nursery groups were not related to distance to disturbance. Nursery groups were more likely to respond to certain stressors (e.g., light trucks, heavy trucks, and blasts) than non-nursery groups, which showed no variation in responses to different stressors. However, these results are not consistent with results from some previous years (Rescan 2010).

There are other studies completed at Ekati that have some relevance to the Gahcho Kué Project, these are the monitoring of caribou deflection by the Misery Road during the spring migration, and caribou interactions with the processed kimberlite in the Long Lake Containment Facility (LLCF). The following monitoring objectives were examined.

- If the Misery Road acts as a barrier to caribou movement during the northern migration.
- If caribou crossing frequency varies with traffic activity, roadside snow bank height, caribou group size, and location on road.
- If any caribou were injured by the presence and operation of the LLCF.
- The frequency with which caribou use the LLCF.

Caribou were deflected from crossing the Misery Road in approximately 57% of the observed events since 2002. This suggests that Misery Road may be acting as a barrier to caribou movement. Vehicle activity and group size did not have a significant effect on the probability of caribou crossing the road. Snow bank height, on the other hand, may significantly influence the road crossing behaviour of caribou groups (Rescan 2011). However, the narrow, all-season Misery Road may not be directly comparable to the wider and seasonal winter roads used to access the Gahcho Kué Project.

To date, no caribou injuries or deaths have been directly attributed to the LLCF. In 2006, a caribou with a broken hind leg was observed on the LLCF but it is unknown whether the injury resulted from an interaction with the LLCF or was incurred prior to the animal entering the LLCF. Observations of caribou and caribou tracks on the LLCF suggest that the processed kimberlite does not block caribou movement (Rescan 2011).

Diavik

The monitoring objectives for caribou at Diavik include the following.

- To determine whether the zone of influence changes in relation to mine activity.
- To determine if caribou behaviour changes with distance from the mines.

A ZOI is apparent for all caribou groups in the area of the mine, with the threshold distance varying from year to year. For example, a ZOI near 40 km was noted for three monitoring years (2001, 2005 and 2009) and a ZOI of 15 km was noted in 2006. However, large lakes such as Lac de Gras appear to have a stronger influence on the distribution of caribou when compared to the level of activity at the mine in some years. The calculated zones of influence varied from year to year, but not in a progressively increasing manner. There was no relationship between the extent of the ZOI and the level of activity at the Diavik mine site (Rio Tinto 2011).

Behavioural responses of caribou groups with calves indicated that the amount of time spent feeding or resting increased with distance from the mine. Groups with calves that were within 5 km of the mines spent 10% less time feeding or resting and 7% more time alert or moving than groups further than 5 km from the mine. Additionally, caribou groups without calves were found to spend approximately 5% less time feeding when they were within 7 km of the mine. Overall, the results of the analysis indicate that caribou behaviour changes with distance from the mine footprints in the region (Rio Tinto 2011).

Snap Lake

The monitoring objectives for caribou at the Snap Lake Mine include the following:

- To determine if the mine influences the group size, density and distribution of caribou within the study area during the northern and post-calving migration periods.
- To determine if the mine influences caribou behaviour within the study area.
- To determine if the mine influences the composition of caribou groups within the study area during the post-calving period.

Using data collected from 1999 through 2007, there was evidence that caribou distribution varied annually and was influenced by distance from the mine. There appeared to be avoidance of the mine within 17 km during the post-calving migration. However, distribution was also affected by major lakes in the study area. The likelihood of observing groups with calves varied significantly from year to year, but did not decline over the study period. There was a high degree of variation in caribou density in the study area from 1999 through 2007 (Golder 2008b).

Instantaneous observations of caribou behaviour did not indicate that there was a mine-related effect. Caribou behaviour was not affected by distance from the mine, nor did it show a trend over time (Golder 2008b). Further, the analysis indicated reduced likelihood of nursery groups within 19 km of the mine.

Direct Mortality

Direct mortality of caribou from mining activity has been low and within the qualitative predictions in the 2010 EIS for each of the diamond mines. To summarize (from De Beers 2010, Section 7.3.3.2.4), road and airstrip traffic mitigation appear effective, as no caribou have been killed in vehicle or aircraft collisions at mine sites. The exception is the Tibbitt-to-Contwoyto Winter Road, where five caribou were killed by a grocery truck. Electric fencing, flagging, and inukshuks have been moderately successful at deterring caribou from airstrips and other mine facilities. However, caribou have become entangled in electric fences. At the Ekati Diamond Mine, six caribou have been entangled in the electric fence surrounding the airstrip from 2001 through 2009 and four of these animals died. At the Diavik Diamond Mine, a caribou became entangled in an electric fence and was later killed by a grizzly bear. Since 1995, one caribou died while becoming entangled in an electric fence at the Gahcho Kué Project.

Conclusion

To conclude, De Beers invested considerable effort in describing the observed effects to caribou from the existing mines, and incorporated this information into the effects analyses and impact predictions. Further, the best-practice mitigation from existing mines has been identified, and will be implemented at the Gahcho Kué Project. However, it is unlikely that the various mine-related effects to caribou (such as noise, dust, smells and activity) will ever be fully understood, thus limiting the ability to completely mitigate these effects and testing the efficacy of mitigation.

References

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Golder. 2008b. *Snap Lake Mine Analysis of Environmental Effects on Wildlife, 1997 to 2007*. Prepared by Golder Associates Ltd. for De Beers Canada Ltd.

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Rio Tinto. 2011*. Wildlife Monitoring Program Report – 2010*. Diavik Diamond Mine.

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 4

Source: Gahcho Kué Panel

Subject: Inadequate use of baseline data: caribou distribution relative to the winter access road and the Tibbett-Contwoyto Lake winter road

EIS Section: Section 7

Preamble

The Environmental Impact Statement does not analyze the annual probability of caribou encountering the winter roads although this was done for the mine site (Figure 7.5.8). The maps showing caribou distribution are only for 2004 and 2005 and suggest a relatively high likelihood of caribou encountering the winter access road and the Tibbett-Contwoyto Lake winter road but the baseline information based on aerial surveys from 1999-2005 is not analysed or mapped. The tables summarizing the surveys are not used to contribute to assessing the likelihood of caribou encountering the winter roads.

The annual variability in winter distribution is high added to which as abundance changes, so does distribution especially on the winter range. The analyses would assist the Developer in examining the effect of the road on access for hunting. Although the Developer suggests that the decreases in hunting traffic may be due to high volumes of mine-related vehicles on the road, it could also be a change in caribou winter distribution.

Although analyses are needed to assess the likelihood of caribou encountering the road, the methodology used elsewhere in the report for the mine site and for cumulative effects depends on the satellite collared caribou. The Environmental Impact Statement does not describe the limitations or their consequences (only cows are collared) nor does the document discuss the representation of the collared caribou of the herd’s distribution from the collared cows. The Environmental Impact Statement does not include even a summary of all the information available on winter and pre-calving migration available since the 1980s.

Request

1. Provide a description and analysis of annual changes in the winter and pre-calving migration relative to the winter access road and the Tibbett-Contwoyto Lake winter road using all available information.
2. Develop encounter rates based on the satellite collared cows for the winter access road and the Tibbett-Contwoyto Lake winter road.
3. Assess the extent to which the collared cows represent the distribution of the entire herd including bulls.

Response

1 and 2. To further investigate caribou interactions with the Tibbitt-to-Contwoyto Winter Road (TCWR), and the Gahcho Kué Project winter access road, satellite telemetry and GPS collar data from 1996 to 2010 for the Bathurst herd were analyzed using Geographic Information System software. Only data from the Bathurst caribou herd was used, as this herd has the most available collar data, and is most likely to be influenced by the Project (see De Beers 2010, Section 7.3.3.1.1).

The following criteria and assumptions were made in the analysis:

- Encounters with the TCWR and the Project winter access road were assessed separately. The TCWR has been active annually, but the Project winter access road has only been used in 1999, 2001, 2002 and 2006.
- All other spur roads and developments were excluded from the analysis.
- Although the dates of opening and closure for the TCWR are available for each year (De Beers 2010, Table 11.8-6; Section 11.8.2.5.1), the earliest opening and the latest closing dates for any year between 2000 and 2010 were used to define the annual temporal boundaries of the analysis (January 26 to April 16, a span of 81 days). This provides a conservative approach, which also considers traffic from winter road construction prior to the operating period and public traffic after the operating period.
- Studies have indicated that caribou in a tundra environment may avoid roads by up to 4 km during the sensitive calving season (please see response to information request GKP 11 for further discussion).

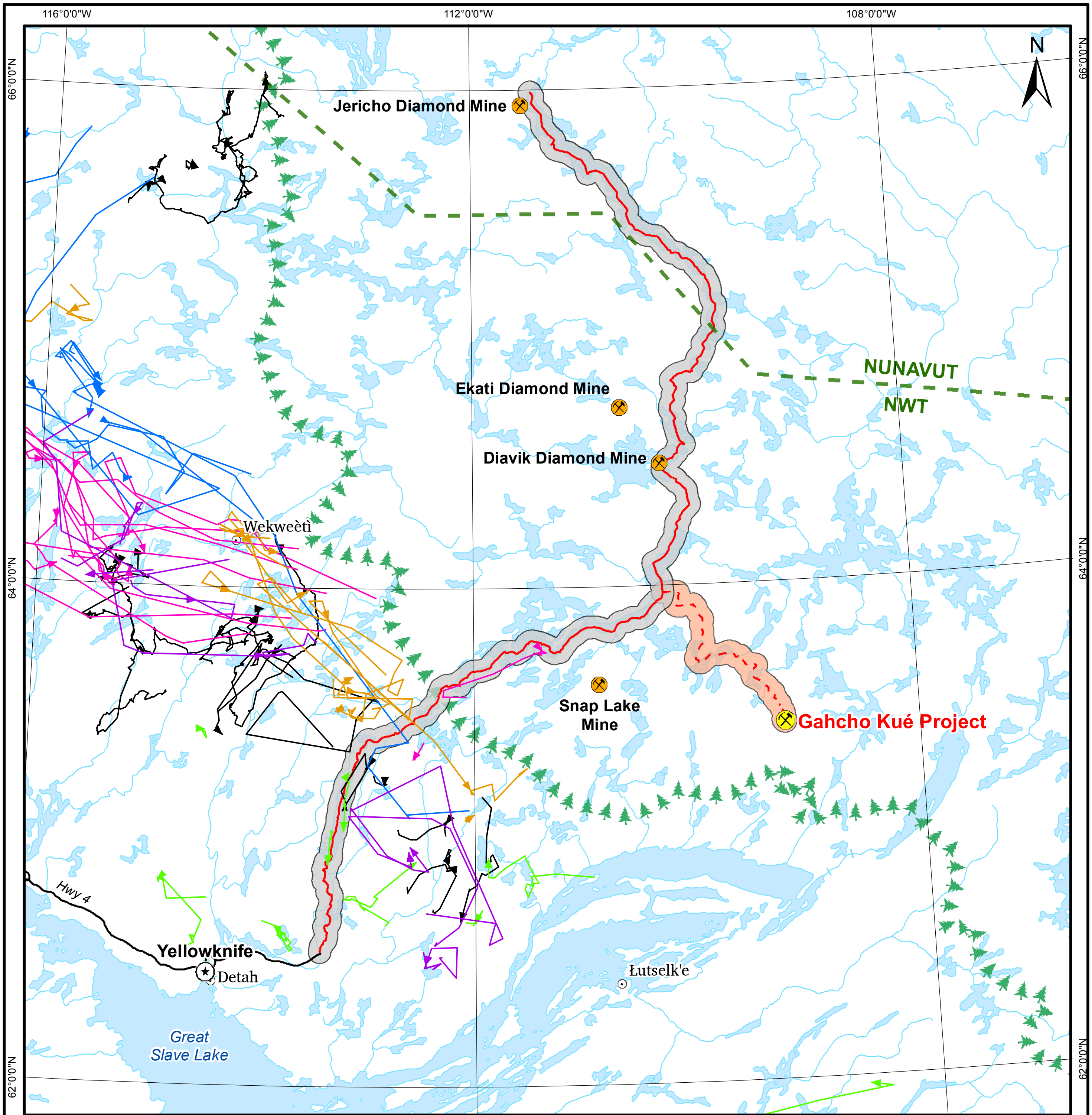
Thus, all caribou collar locations within 5 km of either side of the TCWR and the Project winter access road (i.e., zone of influence [ZOI]) were considered to have encountered the road. This distance was selected to include both the potential area of avoidance, and the area where caribou may be observed from the road by hunters.

