ADDENDUM TO ENVIRONMENTAL CUMULATIVE EFFECTS ASSESSMENT

JERICHO PROJECT

Contwoyto Lake, Nunavut

Submitted to:
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Toronto, Ontario

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September 2003

VE51295

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EXECUTIVE SUMMARY

Cumulative impacts will occur at both site and regional scales. Site-related cumulative impacts will affect principally terrestrial and aquatic habitats with Project components altering different areas. On a site-specific basis impacts will be moderate, but on a sub-local level some impacts may be high, e.g. a 9 ha lake (Long Lake) will be completely removed as fish habitat; fish in the lake are limited to small populations of slimy sculpins and burbot.

With respect to regional cumulative impacts, only ecosystem components with large ranges or large areas of influence are likely to be affected by developments at the Jericho Diamond Project. The Jericho site and Lupin Mine are approximately 25 km apart by air. In fact, the separation on land is much greater, because Contwoyto Lake sits between the aforementioned locations. Any wildlife whose home range is greater than the land (air, in the case of birds) distance between sites could potentially experience a cumulative impact from the proposed development and the existing Lupin Mine. This would include at least the Bathurst caribou herd, grizzly bears, and Arctic wolves. However, it is expected that there will be no significant impact on wildlife and their use as an economic resource in the region.

The Jericho Diamond Project is one of several potential developments in the West Kitikmeot Region. Others include the existing Lupin Mine; proposed mines at Ulu, Izok Lake, Doris North, George Lake and Goose Lake; Bathurst Contwoyto Road; as well as continued mineral exploration throughout the area. Other than the Doris North Project, the proposed developments are contingent on commodity price increases and/or lowering of infrastructure and transportation costs; unnamed exploration activities are still in their early stages and therefore cumulative effects potential from these projects is uncertain.

1.0 INTRODUCTION

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

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

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

- Valued Ecosystem Components (VECs) and Valued Social and Economic Components (VSECs);
- significance of the cumulative environmental effects;
- Comments from the public that are received in accordance with the Canadian Environmental assessment Act and regulations;
- Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and
- Any other matter relevant to the assessment by a review panel (such as the need for the project and alternatives to the project) that the responsible authority the Minister after consulting with the responsible authority, may require to be considered.

This CEA is limited to those residual effects (post mitigation) on VECs resulting from past, present or reasonably foreseeable actions which occur within the area where a linkage between the residual effects of the Jericho Diamond Project (JDP) and the residual effects of other actions occurs. Due to the differences between assessing cumulative effects on VECs and VSECs and for the sake of simplicity the CEA for VSECs are presented in a separate report (Robert Hornal and Associates Ltd. 2003). For details on the baseline conditions in the JDP

and assessment of the potential environmental effects resulting from Project activities please refer to their respective sections in the Environmental Impact Statement (EIS) and addendums (Tahera 2003).

1.1 Background

This addendum to the JDP's Environmental CEA was developed to comply with requests for additional information from Indian and Northern Affairs Canada (INAC or DIAND), Department of Sustainable Development (DSD), Kitikmeot Inuit Association and Nunavut Tunngavik Incorporated (KIA/NTI), and Environment Canada as well as the Nunavut Impact Review Board (NIRB) Guidelines and requirements. These requests resulted from their review of the January 2003, JDP Final Environmental Impact Statement (FEIS) including the Jericho Project Environmental Cumulative Effects Assessment Report which was submitted for project approval and permitting by Tahera Corporation in January 2003.

1.2 NIRB Guideline Requirements

In April 2000, Paul F. Wilkinson & Associates Inc. submitted a Conformity Analysis Report to NIRB and NWB in response to their request to provide guidance on the extent to which the studies that Tahera had undertaken up until 1999 equipped them to produce an acceptable final EIS.

The conformity analysis passed judgement on whether the EIS addressed each of the requirements of the guidelines to which it is responding. The quality of the response was not addressed.

This CEA report addresses the portion of the conformity analysis which deals with CEA on VECs. The NIRB Guideline requirements presented below were extracted from the conformity analysis report.