- The analysis excluded the northern migration (May 1 to 31) when many Bathurst caribou cross the physical structure of winter roads. By this time the winter roads are considered to have little effect on caribou movement, as there is no traffic and the snow berms have begun to melt.

Using the criteria above, the number of encounters and residency times of collared caribou within the ZOI of the TCWR and the Project winter access road were calculated. During the winter road season, information from 98 collars over 14 years was available to estimate encounter rates and residency times.

The results indicated that there have been no encounters between collared caribou and the Project winter access road in any year since 1996 (Figure GKP 4-1). The Project winter access road was active in only four years, but all years were considered in the analysis. This indicates a low probability of collared caribou encounters with the Project winter access road during the active winter road season.

With regards to the TCWR, there were encounters in 6 of the 14 years analyzed. The encounter rate was estimated for each of these six years (Table GKP 4-1). The number of collars available for analysis in each year ranged from 8 to 22. The resulting encounter rates, measured as the number of collared caribou entering the 5 km buffer, ranged from a 4.7% in 2007 to 25% in 1997. Average (geometric mean) encounter rate over all years for which there were encounters was 11.9%, but less than 1% when all years are included (1996 to 2010). With the exception of a single collar in 2007, the encounters occurred within a particular section of road, between Gordon Lake and the treeline (Figure GKP 4-1). The residency times for years in which there were encounters ranged from 0.3% to 8%. The number of entries and exits shows that collars passed through the ZOI several times in some cases.



LEGEND

- Gahcho Kué Project
- Existing Mine
- Territorial Capital
- Populated Place
- Highway
- Tibbitt-to-Contwoyto Winter Road
- Winter Access Road
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Treeline
- Tibbitt-to-Contwoyto Winter Road Buffer
- Gahcho Kué Winter Access Route Buffer
- 1997 Collar Movements
- 2002 Collar Movements
- 2003 Collar Movements
- 2005 Collar Movements
- 2007 Collar Movements
- 2010 Collar Movements

NOTES
Base data source: The Atlas of Canada; ENR GNWT collar data, 2010.

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GAHCHO KUÉ PROJECT

Collared Caribou Encounters with Winter Roads

PROJECTION: Canadian Lambert Conf. Conic	DATUM: NAD83
Scale: 1:2,500,000 (50 25 0 50 Kilometres)	
FILE No: IR-Wild-008-GIS	DATE: April 3, 2012
JOB NO: 11-1365-0001	REVISION NO: 2
OFFICE: GOLD-SAS	DRAWN: ANK / CHECK: JV

DE BEERS CANADA

Figure GKP 4-1

Table GKP 4-1 Encounters between Collared Caribou and the Tibbitt-to-Contwoyto Winter Road from 1996 through 2010

Year	Number of Collars	Number of Collars Encountering the ZOI [a]	Number of Entries and Exits of ZOI	Total Collar Time (hours)[b]	Encounter Rate[c] [%]	Residency Time[d] [%]
1997	8	2	4	12,262	25.0	0.3
2002	12	2	4	13,326	16.7	0.8
2003	15	1	6	17,812	6.7	0.9
2005	20	3	3	17,519	10.0	8
2007	21	1	5	29,648	4.7	3.6
2010	22	3	8	19,595	13.6	1.7

(a) The ZOI included a 5 km area on either side of the road.

(b) Cumulative time for all collars from January 26 to April 16.

(c) Measured as percent of collars encountering the ZOI.

(d) Measured as the percent of total collar time spent in the ZOI.

ZOI = zone of influence.

The results of this analysis indicate that caribou presence in the vicinity of the boreal sections of the TCWR is variable from year to year, and that there is a low frequency of caribou in the vicinity of tundra sections of the TCWR or the Project winter access road during the active hauling season (particularly considering that no collared caribou entered the buffer in 8 of the 14 years). Residency time within the 5 km ZOI appears to be a small component of the overall 81 day period considered. No temporal trends in the encounter rate or residency time are apparent.

3. Bulls and immature caribou lag behind the cows and do not go all the way to the calving grounds, but meet in summer as the cows and calves return from the calving ground (ENR 2012). Mixing of cows and bulls is complete by October when the rut begins. ENR completes composition surveys in October as part of calculating herd size, as the counts made on the calving grounds include very few bulls (Adamczewski et al. 2009). As winter progresses, bulls and cows begin to separate again, with small groups of bulls often separating and moving to the outer extent of the winter range (Croft 2012, pers. comm.). Regardless, the location of collared females are

helpful in guiding late-winter calf:cow ratio surveys, which attempt to include the entire distribution of caribou (Adamczewski et al. 2009).

References

Adamczewski, J., J. Boulanger, B. Croft, D. Cluff, B. Elkin, J. Nishi, A. Kelly, A. D'Hont, and C. Nicholson. 2009. Decline in the Bathurst Caribou Herd 2006-2009: A Technical Evaluation of Field Data and Modeling. DRAFT Technical Report December 2009. Government of the Northwest Territories.

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

ENR (Environment and Natural Resources). 2012. Website, http://www.enr.gov.nt.ca, accessed on 27 March 2012.

Personal Communications

Croft, Bruno. 2012. Manager, Research and Monitoring, Environment and Natural Resources. Personal communication with Damian Panayi by email on 28 March 2012.

Information Request Number: GKP 5

Source: Gahcho Kué Panel

Subject: Uncertainty in the assessment for the duration of the winter road season and frequency of traffic.

EIS Section: Section 11.8

Preamble

The Environmental Impact Statement does not analyze any trends in the duration of winter road season and the frequency of traffic. Table 11.8.7 gives the dates of the beginning and end of the season but does not include the number of days for the trucking season or the daily frequency of traffic or their trends. The table does not include the earlier years of the winter road which would be useful to determine the trend in the duration of the winter road. Although the Environmental Impact Statement does not give the length of the winter road season it can be calculated from the dates of opening and closing. From 2000 to 2011, the road was open an average of 62 (range between 48 and 80 days); the linear trend toward a shorter duration is insignificant ($p=0.061$).

The Environmental Impact Statement does not include reference to a study by EBA Engineering Consultants Ltd. (2008) which examined the risks that climate warming for reducing the length of the winter road season. The analysis correlated the length of operating season and the cumulative air freezing index for the season. The freezing index correlates with the historic road operating season (1994-2006, 65 days) which could decline to an average of 54 days by 2020.

The Environmental Impact Statement does not describe caribou behaviour relative to snow and ice roads such as the information from the snow track surveys for Ekati’s Misery road or other mines such as the Alaskan Red Dog mine. The cited references are mostly older reviews of wildlife in general relative to roads. EBA Engineering Consultants Ltd (2008) report that one option to offset a shorter winter road season (or increased frequency of traffic) is to twin sections of roads crossing ice-covered lakes. This could influence the likelihood of caribou either paralleling or crossing the roads.

Request

It is not clear if the EBA Report identified above was included with respect to climate warming and the winter road season analysis. Please describe how incorporation of the EBA Report would change the assessment of caribou behaviour relative to snow and ice conditions and describe mitigation for a reduced winter road season and implications for caribou.

EBA Engineering Consultants Ltd McGregor, R. V., H. M. Hassan, D. Hayley. 2008. Climate change impacts and adaptation: Case studies of roads in northern Canada. "Climate Change and the Design and Management of Sustainable Transportation" Session, 2008 Annual Conference of the Transportation Association of Canada, Toronto, Ontario

Response

Data from 2000 through 2010, indicate that the Tibbitt-to-Contwoyto Winter Road (TCWR) opened as early as late January and closed as late as mid-April (see 2010 EIS Table 11.8-6; Section 11.8.2.5.1 (De Beers 2010)); also see response to Tlicho Government Information Request 42). These data are considered to be an appropriate representation of vehicle activity on the TCWR as it includes the largest traffic volumes during operation of the Ekati mine, and construction and operation of the Diavik, Snap Lake, and Jericho mines. The highest recorded traffic volume in 2007 was related to the early closure of the road in 2006 (De Beers 2010, Section 11.8.2.5.1).

EBA (2008) predicted that global warming could result in a reduction of TCWR operating season if adaptation strategies are not undertaken to improve road condition, create more alternate route options, and manage traffic. More recently, the TCWR now uses a secondary route for returning south-bound traffic, which increases road capacity. A shorter winter road season and the associated mitigation (additional southern route) is not expected to alter the predicted effects from increased vehicle traffic on the TCWR associated with the Gahcho Kué Project on caribou movement and behaviour.

Construction represents the period of maximum vehicle traffic for a project. De Beers is not aware of other proposed mines that may also be in construction at the same time as the Gahcho Kué Project and that will also use the TCWR. Further, the projected maximum of 2,000 trips required during construction (and 1,200 during operations) of the Project will not cause winter road traffic to exceed the range of historic numbers. Between 2008 and 2011, at least 3,300 fewer trucks have used the TCWR annually, so total traffic volume including additional volume required for the Project should not exceed the maximum traffic levels observed in 2007. Mitigation used on the TCWR to reduce impacts to caribou includes communication between drivers and a caribou right-of-way policy (Fitzgerald 2012, pers. comm). Similar mitigation will be applied to the winter access road for the Project.

The effect of winter roads on caribou movement and behaviour has not been quantitatively analyzed, but likely depends on a number of factors such as the amount and intensity of traffic on the road, and associated noise, smells, and/or vibrations. Berm height, snow depth, landscape (tundra or boreal), and habituation or learned avoidance behaviour are other factors that may influence the response of caribou to winter roads. It is likely that caribou exhibit predator avoidance behaviour and limit their distribution around the TCWR considering that harvesting from the road is permitted (with the exception of current harvesting ban). However, the recorded caribou mortality from vehicle collisions is low, and would result in negligible (non-measurable) change to caribou abundance.

The location and movement rate of caribou would also influence the likelihood of animals interacting with the TCWR. For example, during the operational period of the TCWR (late January to early April), caribou daily movement rate is lower than other seasons and the potential for interactions with vehicles and the road will partially depend on the distribution of animals (i.e., caribou encounter rate with the TCWR likely decreases with increasing distance from annual winter distribution of the herd). Please see the response to Information Request GKP 4 for a supplementary analysis of caribou encounter rate with the Project winter access road and the TCWR. A decrease in the operational period of the TCWR from climate change may reduce the influence of vehicles on caribou along the winter road.

References

De Beers (De Beers Canada Inc.). 2010. *Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N.* Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

EBA Engineering Consultants Ltd McGregor, R. V., H. M. Hassan, D. Hayley. 2008. Climate change impacts and adaptation: Case studies of roads in northern Canada. “Climate Change and the Design and Management of Sustainable Transportation” Session, 2008 Annual Conference of the Transportation Association of Canada, Toronto, Ontario

Personal Communication

Fitzgerald, Alan. 2012. Manager, Special Projects. Nuna Logistics. Telephone correspondence. February 6, 2012.

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 6

Source: Gahcho Kué Panel

Subject: Reclamation, vegetation and habitat

EIS Section: Reclamation (Section 3.12.1)

Preamble

One of the long-term objectives is to "*return the site to a state that is similar to other habitats in the same region*" (De Beers 2010, Section 3, p.3-99) [emphasis added]. In the Assessment approach of Section 6, the EIS states that "*Reversibility does not imply returning to environmental conditions prior to development of the Project*." (De Beers 2010, Section 6, p. 6-11).

It is unclear what "similar" means and how reversibility is determined. It is important to provide clarity on the objective to return the site to similar habitats because some deviations of plant composition may result in deviations of ecosystem function, particularly related to their value as wildlife habitat. For example, a reclaimed heath tundra habitat that is "similar" to the original habitat in all vegetation species but lacking lichen would not be useful for caribou. Alternatively, a higher abundance and depth of plant litter and grasses would favour a higher abundance of small mammals than the original habitat (effects on both lichen and vegetation litter have been found in the Diavik Diamond mine monitoring programs). If some key forage or cover resource species will not be re-established after reclamation, then the impact could be considered irreversible. This may have implications for much of the wildlife impact assessment.

Request

Please define the term "similar habitat", describe how similarity will be measured or evaluated before and after disturbance and explain whether the definition of similarity is also used to define reversibility in the effects assessment.

Response

Reversibility and similarity are described more fully in the Vegetation Section of the 2010 Environmental Impact Statement (EIS; De Beers 2010, Section 11.7.7.1). "Similar" implies an environment of the same type, region, and time period, and does not refer specifically to a habitat type. The term 'similar' is intended to convey the understanding that it is often impractical to define reversible as 'returning to a state of pre-disturbance or pre-development' (Thorpe and Stanley 2011). Ecosystems continually evolve through time and the return or recovery to pre-Project conditions may not be possible or even desirable.

In the 2010 EIS, reversibility is the time required for the Project to influence the processes and properties of valued components (including plant populations and vegetation communities). The Project may result in changes to vegetation community structure and ecological function relative to a similar environment, and the localized scale of these effects was included in the assessment for vegetation, caribou and other wildlife (e.g., changes to habitat from dust and air emissions). With the exception of permanent changes to the landscape from Mine Rock Piles, and Fine and Coarse Processed Kimberlite Containment (PKC) Facilities, the local-scale effects from the Project on vegetation communities are predicted to be reversible (although it may take 20 to 75 years after Kennady Lake is refilled [De Beers 2010, Section 11.7.7.2]).

Vegetation community structure and composition (e.g., species richness, species composition, and percent cover) data were collected during baseline studies at 33 plots in the local study area (De Beers 2010, Annex E, Section E4.2). A Vegetation Monitoring Program using a gradient approach (i.e., plots will be sampled as a function of distance from the Project, including a reference area) is being considered to determine effects from dust deposition on soil, vegetation, and wildlife.

Reference

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

Thorpe, A.S. and A.G. Stanley. 2011. Determining appropriate goals for restoration of imperilled communities and species. Journal of Applied Ecology 48:275-279.

Information Request Number: GKP 7

Source: Gahcho Kué Panel

Subject: Determination of Significance

EIS Section: Section 6.7.4

Preamble

De Beers provided a definition of significance for the impacts to wildlife leaning on the viability of populations. From an ecological point of view it may be reasonable to assume that an impact is significant when any given wildlife species ceases to be viable in the landscape. However, significance also can reflect social or cultural value; that is, a reduction of wildlife resources or the local extirpation of a species may be deemed significant by some people, even if the regional population viability is not at stake. The Terms of Reference clearly link the determination of significance to the values of communities: "*Communities have expressed that their primary concerns often are broad and holistic, dealing with interconnecting systems of the land and the people who depend on it, instead of the more narrow subjects often studied by conventional scientific specialists*."(p.3) and *"Generally an impact on a highly valued component may trigger significance at relatively low magnitude, duration, and likelihood."(*p. 16).

Community members stated at the analysis sessions in early December, 2011, that impacts may be deemed significant by the community even if the ecologists concluded that, for ecological reasons, any given impact is not significant.

Request

Did the developer include the importance of community information and traditional knowledge in its determination of the significance of impacts to wildlife? If yes, please describe methodology.

Response

The evaluation of significance in the 2010 Environmental Impact Statement (EIS) is based on criteria recommended in the Terms of Reference and best Environmental Assessment (EA) practices. Environmental significance incorporates concepts of sustainability and ecological functioning systems (e.g., an ungulate population that is able to support the harvesting of animals by people and predators). Assessment endpoints were intended to incorporate sustainability (De Beers 2010, Section 6.3.2, p. 6-6). A sustainable population is one that will be present for many generations, protecting the ecological services humans benefit from when ecosystems are functional, where there will be continued opportunity for consumptive and non-consumptive use of caribou by people that value these resources as part of their culture and livelihood (e.g., Hooper et al. 2005). Please see the response to Information Request GKP 1 for the proposed change in the assessment endpoint from population persistence to maintenance of abundance and distribution (sustainable populations).

The wildlife assessment did not consider value-based judgments in the selection of assessment endpoints (e.g., desired population size to maximize opportunity for subsistence or recreational hunting and trapping). Value-based perspectives about wildlife are important, and were a primary factor in selecting Valued Components (VCs) for the 2010 EIS (De Beers 2010, Section 6.3.1). However, competing values about wildlife population size, desirable harvest levels, and/or types of use may be held by different groups and individuals within and among communities. Addressing value-based perspectives with respect to effects on wildlife is more appropriately left to the agencies responsible for making wildlife management and public interest decisions. By focusing the assessment on the ecological effects to the abundance and distribution of populations, the 2010 EIS could also evaluate the impacts from the Project on the availability of animals for the continued opportunity for traditional and non-traditional use of wildlife (sustainability of the population for harvesting).

References

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

Hooper, D.U., F.S. Chapin, J.J. Ewel, A. Hector, P. Inchausti, S. Lavorel, J.H. Lawton, D.M. Lodge, M. Loreau, S. Naeem. B Schmid, H. Setala, A.J. Smstad, J. Vandermeer and D.A. Wardle. 2005. *Effects of biodiversity on ecosystem functioning: a consensus of current knowledge*. Ecological Monographs 75:3-35.

Information Request Number: GKP_8

Source: Gahcho Kué Panel

Subject: Moose and musk ox, pathway analysis

EIS Section: Section 6.5

Preamble

The 2010 EIS states that "no linkage – pathway is removed by environmental design features and mitigation so that the Project results in no detectable environmental change and, therefore, no residual effects to a VC relative to baseline or guideline values;" (De Beers 2010, Section 6, p.6-13).

Environmental design features and mitigation are incorporated into the Project in order to either "*remove*" or "*mitigate*" any identified linkage pathway. This step in the analysis of potential effects of the Project on moose and muskoxen does not eliminate the need to collect sufficient data to permit testing of the effectiveness of mitigation measures. An identified pathway cannot be deemed to have "*no linkage*" simply because untested mitigation has been put in place. Follow-up monitoring programs must determine that mitigation is indeed effective and that no residual effects are present. The prediction that there will be no detectable (measurable) environmental change and residual effects must be tested.

Request

Please describe how mitigation measures or environmental design features for pathways identified as "no linkage" or "secondary" and removed from the effects analysis will be confirmed as effective. Please explain how a "qualitative evaluation" of residual effects will be sufficient to ensure that the Project has had no impact on the pathway in question.

Response

Most of the no-linkage and secondary pathways for moose and muskox (and other wildlife) represent secondary mechanisms at the scale of the Gahcho Kué Project footprint. In other words, they are small-scale direct and indirect effects that occur within the area and vicinity of the Project. The Wildlife Effects Monitoring Program will include site-specific studies to test impact predictions and the effectiveness of mitigation, and provide direct feedback to operations for adaptive management.

Site-specific monitoring would include systematic surveys of the landfill and other areas (e.g., waste storage) at the Project site to determine the presence of attractants and wildlife. Systematic surveys would also be completed along site roads to record the frequency, number, group composition (if applicable), and location of wildlife species within or immediately adjacent to the Project site. Surveys of pit walls and other mine infrastructure will be completed to determine the presence of nesting birds, and appropriate continued monitoring or deterrent actions may be implemented after discussion with the Department of Environmental and Natural Resources and/or Environment Canada. The program would also include an evaluation of the success of deterrent actions (when required) to provide feedback for potential improvement/modification of future deterrent procedures. All wildlife incidents will be recorded (an incident may include simple deterrent actions to the death of an individual). A wildlife log will be kept on site. The information from these and other programs will be reported annually for review and comments by government, communities, and other people interested in the Project. This feedback would be important in the implementation of changes to current procedures and/or additional mitigation to reduce the risks and disturbance to wildlife and wildlife habitat.