> ***4.22 Cumulative Effects Assessment***
>
> *The Proponent shall **(1)** provide a brief overview of the theory and practice of Cumulative Effects Assessment ("CEA") and shall **(2)** justify the methodology adopted in relation to the design of the Project, its management, and the proposed approach to impact assessment.*
>
> *The Proponent shall **(3)** demonstrate how Project-specific CEA fits into regional planning initiatives. It shall assess the potential cumulative effects of the Project to determine its impacts in combination with **(4)** past, **(5)** current, or **(6)** probable future developments of diamond mines and other projects within a designated distance of the site of the Project determined in conformity with Subsection 4.15. The Proponent shall **(7)** determine which other human activities have affected or are likely to affect the same VECs, VSECs, or ecosystems as the Project. The Proponent shall **(8)** then predict the impacts of the Project in combination with*

*those of the other past, present, and reasonably foreseeable future projects, using the most appropriate methodology on a case-by-case basis that is capable of incorporating all of the relevant impacts. At a minimum, it shall **(9)** consider the cumulative effects of: other existing and proposed diamond mines in the region, including **(10)** those owned by BHP Diamonds Inc. and the Blackwater Group, **(11)** Diavik, and **(12)** potential future development at the Jericho site by the Proponent in the light of the results of current exploration; **(13)** gold and other precious and base metal mines and deposits; **(14)** the Echo Bay Mines winter road; **(15)** the possible construction of an all-weather road from Yellowknife to Coppermine and a port and southern road network on the Arctic Coast, as recommended by the Government of the NWT in 1994 (O'Reilly, 1996); **(16)** hunting and guiding; **(17)** exploration by other companies; and **(18)** the likelihood of the NWT Power Corporation's developing some or all of the potential power sites that it has identified in the Region.*

*The term "probable future development" is defined to mean: projects or activities that are currently under regulatory review, and those that will be submitted for regulatory review in the near future, as determined by the existence of a project description in the possession of a government department or agency. Nevertheless, where less precise information about a possible development exists, the Proponent shall **(19)** refer to it and shall **(20)** offer its opinion on whether it might need to be taken into account at a later date.*

*The Proponent shall **(21)** give due consideration to trans-boundary impacts, including **(22)** the effects of the Project outside Nunavut and **(23)** the interactions between the effects of the Project and **(24)** the effects of projects located outside Nunavut. **(25)** Transboundary effects originating from the Project should be clearly identified.*

*The discussion of cumulative effects shall include **(26)** a comparison of the incremental contribution of the Project to regional thresholds for VECs and VSECs, as established by the Proponent or by any other authoritative source, and shall **(27)** indicate to what degree a threshold is likely to be approached or exceeded. It shall also **(28)** acknowledge the influence of biophysical cumulative effects on socio-economic systems, and shall **(29)** evaluate how cumulative socio-economic effects might influence the regional environment.*

*The Proponent shall **(30)** describe and justify all **(31)** assumptions, **(32)** models, and **(33)** information limitations and **(34)** associated levels of uncertainty. It shall **(35)** explain its approach to handling the uncertainty associated with CEA.*

1.3 Summary of Additional CEA Information Request from the Kitikmeot Inuit Association and Nunavut Tunngavik Incorporated

In April 2003, the Kitikmeot Inuit Association and Nunavut Tunngavik Incorporated submitted the technical review of the JDP FEIS conducted by Rescan Environmental Services Ltd. (Rescan) on their behalf in a report titled *'Technical Review of Jericho Project Final Environmental*

Statement'. This CEA report addresses the CEA issues related to VECs which were identified in the Rescan report and are included below for reference.

Rescan Identified Issue

N° 27 Need for Regional Greenhouse Gas Comparison.

Rescan Recommendation

N° 27 Compare the Jericho CO_2 emissions with the 1996 total for Northwest Territories and Nunavut in section 5.1.2 of the Environmental Cumulative Effects Assessment.

1.4 Summary of Additional CEA Information Request from Nunavut Department of Sustainable Development

In May 2003, the Environmental Section of the DSD, Government of Nunavut submitted their review and evaluation of the JDP FEIS in a report titled *'Review and Evaluation of the Tahera Jericho Project Final Environmental Impact Statement'.* This CEA report addresses the CEA issues related to VECs which were identified in the DSD report and are included below for reference.

Air Quality

- The discrepancy between the distance from the Lupin gold mine to the JDP site included in the report of 100 km and the actual distance of 25 km and it's significance on the assessment of cumulative impacts from the projects combined emissions on air quality.