Some secondary pathways have effects that will extend beyond the Project footprint such as effects from dust and changes to downstream flows. Both dust and downstream flows will be monitored separately through the aquatic and air quality monitoring programs to confirm that changes are within the range predicted. The results from these programs would be incorporated into the vegetation and wildlife monitoring programs, where relevant.

Many of the predictions for no linkage and secondary pathways were based on the experience and results of applied mitigation at current operating diamond mines (i.e., Snap Lake, Diavik, and Ekati). For example, mitigation policies and procedures for physical hazards (open pits, mine rock piles, blasting), chemical spills, and aircraft and vehicles have been successful at limiting injury and mortality to wildlife (De Beers 2010, Sections 7.4.2.1, 7.4.2.2, 11.10.3.2, 11.11.3.2, and 11.12.3.2). Secondary pathways from dust deposition and air emissions were based on the results from modeling and numerical analyses provided in the Air Quality section (De Beers 2010, Section 11.4), and are not simply a qualitative evaluation. Similarly, the assessment of pathways related to wildlife exposure from changes in chemical concentrations in air, water, soil, and vegetation were based on the results of a quantitative ecological risk assessment.

Reference

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 9

Source: Gahcho Kué Panel

Subject: Uncertainty in baseline data on dust and lichens

EIS Section: Section 11.7

Preamble

The Environmental Impact Statement (EIS) addresses indirect effects of dust on wildlife and describes one primary and two secondary effects pathways. This means that assessing the effect of mitigation through monitoring is important and the power of monitoring to detect changes depends on the baseline information. However, there are uncertainties in the baseline data which will induce uncertainty in the assessment of effects and design of monitoring programs.

Section 11.7.2.3.5 from the 2010 EIS (De Beers 2010) describes baseline metal concentrations measured for plant tissue collected from six sites at Kennady Lake (De Beers 2010, Annex E; Figure E4.8.1), including one site on processed kimberlite. The table lists five species of lichens each with small sample sizes and the average values of metals were highly variable. The Developer does not state why and if the averages included the samples from the processed kimberlite. The baseline data were collected in 2005 and 2007 which is after the other diamond mines had reported on the extent of changes in lichen chemical composition. This raises the question of why so few lichens samples were analyzed and why the sites were restricted to the immediate vicinity of Kennedy Lake. The small sample sizes make it difficult to discriminate between biological (process) and statistical variation in the baseline data. The restricted baseline sampling limits interpretation of future monitoring. The results were not compared with baseline and post-development levels of metals in lichens from the other diamond mines.

Request

Please provide further details on the baseline levels of metals in lichens and describe implications for sampling design to monitor the effectiveness of mitigation.

Response

The following information is from the 2010 EIS Annex E, Section E4.8 (De Beers 2010). Baseline metal concentrations in soil and vegetation were collected from six sample plots in 2005 and 2007. Sample plots were 20 metres x 20 metres, and were distributed between two ecosystem types. Sample plots were selected to represent common ecosystem types located on typical till geochemical conditions. The location of sample plots was selected to measure local metal concentrations in soil and vegetation surrounding Kennady Lake. One of the sample plots was located on *exposed* kimberlite (De Beers 2010, Annex E, Section E4.8, p. E4-16), and not on *processed* kimberlite as was incorrectly described in the 2010 EIS, Section 11.7.2.3.5 (De Beers 2010, p. 11.7-31). The difference is subtle, but important as exposed kimberlite is natural (represents background chemistry values) and processed kimberlite has been chemically altered through the diamond extraction process. The mean values reported include samples from the plot containing exposed kimberlite. Further details on sampling methods and results for 2005 and 2007 can be found in the 2010 EIS Annex E (De Beers 2010, Sections E4.8 and E5.6 [see also Appendix E.IV]).

In 2011, additional samples of soil, lichen, leaves and fruit were collected at 23 sites in the local study area for analysis of metals. The total number of sites included the six sites sampled in 2005 and 2007 plus an additional 17 new sites. The results will be used as baseline data in the Vegetation Monitoring Program, and to refine toxicology models and associated human and wildlife health risk assessments for the Project. The risk assessment reports are scheduled to be available in August, 2012. A Vegetation Monitoring Program using a gradient approach (i.e., plots will be sampled as a function of distance from the Project, including a reference area) is being considered to determine effects from dust deposition on soil, vegetation, and wildlife.

References

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

April 2012

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 10

Source: Gahcho Kué Panel

Subject: Residual effects on vegetation

EIS Section: Section 11.7.6

Preamble

Residual effects are repeatedly compared to a range of baseline conditions and to natural variation, stating that the effects will be "*within the range of baseline conditions*" (De Beers 2010, Section 11, p.11.7-76), or that "*the magnitude of these effects is predicted to approach the limits of natural variation or baseline values*. "(De Beers 2010, Section 11, p.11.7-77). It is unclear what the range of baseline conditions or the natural variation might be. If the information on either range or variation does not exist, then the effects evaluation and significance determination may not be meaningful.

Request

Please explain how a range of conditions or how the natural variation might be used as yardsticks to evaluate significance, because it is not apparent that either a range of conditions or the natural variation has been measured. Please explain if an alternative effects evaluation would be more meaningful, such as a clear and simple percentage or amount of change (such information exists in some results tables).

Response

De Beers acknowledges that natural variation is not a useful yardstick for predicting the magnitude of effects. Estimates of natural variation typically take many years to obtain, particularly for slow-growing plants in arctic ecosystems. Comparison to natural variation should not have been identified as a criterion in the classification of magnitude. Instead, the criteria for classifying magnitude should have been restricted to the relative changes in baseline values, which were assessed quantitatively (i.e., through absolute and percent changes) and qualitatively in the 2010 Environmental Impact Statement (EIS; De Beers 2010).

To clarify, baseline values represent point estimates of the distribution of values comprising natural variation. These point estimates can be obtained from baseline studies for a project, monitoring studies from other projects, or regional scale investigations led by government (e.g., the vegetation classification system developed for the Slave Geological Province by Matthews et al. 2001). Thus, baseline conditions include the range of values in measurement endpoints prior to application of the Gahcho Kué Project. In the regional study area for the Project, this range of baseline values can include reference conditions (i.e., no development) and various snap shots in time that included different amounts of development prior to application of the Project.

Measurement endpoints are quantitative where possible (e.g., amount of vegetation community types and suitability classes for listed plant species potential) and qualitative where necessary (e.g., indirect effects to vegetation communities that are influenced by changes in stream flow and levels). The classification of magnitude is determined using the predicted relative change in baseline values from the Project for both quantitative and qualitative measurement endpoints.

For quantitative measurement endpoints, magnitude (i.e., intensity) is assessed as either an absolute or relative difference between predicted changes from the Project and baseline conditions or guideline values (De Beers 2010, Section 11.7.7.1). As the reviewer has indicated, these numerical values are presented in several sections and tables of the 2010 EIS (De Beers 2010, Section 11.7, Tables 11.7-17, 11.7-18, 11.7-19, and 11.7-21), and are used to help classify the magnitude of changes. The qualitative evaluation of effects to vegetation communities from dewatering and refilling Kennady Lake included the numerical predictions of changes in hydrology and direct loss from the physical footprint, and information from the scientific literature (De Beers 2010, Section 11.7.4.2.2). Thus, the assessment uses several lines of evidence to classify the magnitude of effects to vegetation (De Beers 2010, Section 11.7.7.2), which is one of the principal criteria for evaluating significance (De Beers 2010, Section 11.7.8).

References

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

Matthews, S., H. Epp and G. Smith. 2001. Vegetation Classification for the West Kitikmeot / Slave Study Region. Final Report to the West Kitikmeot / Slave Study Society. Department of Resources, Wildlife and Economic Development, Government of the Northwest Territories and Mackenzie Land and Water Board. Yellowknife, NWT.

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 11

Source: Gahcho Kué Panel

Subject: Impacts from traffic on road

EIS Section: Section 11.8

Preamble

The EIS provides useful information on impacts of the roads from past records. Information relates mostly to mortalities and spills. However, information on the effects on wildlife behavior, namely movement across the roads or avoidance of roads in the region, is qualitative and appears to be based solely on professional opinion. The EIS assures that "best practices" (e.g. p.11.8-65 or p.118-67) will mitigate impacts to wildlife. However, community members during the Analysis Sessions in early December, 2011, have testified that harvest occurs along the winter access roads. Therefore, it appears that the impacts of increased access during winter have not been assessed adequately.

The EIS assumes that "*changes to the behaviour of caribou from activity along winter roads is predicted to be within 5 km of a road*."(p11.8-70).

Request

Is there any statistical evidence that may exist in support of the claim that "the magnitude of incremental impacts from sensory disturbance from combined indirect effects, including vehicles on the Winter Access Road is predicted to be negligible to low."(p.11.8-70)? Please elaborate on the rationale that a 10 km wide corridor of potentially several hundred kilometres in length (depending on the road segments included in the assessment) results in a negligible impact.

Response

As a point of clarification, the source of this question (Section 11.8, Traffic and Road Issues [De Beers 2010]) contains only a summary of impacts to wildlife from other Environmental Impact Statement (EIS) sections. De Beers refers the Gahcho Kué Panel to Sections 7, 11.10, 11.11 and 11.12 for the full assessment of effects from winter roads on caribou and other wildlife (De Beers 2010).

For example, the recorded caribou mortality from vehicle collisions on the Tibbitt-to-Contwoyto Winter Road (TCWR) is low (Fitzgerald pers comm), and was predicted to result in negligible change to caribou abundance (De Beers 2010, Section 7.4.2.2.3). The 2010 EIS predicted that the incremental effect from vehicles associated with the Gahcho Kué Project along the winter access road and the TCWR on caribou would be negligible to low (De Beers 2010, Section 7.7.2). The assessment of incremental effects considers only the increase in vehicles from the Project along the existing TCWR and proposed winter access road. The cumulative effect of all vehicles from the Project and other developments on caribou movement and behaviour is predicted to be moderate (De Beers 2010, Section 7.7.2). The predictions were based on several lines of evidence such as habitat quantity and fragmentation analysis, noise modelling, the scientific literature, and monitoring studies.

Construction represents the period of maximum vehicle traffic for a project. De Beers is not aware of other proposed mines that may also be in construction at the same time as the Gahcho Kué Project and that will also use the TCWR. Further, the projected maximum of 2,000 trips required during construction (and 1,200 during operations) of the Project will not cause winter road traffic to exceed the range of historic numbers (please see response to Information Request TG_42). In addition, between 2008 and 2011, at least 3,300 fewer trucks have used the TCWR annually, so total traffic volume including additional volume required for the Project is not expected to exceed the maximum traffic levels observed in 2007.

Scientific research indicates that barren-ground caribou may avoid or reduce their use of habitats within 1 to 4 kilometres (km) of roads with moderate traffic levels during the calving season when they are more sensitive to disturbance (Dau and Cameron 1986; Cameron et al. 1992, 2005). Although winter roads do not operate during the calving season, to be conservative the assessment predicted that the extent of sensory disturbance (i.e., zone of influence) of the TCWR and the Project winter access road was 5 km (De Beers 2010, Section 7.6.2.1). Noise from the Project winter access road is expected to diminish to background levels within 3 km (De Beers 2010, Section 7, Table 7.5-7). However, caribou cross the TCWR (please see response to Information Request GKP 4) and are hunted from the TCWR (Zeimann 2007), indicating that they do not completely avoid operating winter roads.

The potential duration of exposure to sensory disturbance from vehicles on winter roads is limited to 10 to 12 weeks per year during late winter when the road is in operation (De Beers 2010, Section 11.8, Table 11.8-6). A supplementary analysis of caribou encounter rates with the TCWR and the Project winter access road indicates that the historic encounter rate has been low, and predominantly contained within the area between Gordon Lake and the treeline (please see response to Information Request GKP 4). For those caribou that may be exposed to sensory disturbance, the results from studies of caribou observed near airstrips or roads showed that resting and feeding behaviour were common (Gunn et al. 1998; BHPB 2007). These results suggest that the presence of traffic does not necessarily lead to stress-associated behaviour.

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Personal Communications

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GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 12

Source: Gahcho Kué Panel

Subject: Other ungulates, musk oxen

EIS Section: 11.11-12

Preamble

"*Surveys for muskoxen populations were completed by government biologists in 1989, 1991, and 1998, and included the eastern and northeastern edge of the RSA (Wildlife Management Area U/MX/02 and Wildlife Management Area U/MX/01). Because the Project lies within the transition zone between the tundra and the treeline, moose, which are characteristic of boreal habitat types, may also occur within the RSA. Incidental observations of muskoxen and moose were documented within the RSA, from 1995 to 2005, during surveys for caribou and other wildlife species. The objective was to estimate the annual and seasonal occurrence, abundance, and distribution of muskoxen and moose in the RSA. Esker surveys completed in 2007 also were used to document the presence of muskoxen sign on all eskers within 35 km of the Project*." (p 11.11-12)

It is not clear if "*baseline*" data will be representative of current conditions for wildlife in the area given that survey information for muskoxen spanned a timeframe of 16 years (1989-2005). Muskoxen population surveys dating back to 1989 (with the most recent being 1998) are more than 10 years out of date and do not cover the entire RSA, if they are even in the RSA.

Furthermore, only incidental observations of muskoxen and moose were documented in the RSA from 1995 to 2005. It appears no moose-specific surveys were completed and muskoxen specific surveys only covered a portion of the RSA over 10 years ago.

Request

1. If muskoxen datasets are combined, rationale should be provided. How will the data be analyzed given the time lag between surveys?

2. Please justify how incidental observations are sufficient to "estimate the annual and seasonal occurrence, abundance, and distribution of muskoxen and moose in the RSA".

Response

1. Aerial surveys for muskoxen completed by the Department of Environment and Natural Resources (ENR) of areas overlapping the Gahcho Kué Project regional study area (RSA) in 1989, 1991 and 1998 are likely out-dated. However, the results help describe baseline conditions, and suggest that muskoxen densities are low and variable in the region. More recently, an aerial survey for muskox was completed by ENR in March 2010. The western boundary of this survey passed through a portion of the RSA, and will provide more information on muskoxen densities. As the survey report has not yet been published, no further information is available at this time (Williams 2012, pers. comm.).

   Muskoxen and moose observations were recorded during aerial surveys for caribou. From 1995 to 2003, surveys were unbounded and non-systematic (mostly reconnaissance level surveys). In 2004 and 2005, surveys were systematic using equally spaced transects and defined survey boundaries. The datasets of muskoxen observations collected during aerial surveys were not combined, and De Beers does not intend to combine them. Results from the surveys across years were presented to illustrate the available data, and the relative occurrence, abundance and distribution of muskoxen in the RSA. Incidental observations of muskoxen and moose were also recorded during surveys for other wildlife.

2. The study design for aerial surveys to record the seasonal occurrence, abundance, and distribution of caribou in the RSA also applies to other ungulates such as muskoxen and moose. The surveys, particularly those completed in 2004 and 2005, were similar to methods used for baseline and monitoring studies at the Ekati, Diavik, and Snap Lake mines, and provide an effective method for detecting ungulates in an open tundra environment. Although observations of muskoxen and moose recorded during the aerial surveys were 'incidental' to caribou observations, the data provide point estimates of the occurrence, number, and distribution of these species in the

RSA. The data collected during aerial surveys, particularly in 2004 and 2005, are not considered to be incidental in the context of muskoxen and moose observations recorded during surveys for non-ungulate species, such as upland breeding birds and carnivores, which use different study designs and sampling methods.

Personal Communications

Williams, Judy. 2012. Wildlife Technician, Environment and Natural Resources. Email communication on 14 March 2012.

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 13

Source: Gahcho Kué Panel

Subject: Uncertainty, impact predictions and monitoring

EIS Section: Section 11.11.9, Section 11.11.10

Preamble

The EIS states that "*a Wildlife Effects Monitoring Program (WEMP) will be implemented to test impact predictions and further reduce any uncertainty related to each prediction*." (Section11.11.10).

The uncertainty analysis discusses various sources of uncertainty and how they were addressed in the EIS, but it does not explicitly identify parameters that would require particular attention in the follow-up programs. There does not appear to be a section in the Environmental Impact Statement on how impact predictions will be verified.

Request

Please explain how impact predictions will be verified, beyond the development of a WEMP (as this is already a requirement and expectation for the Project). Please describe what alternative measures will be used if proposed mitigation is not effective. Please identify specific parameters that would require attention in follow-up programs, or explain why there are none.

Response

De Beers is developing a Wildlife Effects Monitoring Plan that is a component of the broader Gahcho Kué Project Monitoring and Adaptive Management Framework. The Framework provides the proposed structure of site-specific monitoring and mitigation plans, and the approach to broader regional monitoring for caribou, wolverine, wolves, grizzly bears, raptors and species at risk. The Framework outlines an adaptive management mechanism where information is reviewed and decisions are made with respect to additional study or mitigation, as required. De Beers expects that engagement and feedback from government and communities will be an important element of completing the Framework, and the associated Wildlife Effects Monitoring Plan.

April 2012

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 14

Source: Gahcho Kué Panel

Subject: Fish and Fish Habitat

EIS Section: Appendix 3.II

Preamble

It seems that, after the project is completed and Kennady Lake is refilled, the lake will have three submerged pits - Tuzo to 300 metres below the surface, Hearne to 200 metres and 5034, which is to be backfilled to 200 metres below the surface. The conceptual compensation plan acknowledges the existence of those pits, but there appears to be comparatively little information about how they will fundamentally change the properties of the lake's bathymetry. Beyond comments that the overall impacts on the fish community of the lake will be temporary (not entirely accepted by Fisheries and Oceans Canada) and will be compensated, the nature of the post-project lake as fish habitat may remain problematic. Kennady Lake may, after the project, appear from the surface to be a normal lake, but that will not be the case. The EIS should be more explicit about the eventual configuration of Kennady Lake. DBC should further substantiate the assertions in the EIS that the lake will essentially return to normal and may for a period even experience higher fish production.

Request

Please describe in more detail the eventual configuration of Kennady Lake and further substantiate the assertions that the lake will essentially return to normal and may for a period even experience higher fish production.

Response

After closure, Areas 3 to 7 of Kennady Lake will be refilled and the natural drainage of the upper watersheds to Kennady Lake will be restored. After Dyke A is removed, the hydrological regime will return to stable conditions and Kennady Lake will once again consist of five interconnected basins. The physical and chemical environment in Kennady Lake will allow for the re-establishment of an aquatic ecosystem. Although the bathymetry of the lake will change as a result of the mine pits, this is not expected to affect the functioning of the aquatic ecosystem; moreover, fish may take advantage of the pit depths for overwintering or thermal refugia.

The long-term effects of mine development on the hydrology of Kennady Lake are discussed in Section 8.7.4.4 of the 2011 Environmental Impact Statement (EIS) Update (De Beers 2011). As described in this section, after closure, the connection between Areas 3 to 7 and Area 8 of Kennady Lake will be restored, allowing unregulated downstream flow. Some changes to the land and water surfaces in the Kennady Lake watershed will remain, resulting in permanent changes in the proportions of total water surface area to total land area in the watershed. The changes to the Kennady Lake watershed will have a negligible effect on the post-closure (after refilling of Kennady Lake and removal of Dyke A) hydrological regime in the closure phase of the Project.

The following description is a summary of the configuration of Kennady Lake taking into account the supplemental mitigation associated with the Fine Processed Kimberlite Containment (PKC) Facility, as per the 2012 EIS Supplement (De Beers 2012). As described in Section 3.9.7.2 of the 2012 EIS Supplement, at the completion of mine operations, the Hearne Pit will have been backfilled with fine processed kimberlite (PK), the 5034 pit will be backfilled with fine PK and mine rock, while the Tuzo pit will be open and empty. Note that the pit depths referred to in the Preamble are incorrect. The 5034 pit will be completely backfilled, and the Hearne pit is anticipated to be backfilled to approximately 100 m below the original lakebed. Area 2 will be filled with fine PK and reclaimed with a coarse PK and mine rock cover. The planned within-lake reclamation activity will be completed, such as the construction of any fish compensation habitat and the decommissioning of any roads, diversion channels, and pipelines. The in-lake Dykes B, J, K, and N will be breached and lowered to a level below the expected restored lake surface elevation of 420.7 meters above sea level (masl). The diversion dykes (Dykes E, F, and G) will be removed to restore the baseline B, D, and E watershed boundaries of Kennady Lake; these watersheds will be returned to their natural drainage patterns. The A watershed will be connected to Area 3 of Kennady Lake. Once Areas 3 through 7 are refilled to the same elevation as Area 8, and the water quality within the refilled lake is acceptable, the in-lake portion of Dyke A will be removed. The refilling of Kennady Lake, and its reconnection with the downstream watersheds, will then be completed. Water will once again flow from the A, B, D, and E watersheds through the refilled Kennady Lake (Areas 3 to 8), and downstream through Stream K5 into the L and M watersheds.