Terrestrial Wildlife and Avian Species

Effects on the Bathurst Caribou Herd: long-standing concern of the Government of the Northwest Territories and Government of Nunavut, and the people of the two territories, that human developments in the barren lands might result in "behavioural" habitat fragmentation for the economically, culturally and environmentally important Bathurst Caribou herd. Concerns included:

- Proximity of the kimberlite pipe proposed for development to lands that are an important confluence point for the herd moving toward the calving ground;
- Low confidence level in management practice described in the report for management of the effects of the Project and related activities on caribou; and
- Lack of citation in the EIA of published scientific studies or aspects of traditional knowledge that reflect an objective examination of underlying issues.

Recommendations included:

- For Tahera, to support the Government of Nunavut research on movements and demographics of the Bathurst Caribou population, although it is unclear what specific

triggers could be applied and to what effect should the project proceed and should there emerge any evidence of effects on caribou; and

- Development of monitoring plans which are both detailed in their objectives and design, and relate directly to opportunities to appropriately adjust operational activities when the data indicate a problem is emerging. Some of the proposed project components would clearly be difficult to adjust after the fact (e.g., open pit abandonment).

Vegetation

- Further evaluation of plant communities and the associated habitats as one of the VECs was not carried out into cumulative effects assessment.
- It was suggested that the effects resulting from physically disturbance of approximately 220 ha of plant communities and the associated habitats be analyzed in a regional content over a longer period of time (post project closure and abandonment phases).
- It was pointed out that the current capabilities for or limitations associated with the re-vegetation of the major community types described by Burt, 1999 were not discussed nor were the availability of land reclamation tools that work in this type of setting.

Cumulative effects

- It was felt that most of the cumulative assessment portion of the overall EIS of relevance to VECs simply re-stated the assertions about effects of the Jericho Project specifically, without truly evaluating "The effect on the environment that results from the incremental impact of proposed actions when added to other past, present and reasonably foreseeable future actions." (Appendix B.2.4).
- Suggestion was given to take a longer-term view of the expected delayed re-vegetation of the approximately 222 ha that would be directly disturbed. This represents both a pre-condition for longer-term habitat fragmentation as well as an area that would be added to incrementally by each operating and new mine, in the absence of tried and true techniques for accelerating the achievement of sustained, reasonably diverse plant communities.
- Under-emphasis in the EIS of the cumulative effect of multiple mine projects and transportation corridors on caribou, large carnivore, and raptor populations.

1.5 Summary of Additional CEA Information Request from Indian and Northern Affairs Canada

In May 2003, DIAND submitted their technical review of the January 2003, JDP FEIS in a report titled '*Technical Review of the Jericho Diamond Project Final Environmental Impact Statement: Submission to the Nunavut Impact Review Board*'. This CEA report addresses the CEA issues related to VECs which were identified in the DIAND report and are included below for reference.

DIAND's Conclusion and Rationale

- DIAND concluded that Tahera did not provide a rigorous assessment of potential cumulative effects, and, as such, DIAND feels that the assessment may have underestimated the cumulative effects to which the Jericho project will contribute.
- Their rationale included fundamental weaknesses identified in the CEA particularly with the following aspects:
  - inadequate description of the methodology, assumptions and justifications;
  - lack of a CEA analysis which is both traceable and reproducible, for example lack of consistency in addressing both VECs and VSCs (the methodology of CEA advocated in the Cumulative Effects Assessment Practitioner's Guide (1999) was not followed during the cumulative socio-economic effects assessment); and
  - explicit identification of the residual adverse effects on the VECs were not provided.

DIAND's Recommendations

- Provision of a more detailed CEA that explicitly identifies the residual adverse effects of the Jericho project and those similar effects resulting from other projects.
- Adoption of a consistent approach to the CEA with respect to the biophysical and socio-economic components of the environment.
- Inclusion of temporal dimension in the assessment, to ensure that the analysis is related to the expected duration of the residual adverse effects and those of other projects.

1.6 Summary of Additional CEA Information Request from Environment Canada

In May 2003 Environment Canada submitted their technical review of the January 2003, Tahera Corporation, JDP FEIS in a report titled *'Environment Canada, Technical Review, Tahera Corporation – Jericho Diamond Project, Final Environmental Impact Statement'*. This CEA report addresses the CEA issues related to VECs which were identified in the Environment Canada report and are included below for reference.

Environment Canada's Conclusion and Rationale

- The proponent has not collected the appropriate quantity and quality of baseline data to adequately determine the potential effects of the project on a number of the identified VEC's.
- Many aspects of the proponents proposed monitoring program are inadequate to ensure the protection of VEC's.