The effects of the Project on the configuration of Kennady Lake Areas 2 to 8 post closure are summarized in Table GKP 14-1 and Figure GKP 14-1, with the following key points:

- The lake portion of Area 2 will be entirely replaced by fine PK.
- The West Waste Rock Pile will reduce slightly the lake portion of Areas 3 to 5. The mean depth will increase. The Tuzo pit will increase the lake portion of Area 4. The minimum lakebed elevation will decrease to 120.0 masl, and the mean depth will increase.
- The South Waste Rock Pile will reduce slightly the lake portion of Area 6 (offset by the Hearne pit and the 5034 pit). As a result of the Hearne pit, the minimum lakebed elevation will decrease to 225.0 metres above sea level (masl), and the mean depth will increase.
- The lakebed elevations in Areas 7 and 8 will not be affected by the mine and will remain at baseline conditions.
- Above 402.0 masl (approximate minimum lakebed elevation under baseline conditions), the total lake volume will be increased at low elevations (from 402.0 masl to 418.0 masl), and will remain similar to baseline conditions at high elevations (from 418.0 masl to 421.0 masl).

Table GKP 14-1 Comparison of Parameters Relevant to the Configuration of Kennady Lake, for Baseline and Post-Closure

Area	Minimum Lakebed Elevation (masl)		Average Depth (m)[(a)]		Water Surface Area (km^2)	
	Baseline	Post-Closure	Baseline	Post-Closure	Baseline	Post-Closure
Area 2	413.0	[(b)]	4.17	[(b)]	0.62	[(b)]
Area 3-5	405.0	405.0	6.65	6.83	2.56	2.19
Area 4	404.5	120.0	6.11	61.1	0.74	0.87
Area 6	402.5	225.0	5.37	10.5	1.70	1.40
Area 7	408.5	408.5	3.96	3.96	0.92	0.92
Area 8	410.5	410.5	2.56	2.56	1.36	1.36

Notes: Based on the Supplemental Mitigation for Fine PKC Facility as per the 2012 EIS Supplement (De Beers 2012).
Depth and Areas were calculated based on a water surface elevation of 421.0 masl

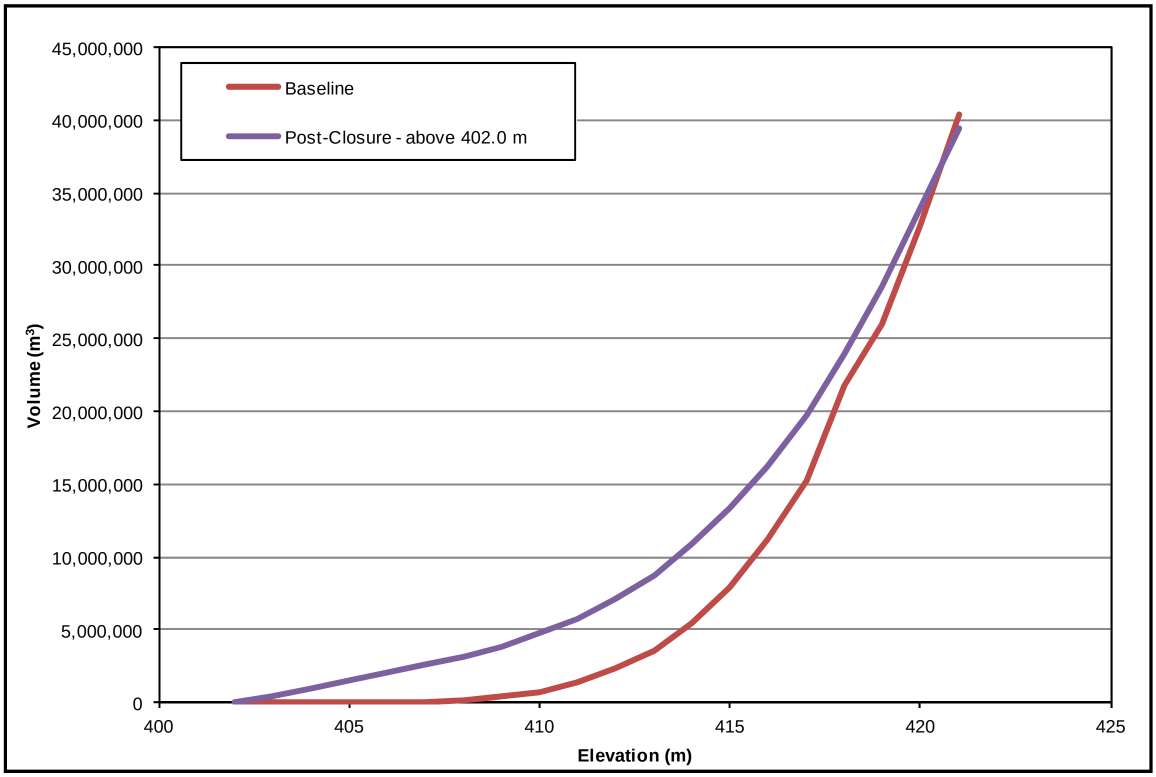
[(a)] Volume / Area.

[(b)] Replaced by fine PK.

masl = metres above sea level; m = metres = km2 = square kilometres; PK = processed kimberlite.

The reduced lake area will affect lake evaporation and evapotranspiration within the watershed and the annual outflow from Kennady Lake, while the increased land area will increase runoff to the lake. Due to the post-closure decrease in water surface area in Kennady Lake by 12.4%, post-closure flood peak discharges and water levels will slightly increase.

Figure GKP 14-1 Elevation-Volume Curves (above 402.0 m, based on the Supplemental Mitigation with Fine PKC Facility)



The recovery of Kennady Lake is described in Section 8.11.1.3.3 of the 2011 EIS Update (De Beers 2011). As described above, the Kennady Lake hydrological system will be restored once Dyke A is removed and the natural drainage of the diverted watersheds is reconnected to Kennady Lake. Water quality in the refilled lake will return to conditions suitable to support aquatic life. Therefore, the physical and chemical environment in Kennady Lake will be in a state that will allow re-establishment of an aquatic ecosystem. However, based on the long-term steady state projections for phosphorus in the refilled lake, a more productive ecosystem will result and be sustained over the long-term. The increased nutrient levels in the refilled Kennady Lake will facilitate phytoplankton and zooplankton community re-establishment and result in a more productive plankton community. The benthic invertebrate community will also be of higher abundance and biomass, reflecting the more productive nature of the lake. Due to the increases in the food base for fish (zooplankton and benthic invertebrates), and likely in the small-bodied forage fish community, there may also be increased growth and production in the large-bodied fish species of Kennady Lake. The full discussion relating to the effects of nutrient enrichment on Kennady Lake is included in Section 8.10.4.4.1 of the 2011 EIS Update under the *Effects of Changes in Nutrient Levels* pathway. It is expected that the fish species currently present in the lake will re-establish in the refilled Kennady Lake; due to biotic and abiotic factors, the community structure (i.e., relative abundances of the species) may differ.

However, based on the supplemental mitigation associated with the Fine PKC Facility presented in the 2012 EIS Supplement, the predicted long-term steady state phosphorus concentration is projected to be 0.009 milligrams per Litre (mg/L), which indicates that long-term trophic status in Kennady Lake will remain oligotrophic (i.e., less than 0.010 mg/L); this level is less than the maximum level that was presented in the 2011 Update. Although the increase in nutrients from baseline will result in a somewhat more productive lake, effects will be less than presented in the 2011 EIS Update based on a higher maximum. Furthermore, as described in Section 8.10.4.4.1 of the 2011 EIS Update, the upper levels of the open Hearne and Tuzo pits are likely to remain well-oxygenated through the winter due to their depths (i.e., greater than 100 m). It is expected that these pits will provide additional overwintering refugia for cold-water fish species, such as lake trout, due to the large volumes of cold, well-oxygenated water. These pit areas would likely also provide thermal refugia during summer. The 5034 Pit will be completely backfilled; if practicable, excess overburden materials will be spread over the pit area to provide lake bed substrate for the refilled lake.

The Preamble also refers the “temporary” nature of the impacts. De Beers recognizes that Areas 3 to 7 of Kennady Lake will be unavailable for fish during the life of the mine. As well, from discussions with Fisheries and Oceans Canada (DFO), it is recognized that compensation will be required for the dewatered, but otherwise physically unaltered areas that will be re-submerged at closure. De Beers is committed to continuing to work with DFO and communities on coming to agreement on the appropriate type of compensation for these areas as part of the ongoing development of the detailed fish habitat compensation plan. The objective of the detailed compensation plan will be to achieve no net loss of fish habitat according to DFO's Fish Habitat Management Policy (DFO 1986).

References

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

De Beers. 2011. Environmental Impact Statement for the Gahcho Kué Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review. July 2011.

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GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: GKP 15

Source: Gahcho Kué Panel

Subject: Cumulative Effects to Valued Components of the Terrestrial Environment

EIS Section: 7.4.1, 13.3.2

Preamble

EIS Section 13 - Cumulative Effects does not provide sufficient detail to evaluate the potential significance of each Key Line of Inquiry (KLOI) and Subject of Note (SON) because the assessment pathways that were considered are not clear.

For example, the caribou assessment provided in Section 13.5.1 notes that five primary pathways were considered, but only references two of these (direct habitat loss and fragmentation and indirect changes to habitat quality) were evaluated. It is not clear whether, or how, other pathways such as road and subsistence harvest mortality, and effects of cumulative contaminant ingestion from multiple mines sites were evaluated. Impacts and linkages for non-primary pathways are also unclear in the carnivore assessment, 13.5.2, other ungulates assessment, 13.5.3 and species at risk, 13.5.4.

During the EIS Analysis Session, De Beers (Day 1 Transcript beginning at page 162) noted that the EIS considered primary, secondary, and no linkage pathways and that although secondary linkage pathways may not have been explicitly discussed, they were considered in the cumulative effects assessment. However, EIS Section 7.4.1 (page 7-50) states that "Pathways with no linkage to caribou populations or that are considered minor are not analyzed further ....". Similarly, EIS Section 13.3.2 (page 13-9) suggests that the evaluation of significance considered only primary pathways.