Environment Canada's Recommendations

- The proponent should collect, analyze, and interpret further baseline data and improve its proposed monitoring programs as per the recommendations made throughout the Environment Canada Technical Review report.
- The proponent should be mindful of employing best management practices in all phases of project development to help minimize potential impacts, including cumulative impacts, on the environment.
- The proponent will need to remain aware of developments under the Cumulative Effects Assessment and Management Strategy and Framework, in particular, the Regional Plan of Action for the Slave Geological Province. The proponent is encouraged to participate in these initiatives and to be aware of the potential impacts they may have on the proposed project.

1.7 Summary of NIRB Adjournment and Supplementary FEIS Decision for the Jericho Diamond Project FEIS

In August 2003, NIRB submitted their decision for the JDP FEIS in a report titled '*Nunavut Impact Review Board, Adjournment and Supplementary FEIS Decision for the Jericho Diamond Project Final Environmental Impact Statement, submitted by the Tahera Corporation*'. This report attempts to provide re-assessment of the Project's cumulative environmental impacts and address related issues brought up in the adjournment (included below for reference).

NIRB Conclusions and Rational

- Concerns were expressed over the fact that the FEIS does not address all future development or past projects as directed in the Guidelines.
- The Dene Committee questioned whether the Project, in combination with others in the area, might affect the migration routes of the Bathurst caribou, resulting in the deflection of herds from their normal routes and wintering grounds.
- The committee concluded that this would impact upon hunters who would have to travel longer distances to harvest caribou.
- Government of Nunavut pointed out the discrepancy between the distance from the Lupin gold mine to the JDP site included in the report of 100 km and the actual distance of 25 km and it's significance on the assessment of cumulative impacts from the projects combined emissions on air quality.

NIRB Requirements

- A comprehensive examination of all cumulative effects must be included in the Supplemental FEIS (SuppFEIS).
- Conclusions must be based on the data provided and any assumptions fully justified.

- All future developments or past projects must be addressed as directed in the Guidelines.
- Employment of consistent indicators and criteria in the assessment.
- Provision of discussion of the impact of cumulative effects on the migration routes of the Bathurst caribou.
- Correction of modeling study to take into account the actual distance of the Lupin mine and reassessment of the cumulative impacts on this basis.
- Identification of appropriate mitigation measures.

2.0 METHODOLOGY

The methodology used during this CEA follows the guidelines provided by the Canadian Environmental Assessment Agency (CEAA) in their February 1999 guide titled, '*Cumulative Effects Assessment Practitioners Guide*' taking into consideration the guidelines, comments and recommendations from NIRB, KIA/ NTI, DSD, INAC and Environment Canada (described above) as well as the use of professional experience and judgement of Tahera staff and their consultants.

2.1 Regional Issues of Concern

The issues of concern considered in this CEA were obtained from concerns and values expressed to Tahera during community consultation sessions, and from similar studies completed for other mining ventures that have been conducted in the central mainland tundra over the past ten years: the Izok Project proposed by Metal Mining Corporation in 1993, the NWT Diamonds Project (now EKATI™ Mine) in 1996, the Ulu Project by Echo Bay Mines Ltd. in 1997, and the Diavik Diamonds Project in 1998. The issues and concerns on cumulative environmental effects of the JDP in combination with other projects or activities that have been or will be carried out in the Slave Geological Region include but are not limited to the following:

- Visual quality of the region;
- Cumulative effects of combined emissions from the JDP and Lupin Mine on air quality;
- Cumulative effects of JDP and Lupin gold mine activities on environmental noise;
- Cumulative effects on groundwater quantity and groundwater levels;
- Cumulative effects on groundwater quality;
- Cumulative effects of sediment loading on receiving streams, lakes and wetlands;
- Cumulative effects on surface water quality;
- Cumulative effects on fish and fish habitat;

- Cumulative effects on permafrost and ground thermal regime;
- Cumulative effects on ecological land classification, terrain and biodiversity; and
- Cumulative effects on caribou, grizzly bears, caribou, carnivores, breeding birds and their respective habitats.

2.2 Valued Ecosystem Components

Valued Ecosystem Components (VECs) are defined as:

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

VECs considered included all physical and biological components of the environment assessed for potential Project impacts. As previously mentioned in the introduction, VSECs are considered in the Socio-Economic Impact Assessment (Robert Hornal and Associates Ltd. 2003). In developing VECs, reference was made to community consultations where people identified issues of concern. Issues raised by communities were very limited and very consistent: water quality, wildlife habitat, and wildlife (specifically caribou, grizzly, wolf, and wolverine). The VEC list considered for cumulative effects assessment for the JDP includes:

- Air quality;
- Water quantity and quality;
- Permafrost;
- Terrestrial vegetation (as the key component of wildlife habitat) and eskers;
- Aquatic habitat;
- Fish; and
- Caribou, muskox, carnivores (including grizzly bear, wolves, fox, and wolverines), raptors, and migratory birds.

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

2.3 Temporal Boundaries

Temporal boundaries varied with the component of the biophysical environment being considered. Temporal boundaries for wildlife, vegetation, and aquatic studies are presented in Table 2.2 and discussed in their respective sections. Were possible temporal boundaries were defined as the four project phases, associated with the proposed development, i.e., construction; operation; closure; and post-closure.

After project approval, it is anticipated that the infrastructure will be completed within one and a half years. Construction is to begin in January of Year 1 and commercial operation will commence in March to May of the same year. The mine will have an expected operating life of eight years. Closure is expected to be completed by approximately one year later. Post-closure activities will end in approximately five years after closure, depending on regulatory requirements and post-closure monitoring.

2.4 Spatial Boundaries

Spatial boundaries for cumulative effects assessment vary with the component of the environment being considered. In Nunavut and Northwest Territories data are lacking from which to make a quantitative decision on spatial boundaries for many VECs. Hegmann, et al. (1999) suggest an adaptive approach be used in setting spatial boundaries and this is especially appropriate for the Jericho Project. Boundaries should be flexible so they can be moved, should the introduction of relevant new information suggest current boundaries are inappropriate for the VEC in question. Guides suggested by Hegmann, et al. in setting spatial boundaries include but were not limited to:

- Establishing a regional study area that includes the areas where there could be possible interactions with other human activities, considering the interests of other stakeholders;
- Considering the use of several boundaries, one for each environmental component (dictated by the guide above);
- For terrestrial VECs, such as vegetation and wildlife, selecting ecologically defensible boundaries wherever possible;
- Providing for expansion of boundaries sufficiently to address the cause-effect relationships between actions and VECs (if known or knowable);
- Characterizing the abundance and distribution of VECs at a local, regional, or larger scale if necessary, and ensure that the boundaries take this into account;
- Determining if geographic constraints limit cumulative effects within a relatively confined area near the activity;
- Characterizing the nature of pathways that describe the cause-effect relationships (where known) to establish a "line-of-inquiry"; and

- Setting boundaries at the point at which cumulative effects become insignificant.

Because of the general lack of information, professional judgement is required to use most of these guides in Nunavut. Assessing the potential for cumulative impacts required collection of appropriate baseline data now, and will require a commitment to monitoring programs in the future. Tahera Corporation provided funding for regional studies carried out by WKSS. Monitoring programs associated with the Jericho Diamond Project are discussed in the Environmental Monitoring Plan (see JDP FEIS, Appendix B.3.3) and will be negotiated in detail during the permitting process.

Spatial boundaries chosen and the rationale are presented in Table 2.2 and discussed in each VEC section.

2.5 Actions Considered

Guidelines established by some other agencies, subsequent to the Canadian Environmental Assessment Office policy, have broadened the scope of projects to be considered. The guidelines prepared for Tahera by the Nunavut Impact Review Board require consideration of the following:

- EKATI™ Diamond Mine (including expansion) (EKATI™);
- Diavik Diamond Mine (DDM);
- Potential future developments at the JDP site;
- Gold and other precious and base metal mines and deposits;
- The Echo Bay Mines winter road;
- The possible construction of an all-weather road from Yellowknife to Coppermine and a port and southern road network on the Arctic coast;
- Hunting and guiding (no indication of what should be included or excluded);
- Exploration by other companies; and
- The likelihood of the NWT Power Corporation's developing some or all of the potential power sites that it has identified in the Region.

This list opens the assessment to considerable speculation; many activities are unknown, very transitory, variable from year to year, and of low to negligible local impact and no regional impact. This assessment is therefore limited to activities for which there is a project description in the public record, typically in support of exploration or development activities.