Request

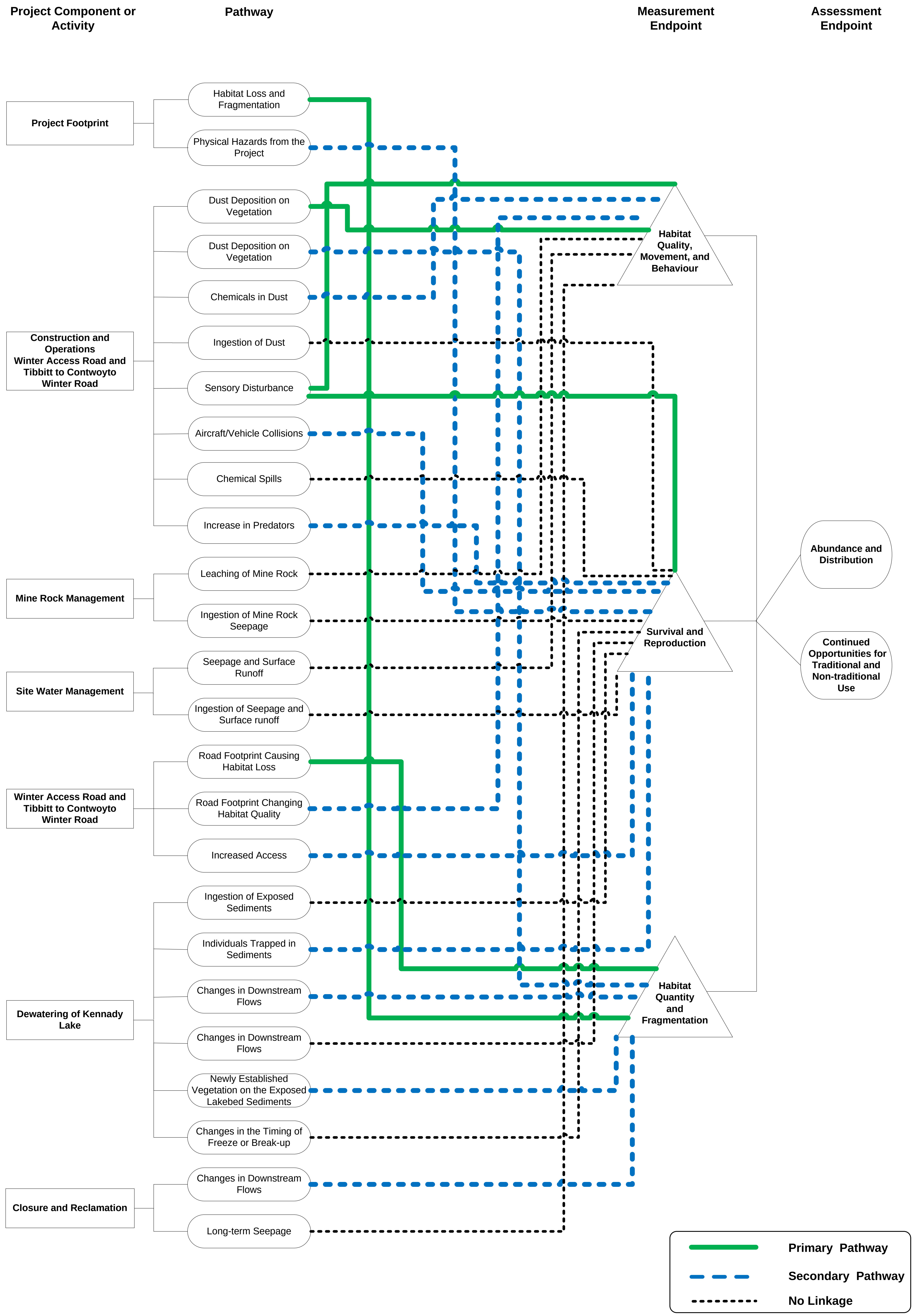
Please provide linkage diagrams [also referred to as impact hypothesis diagram] that shows all primary, secondary, and no linkage pathways that were considered in the EIS to reach the conclusions presented in Sections 13.5.1, 13.5.2, 13.5.3, 13.5.4. Ensure that if possible, the linkage diagrams show how interactions between pathways were considered (i.e., potential for additive, multiplicative, and synergistic effects), how effects on different seasonal ranges were integrated, and how results from this integrated scientific evaluation contributed to the evaluation of effects on sustainable use by people. Also provide a reference to where each pathway is described and assessed in the EIS.

Response

A linkage diagram for the assessment of impacts to caribou is provided in Figure GKP_15-1, which is a reproduction of information presented in Table 7.4-1 in the Key Line of Inquiry: Caribou of the 2010 Environmental Impact Statement (EIS). Figure GKP_15-1 also applies (with slight changes) to Table 11.10-5 (Subject of Note: Carnivore Mortality), Table 11.11-2 (Subject of Note: Other Ungulates), and Table 11.12-12 (Subject of Note: Species at Risk and Birds) (De Beers 2010). De Beers chose to present the pathway analysis for each Key Line of Inquiry and Subject of Note in table format rather than in a linkage diagram because a table provides more space for clearly describing each effects pathway, and the application of mitigation and environmental design features.

For caribou, the pathways illustrated in Figure GKP_15-1 are described and assessed in Sections 7.4.2.1 (pathways with no linkage), 7.4.2.2 (secondary pathways) and 7.5 (primary pathways) (De Beers 2010). For carnivores, no linkage and secondary pathways are assessed in Sections 11.10.3.2.1 and 11.10.3.2.2, respectively; primary pathways are assessed in Sections 11.10.4 and 11.10.5 (De Beers 2010). For other ungulates, no linkage and secondary pathways are assessed in Sections 11.11.3.2.1 and 11.11.3.2.2, respectively; primary pathways are assessed in Sections 11.11.4 and 11.11.5 (De Beers 2010). For species at risk and birds, no linkage and secondary pathways are assessed in Sections 11.12.3.2.1 and 11.12.3.2.2, respectively; primary pathways are assessed in Sections 11.12.4, 11.12.5 and 11.12.6 (De Beers 2010).

Figure GKP 15-1 Caribou Pathway Analysis



The potential for additive, multiplicative and synergistic effects was assessed through the pathway analysis and the subsequent effects analysis and determination of environmental significance. One objective of the pathway analysis was to be transparent and comprehensive so that all potential pathways were identified and assessed. A second objective was to determine the local-scale relationships that represent secondary mechanisms (pathways) of primary pathways, which can act independently or combine to produce larger scale effects.

As demonstrated in the 2010 EIS, the changes from most secondary pathways occur within the physical Project footprint. In some exceptions, effects are anticipated to extend a short distance beyond the Project footprint (such as dust). However, the combination of these pathways (additive, synergistic or multiplicative) is not producing incremental or cumulative effects beyond the local scale that are not captured by the primary pathways. In other words, the combination of Project-specific cumulative effects from secondary pathways on wildlife is captured in the more detailed analysis and assessment of significance of the primary pathways. All primary pathways are then considered together in determining the significance of incremental and cumulative effects from the Project and other developments on wildlife (e.g., Section 7.8 of the 2010 EIS).

Effects to sustainability of the caribou harvest were captured in the assessment endpoint ‘Continued Opportunity for Traditional and Non-Traditional Use’ (see Figure GKP_15-1). Changes in measurement endpoints (habitat quantity and quality, survival and reproduction) from primary pathways are used to predict effects on the abundance and distribution of the population, which is related to the availability of animals for human use. In other words, the assessment of the continued opportunity for traditional and non-traditional use of caribou is based on the predicted effects to abundance and distribution, which is determined by examining the lines of evidence from the quantitative and qualitative analyses of measurement endpoints.

Reference

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

Information Request Number: GKP 16

Source: Gahcho Kué Panel

Subject: Cumulative Socio-Economic Effects

EIS Section: 13.7, 13.3

Preamble

Section 13 of the Environmental - Cumulative Effects (De Beers 2010, Section 13) does not always provide sufficient detail to evaluate project significance of each Key Line of Inquiry (KLOI) and Subject of Note (SON).

The Assessment of Cumulative Effects to the Social Environment provided in Section 13.7.3 of the 2010 Environmental Impact Statement (EIS) (De Beers 2010) concludes that "... it is likely that the cumulative positive and negative effects of social disparity will continue, although the effect will likely be low and not significant" but provides limited support for this conclusion. The Language assessment provided in Section 13.7.4.1 (De Beers 2010) and the Cultural Landscape assessment provided in Section 13.7.4.2 (De Beers 2010) does not provide assessment conclusions.

Request

Please provide a linkage diagram [also referred to as impact hypothesis diagram] that shows all primary, secondary, and no linkage pathways that were considered in the 2010 EIS to reach the conclusions presented in Section 13.7.4.1 and 13.7.4.2 (De Beers 2010). Ensure that the linkage diagram shows how interactions between pathways were considered. Please indicate how the proposed project, in combination with other existing and reasonably foreseeable projects, will affect the cultural landscape using the impact criteria provided in Section 13.3.1 of the 2010 EIS (i.e., direction, magnitude, geographical extent, duration, reversibility, frequency, likelihood).

Please provide a conclusion of the overall significance of the Project in combination with other existing and reasonably foreseeable projects on the assessment endpoint for the socio-economic environment.

Response

Table GKP_16-1 below describes the assessment endpoints and measurement endpoints for the valued components associated with the Key Line of Inquiry (KLOI): Culture, Heritage and Archaeology, and the effect pathways as identified in the 2010 Environmental Impact Statement (EIS) Section 12, Table 12.5-1 (De Beers 2010, p. 12-117).

For the purposes of a socio-economic assessment, linkage diagrams do not provide an appropriately detailed description of effects to KLOI and Subjects of Note (SONs). A discussion of the valued components, effect pathways and assessment and measurement endpoints provides a clearer description.

Table GKP_16-1 Assessment and Measurement Endpoints for Key Line of Inquiry: Culture, Heritage and Archaeology

KLOI/SON	Valued Component	Effect Pathway	Assessment Endpoint	Measurement Endpoint
• Culture, Heritage and Archaeology	• Aboriginal language use • Changes to cultural landscape • Effects on archaeological sites	• Employees may lose language proficiency and other cultural skills (Primary) • The Project may result in changes that affect availability and enjoyment of wilderness and wildlife including fish, caribou, and other species , for harvesting or viewing (Primary) • The Project may result in new tourist operations in areas near the Project site (Secondary) • The Project may increase knowledge and pride as a result of cultural and archaeological studies (Primary)	• Continued opportunities for traditional pursuits • Persistence of knowledge and pride of culture and heritage • Persistence of historic and sacred sites	• Aboriginal language spoken at home • Time spent on traditional pursuits • Loss of archaeological resources • Gain in knowledge of archaeological resources • Level of information available for communities to tell their story • Publications by communities / for communities • Cultural programming in schools • Loss of Cultural landscape features

KLOI = Key Line of Inquiry; SON = Subject of Note.