2.5.1 NWT Power Corporation's Potential Power Site Developments

Figure 2.1 shows the location of power projects that have been considered by NWT Power. No projects are being actively considered at the time of writing of this report. Two prospective sites are located on the lower Burnside River just upstream from its mouth and 220 to 240 km downstream of JDP, on Bathurst Inlet: Burnalde Falls and Lower Burnside. In September 2003 Paul Greisman and Donald S. Dunbar completed a numerical simulation of the dilution of JDP Polishing Pond effluent discharge into Lake C3 and Carat Lake which are located upgradient of Burnside River within the Burnside River watershed (see dilution model submission). Results from their model demonstrated that although the dilution ratio of Lake C3 will likely be very low during worst case low flows (particularly in close proximity to the inflow from the Processed Kimberlite Containment Area (PKCA)), the dilution in Carat Lake is very likely to remain above 100:1 and never below 120:1 at the intake at the end of the causeway. Given this information, the distance from Carat Lake outflow to Burnalde Falls and Lower Burnside which will offer further dilution, along with results from previous aquatic studies conducted for the JDP and JDP's commitment to meets their water licence effluent discharge criteria, the three actions are not likely to cause cumulative effects on the water quality of Burnside River; i.e., the influence of the Jericho Project on Burnside River water quality will be undetectable. Other proposed hydro projects are on drainage systems remote from the Jericho site (e.g. the lower Coppermine River). Off-site impacts to caribou migration have been assessed to be insignificant (Diavik 1998, Hubert and Associates Ltd. 2002) and the ranges of other terrestrial fauna known to occur at hydro power sites would not overlap with JDP actions. Potential residual effects from JDP actions on each of the other VECs (air quality, permafrost, wildlife habitat, muskox, carnivores (including grizzly bear, wolves, fox, and wolverines), raptors, and migratory birds) were assessed to be local and subregional (limited to a few kilometers around the site, Tahera FEIS). No cumulative effects from JDP, Burnalde Falls and Lower Burnside actions are likely to accrue to VECs.

2.5.2 All-Weather Roads

The only active all-weather road proposal for the West Kitikmeot at present is the Bathurst Inlet to Contwoyto road and this is the only all-weather road proposal that has therefore been considered. The other access road proposals have been proposed over the past 40 years with no concrete results (Diavik CSR, CEAA1999), and will not be considered for this project.

The Bathurst Inlet Port and Road Project would involve construction of a port on Bathurst Inlet, a 211 km road to Contwoyto Lake, and an all weather road to the Izok mineral deposit. Crossing of Contwoyto Lake would be via ice road in winter and barge in summer (Bathurst Inlet Port and Road Joint Venture 2002). The following brief summary is based on a draft project description submitted by the Joint Venture to the NIRB. The road would supply the existing Lupin and EKATI™ mines, the Diavik Mine under construction, and the proposed Izok Lake and Jericho mines. It would replace the current Lupin winter road, i.e., all the industrial traffic currently using the present road would switch to the Bathurst Road.

Road construction is scheduled from October 2004 from Bathurst Inlet and from February 2005 from Contwoyto Lake provided that Road Project approval and funding is granted. The Lupin – Izok Lake leg will begin February 2006. Road construction is scheduled to be completed in October 2006. There will also be two barge terminals on Contwoyto Lake; the east terminal will include a 20-person camp, a small maintenance shop, and a truck parking area. During operation, an estimated 45,000 tonnes of fuel and supplies will be hauled west over the road to operating mines. From 300,000 to 470,000 tonnes per year of concentration will be hauled east from Izok Lake Mine. Summer barge operation will be from mid July to mid October.

No heavy hauling will occur in May and June, when the Bathurst caribou herd may be migrating across the road route north. To the extent that traffic switches from the Yellowknife-Lupin winter road to the Bathurst road, no incremental effects on caribou will occur, although the effects of road traffic may not be less. Caribou will have the right-of-way on the road and traffic will be halted for large groups of migrating caribou on the road.

From the perspective of cumulative effects arising from the Jericho Project, impacts would be similar, or less, than those that would occur from Jericho's use of the current Lupin winter road. Impacts on caribou from transportation activities could be lessened since the campaign hauling nature of the all weather road could be reduced, except for the Contwoyto Lake to Jericho leg. Further, the winter haul could largely take place in February and March, prior to the appearance of any caribou in the Jericho area, since lakes freeze sooner at this latitude than in the Yellowknife area.

2.5.3 Hunting and Guiding

Hunting and guiding activities are moderate impact in a regional sense. The cumulative effect of all hunting activities on the Bathurst caribou herd is an estimated 14,500 to 18,500 animals harvested annually (WKSS 1999). The JDP will not involve the harvesting of caribou, nor result in the death of caribou, except possibly by accident; accidents will be mitigated as described in the Environmental Management Plan (Appendix B.3.1). Therefore, no measurable cumulative effects are expected from mining at the Jericho site in combination with hunting and guiding activities. Cumulative effects of guiding and hunting activities were considered in the wildlife effects report prepared by Hubert and Associates (Appendix B.2.2). Hubert and Associates concluded the following:

- The environmental effects from the Project on wildlife do not extend beyond the life of the Project, and will not be detectable in any wildlife population;
- No residual effects are predicted; and
- No measurable cumulative environmental effects are foreseen for wildlife populations in the Project area or region.

The active JDP, with its no-hunting and policy strategy of co-existence within property boundaries, will actually provide a safe haven for wildlife.

2.5.4 Mineral Exploration

Most mineral exploration is transitory, very localized, and very low impact. The vast majority of temporary camps are in place for a matter of one to a few years, the footprint of the camps is relatively small (a few ha. at most), and no heavy equipment or extensive land disturbance are involved (various NWT Preliminary Screening reports 2003-2004 from MVRMA – Preliminary Screenings web site 2003). Disturbance is limited to the physical presence of the camp and the noise of human activities, both of which are very localized. While concentrated helicopter-supported exploration may lead to significant wildlife disturbance in an area, the JDP would not contribute to this effect since:

- Exploration will continue throughout the mine's life and facilities at the mine or the current exploration camp will be used by exploration crews, depending on the complement of mine personnel on site (space availability in the accommodation complex) and the size of the exploration crew.;
- Exploration crews to date have ranged between 4 and 20 people and further exploration will likely be within this range;
- No new facilities will be required to accommodate exploration crews at Jericho;
- No mineral exploration by other outfits will occur close to the JDP, as Tahera Corporation holds the rights to explore for minerals around the JDP (see Map G, Jericho FEIS); and
- Use of aircraft for exploration at Jericho has not resulted in significant impacts to wildlife to date and is not expected to in the future.

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

2.5.5 Mining Projects

Advanced projects that are considered in this assessment include the following:

- Izok Lake deposit (Izok);
- Ulu Gold deposit (Ulu);
- George and Goose Lake Project (Goose Lake);
- Doris North Project (former BHP Doris and Boston) (DNP); and

- De Beers Snap Lake Diamond Project (SLDP).

Published records were relied upon for descriptions of current activities at the sites. Information provided by DIAND, and not readily available, was included in the Jericho FEIS Environmental Cumulative Effects Assessment, Appendix B.2.4. Information on other mining projects is in the public record. Existing (or approved) mines included in the evaluation are:

- Lupin Gold Mine (Lupin);
- EKATI™ (including EKATI™ Sable expansion); and
- DDM.

The proposed Sable expansion is judged not to add significantly to regional cumulative effects, although it may affect site cumulative effects at EKATI™ Mine. The principal reason for this conclusion is that winter road haulage (the only shared component between Jericho and the southern diamond mines) will not significantly affect caribou northward migration as explained in Section 1.15 of the Environmental Impact Assessment (EIA) (Tahera FEIS, Appendix B.2.1).

As discussed in the Project Description (Tahera FEIS, Appendix A.1), any expansion at Jericho would depend on finding further economic resources and would likely trigger a new environmental impact assessment.

Table 2.1: Projects with Potential Linkages Considered in the Cumulative Effects Assessment

Project	Project Phase	Type of Development	Total Footprint (km^2)	Predicted Duration (years)	Through Put at Peak Production (t/d)	Approximate Distance from Jericho Mine (km)
JDP	permitting	open pit	2.2	8	900	
Lupin	operational (since 1982**) suspended operations (August 2003**)	underground	11.5	27	1,830	25 SE
Tibbitt-Contwoyto winter road	operational	seasonal winter ice road	2.6	indefinite	not applicable	25
Izok	permitting / on hold (since 1993)	open pit	not available	not available	3,000 ore + 11,000 now grade (waste material	50 SW
Ulu	development / on hold (since 1993)	underground	not available	not available	not available	140 NE
Goose Lake	permitting / exploration	mine (not defined)	not available	not available	not available	~210 SE
SLDP	approved (2003)	underground	6.4	26	3,000	270 S