Identification of assessment endpoints for Valued Components (VCs) in the 2010 EIS was determined primarily from the outcome of the community, public, and regulatory engagement process (MVEIRB 2006). Measurement endpoints, on the other hand, are defined as quantifiable (i.e., measurable) expressions of changes to the assessment endpoint. Measurement endpoints also provide key variables for study in monitoring and follow-up programs.

The 2010 EIS does not assign cumulative impact significance rankings for potential effects to the KLOI: Culture, Heritage and Archaeology because it is not possible to know the magnitude of the change for planned projects.

The 2010 EIS Section 13, Table 13.7-1 'Identification of Residual Project Effects that have Potential Cumulative Effects', affirms that there will likely be cumulative effects to Aboriginal language use, changes to cultural landscape and effects on archaeological sites from other diamond mining or mining projects in the Northwest Territories (De Beers 2010).

The cumulative effects analysis for language (De Beers 2010, Section 13.7.4.1) suggests that there is a "resurgence" in Aboriginal language use, or at the very least a slower decline than was anticipated when mining began at the end of the 1990s.

Aboriginal language use as a second language may actually be slightly increasing in some local study area (LSA) communities. This suggests that those individuals exposed to an Aboriginal language as a child may be retaining it into adulthood and that other language learning opportunities outside the home may be promoting retention as well. This is possibly a reaction to imposed policy and cultural changes, or a collective desire to maintain and expand traditional language use.

There has been, however, a noticeable and statistical decline in some languages. This decline is not attributed to mining or employment but, rather, on English media and mobility. Specifically, people will leave a community for economic opportunity in places where the dominant language is English.

The 2010 EIS Section 13.7.4.2 – Cultural Landscape also identifies that the cumulative effect of changes to the cultural landscape is of overall concern in the LSA communities (De Beers 2010). With the limited information available, it is difficult to predict what the cumulative effects may be to the cultural landscape of the LSA.

The eventual development of the East Arm National Park is a positive change to the landscape since it will help to protect both cultural and ecological values. People will not frequently see the reasonably foreseeable future projects due to their remote location, but will be aware of them, and this may cause changes to people's sense of place.

Archaeological site numbers are increasing as a result of the inventory completed in recent years (De Beers 2010, Section 12.8). Provided that appropriate mitigation or management continues to be completed in advance of development, the impact of sites may be prevented by avoidance, or compensated for by detailed archaeological investigations in advance of ground disturbing activities. The mitigation of sites through surface collection and excavation contributes to the archaeological database and is both a negative effect (site is disturbed or destroyed) and a positive effect (data are collected).

Table GKP_16-2 below presents the 'Classification of Residual Impact to Culture, Heritage and Archaeology' as found in 2010 EIS Section 12, Table 12.7-22 (De Beers 2010, p. 12-304).

Table GKP_16-2 Classification of Residual Impacts to Culture, Heritage and Archaeology

KLOI/SON	Valued Component	Direction	Magnitude	Geographic Extent	Duration	Likelihood
Culture, Heritage and Archaeology	Aboriginal Language Use	Negative	Low	Local	Long-term	Possible
	Changes to Cultural Landscape	Negative	Low	Local	Permanent	Highly likely
	Effects on Archaeological Sites	Negative and positive	Moderate	Local	Permanent	Highly likely

KLOI = Key Line of Inquiry; SON = Subject of Note.

The residual impacts are classified after considering the environmental design and other mitigation efforts by De Beers and the Government of the Northwest Territories (GNWT), as described in Table 12.7-21 'Summary of Mitigation for Culture, Heritage and Archaeology' (De Beers 2010, Section 12, p. 12-303).

The residual impacts of the application case to culture, heritage and archaeology are predicted to be not significant (De Beers 2010, Section 12, Table 12.8-1).

The Gahcho Kué Project and seven reasonably foreseeable and future projects are located in the Project regional and local study areas, and have been included in the cumulative impact assessment (De Beers 2010, Section 13, Table 13.4-1). Without any information about the cultural and heritage resource effects of these other projects it is not possible to determine the combined effect to culture, heritage and archaeology for cumulative effects in the Project assessment.

The 2010 EIS, Section 13, Table 13.7-1 (pg. 13-23) and Table 13.9-1 (pg. 13-24) indicates what valued components have the potential to have cumulative effects with a 'yes' or 'no' categorisation (De Beers 2010). With respect to the request to present the overall significance for each of the socio-economic valued components in consideration of existing and reasonably foreseeable projects, it is difficult for the proponent to assign significance for cumulative effects because it would pre-suppose value based judgments by regulators and stakeholders on the information presented in the EIS.

Reference

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

MVEIRB (Mackenzie Valley Environmental Impact Review Board). 2006. Reasons for Decision and Report of Environmental Assessment for the De Beers Gahcho Kué Diamond Mine, Kennady Lake, NWT.

Information Request Number: GKP 17

Source: Gahcho Kué Panel

Subject: Cumulative Terrestrial Effects

EIS Section: 7-91

Preamble

The De Beers 2010 Environmental Impact Statement (EIS) and presentations at the EIS Analysis Session cite several papers to support their conclusion that projected direct and indirect habitat loss is low relative to science-based 'critical thresholds'. For example, on page 7-91, the EIS states that cumulative direct disturbance to each seasonal range of the Bathurst herd is predicted to be less than or equal to 1.7%, and notes that "... this change is well below the 40% threshold value identified for habitat loss associated with declines in bird and mammal species... ". This conclusion may be misleading because the 40% value actually refers to the range at which numerical population effects increase more than expected, not the point at which numerical population effects begin to be observed. It is also inconsistent with Canadian analyses which have demonstrated that caribou are highly sensitive to comparatively low levels of direct habitat loss and alteration.

Request

1. Provide a summary of research and studies that relate total direct and indirect disturbance (anthropogenic and natural) to barren-ground caribou population performance and likelihood of persistence.

2. Describe the potential effects of cumulative habitat loss relative to natural influences at different points in the natural caribou population cycle (i.e., population low, population high, increasing population, declining population).

Response

1. To our knowledge, there are no studies that specifically relate total direct and indirect disturbance (anthropogenic and natural) to barren-ground caribou population performance and likelihood of persistence. However, a review of direct and indirect effects on caribou habitat use, behaviour and distribution (e.g., zones of influence), and population demography is provided in

Section 7.3.3.2 of the 2010 EIS (De Beers 2010). Both natural and human-related effects to caribou population ecology are discussed. Similarly, a summary of effects from natural and human disturbances on caribou behaviour, energy balance, and calf production is presented in Section 7.5.3.2.2 of the 2010 EIS (De Beers 2010).

To clarify, the 40% value for habitat loss was not used as a threshold to identify potential significant effects on caribou abundance and distribution, and the continued opportunity for traditional and non-traditional use of caribou. This value and other values in the literature were intended to provide context for estimated cumulative direct and indirect (functional) decreases to habitat, which vary from 1.7% to 7.3% across seasonal ranges. Responses to habitat loss and fragmentation vary by species and landscape type, and caution should be used when applying results from one situation to another. This is why a screening level value of 20% change (i.e., percent loss of habitat quantity and quality) was used to define a high magnitude effect for caribou, and other wildlife valued components (VCs) (De Beers 2010, Section 7.7.1.1).

2. The impact assessment considers the natural fluctuations in caribou herds (i.e., low, high, increasing, decreasing population). The analysis used data on the abundance, distribution and movement of caribou from 1995 to 2010. Data on the number and location of developments was also incorporated into the analysis for this time period, which captures the high and low trends in the abundance of the Bathurst herd.

   In the 2010 EIS, natural, temporal directional changes (i.e., not simply stochastic changes) in calf survival and parturition rates were incorporated into the simulated population models (De Beers 2010, Section 7.4.5.1.1, Figure 7.5-9). Calf survival was modeled to decline over time and reflected the range of demographic values reported for the Bathurst herd (0.80 to 0.28; Case et al. 1996; Gunn et al. 2005). Parturition rates were also modeled to decline over time and were based on values predicted from the energetic model (0.95 to 0.54). Follow-up work based on review comments of the 2010 EIS by the Department of Environment and Natural Resources also incorporated the effects of temporal variation in summer to autumn range conditions on parturition and calf survival that may be partially related to climate change events (i.e., by using increasing, decreasing, and average range condition scenarios). This work is captured in a memo entitled Additional Information Regarding Energetics, Population Viability Analysis, and Effects of Access from the Winter Road (dated December 15, 2011 that is publicly available through the Mackenzie Valley Review Board's website; Golder 2011).

One modelled scenario indicated that the magnitude of effects to the viability of the modeled population remained similar even with a substantial reduction in the carrying capacity of the landscape over a 30 year period. In other words, caribou are predicted to remain resilient to the cumulative direct and indirect habitat effects from the Project and other developments even under a hypothetical scenario of a decrease in range conditions due to climate change.

The current level of development within the annual and seasonal ranges of the Bathurst caribou herd is unlikely to have a strong influence on natural caribou population cycles (i.e., population growth rate). The Project footprint is predicted to decrease high and good quality habitat by less than 1.5% on the seasonal ranges relative to baseline conditions. The cumulative decrease in preferred habitat from the Project and other past, existing and future developments is approximately 7.3% on the autumn range, and less than 5% on the spring and post-calving ranges. The energetic models predicted that the Project would decrease parturition rates by less than 1%. These changes in habitat quality and parturition rates are predicted to not have significant adverse effects on caribou abundance and distribution. A recent review by Adamczewski et al. (2009) also indicates that effects from the mines are limited and unlikely a major contributing factor in the decline of the Bathurst caribou herd, relative to other environmental factors.

References

Adamczewski, J., J. Boulanger, B. Croft, D. Cluff, B. Elkin, J. Nishi, A. Kelly, A. D'Hont, and C. Nicholson. 2009. Decline in the Bathurst Caribou Herd 2006-2009: A Technical Evaluation of Field Data and Modeling. DRAFT Technical Report December 2009. Government of the Northwest Territories.

Case, R., L. Buckland, and M. Williams. 1996. The Status and Management of the Bathurst Caribou Herd, Northwest Territories, Canada. Northwest Territories Renewable Resources, File Report No. 116. 34 pp.

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

Golder (Golder Associates Ltd.). 2011. Technical Memorandum. Additional Information Regarding Energetics, Population Viability Analysis and Effects of Access from the Winter Road. Project No. 11-1365-0001/3030/DCN-042. Submitted to De Beers Canada Inc. (Veronica Chisholm and Stephen Lines) on December 15, 2011.

Gunn, A., J. Boulanger, and J. Williams. 2005. Calf Survival and Fall Sex Ratios in the Bathurst Herd of Barren-ground Caribou 2000-4. Northwest Territories Department of Resources, Wildlife and Economic Development. Manuscript No. 164. 75 pp.