Project	Project Phase	Type of Development	Total Footprint (km^2)	Predicted Duration (years)	Through Put at Peak Production (t/d)	Approximate Distance from Jericho Mine (km)
EKATI^{tm} (including expansion)	operational / development (1997 and 2003)	open pit	24.5	17	10,000-18,000	170 SE
DDM	operational (since 2003)	open pit	6.2	20	4,100	170 SE
DNP	permitting	underground	0.3	2	621	280 NE

Note:
km^2 = square kilometres
t/d = tonnes per day
km = kilometres
This table contains information from the DeBeers 2002 Snap Lake EIA Report which was updated where possible with current information from the sites listed below:
* Information obtained from the Diavik Diamond Mines web site at http://www.diavik.ca/html/diavik_diamonds_project.html
** Information obtained from the Kinross Gold Corporation web site at http://www.kinross.com/news/030813.htm

Due to the lack of information for the Goose Lake Project, its cumulative effects with other actions will not be considered further in this CEA.

2.5.6 Assessment of Spatial and Temporal Overlap

Table 2.2: Assessment of Spatial and Temporal Overlap between JDP and other Actions

VEC	Action	RSA	Duration	Rational	Overlap with JDP
Air System	JDP	Beyond the sub-regional boundary and within 100 km from the site.	Construction, operation, and closure (~2004-2013).	Air emissions from mining activities impact an area within 10 km of the centre of the mine pit (Tahera 2003).	--
	Lupin	Not available.	Construction, operation, and closure (1982-2009).	A very conservative estimate of cumulative impacts can be made by assuming the emissions concentrations at 10 km and 15 km range from the JDP are doubled, i.e., equal to the maximum Jericho concentrations at source. This yields approximately: a maximum 1-hour concentration at 15 km for NOx of 200 µg/m^3 and for SO_2 of 50 µg/m^3; and a 24-hour PM_{10} without mitigation of 50 µg/m^3 and with mitigation of 20 µg/m^3 which meet Canadian Air Quality Objectives. Given the predominant NNE to WSW wind direction at Jericho and predominant E to W wind direction at Lupin, the actual contaminant concentration in air are not expected to reach the above stated values .	Never spatial; Potential temporal

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	Tibbitt-Contwoyto winter road	Not considered.	Not considered.	Serving mine sites increases the volume of the cargo on the Project's road but does not increase the environmental effects of the Project in that it directs existing cargo volumes to their destinations by way of a shorter and more economical route (Bathurst Inlet Port and Road Joint Venture 2002).	Never spatial; Potential temporal
	Izok	Not available.	Not available.	Not included in assessment due to distance away from the JDP and unavailability of information.	Never special; Potential temporal
	Ulu	Not available.	Not available.	Not included in assessment due to distance away from the JDP and unavailability of information.	Never special; Potential temporal
	SLDP	Between 29 and 49 km from the site, depending on the direction.	Construction, operation, and closure (~2003-2027).	Size and shape of the regional study area was determined from wind direction and speed (DeBeers 2002).	Never spatial; Often temporal
	EKATI™ (including expansion)	25 km E-W by 35 km N-S area, centred between the Diavik and Misery sites (Diavik 1998b); 40 km by 40 km area encompassing the Misery and Sable sites, centered at the main EKATI™ facility (BHP, 1995).	Project development to mine closure (~1997-2014).	The cumulative effects assessment for air quality is limited to the regional area where regulations and/or guidelines are applicable (BHP 2000).	Never spatial; Often temporal
	DDM	Area 25 km east-west by 35 km north-south centred around East Island.	Construction, operation, and closure (~2003-2023).	The RSA encompasses the entire area within which ambient concentrations are likely above the thresholds commonly used to define the distance from the emissions sources to locations where modeling is no longer necessary (Diavik 1998).	Never spatial; Often temporal
	DNP	The Hope Bay Belt.	Construction, operation, and closure (~2004-2006).	Additional exploration activities included in the development plan are limited to continued exploration within the Hope Bay Belt (RSA) and underground exploration from the project's underground workings to the ore deposit under Doris Lake (Miramar 2003).	Never spatial; Often temporal

VEC	Action	RSA	Duration	Rational	Overlap with JDP
Surface Water (Water Quality, Quantity)	JDP	Burnside River system.	All phases of the Project (~2004-2018).	The Jericho Site is located within a small catchment basin (227 km^2) that drains to the northeast via the Jericho River. The Jericho River eventually joins the Burnside River, which flows to the Arctic Ocean. To allow examination of the effects of the proposed project on a regional basis, the catchment basins of Carat Lake and Contwoyto Lake (950 km^2) were used as the regional study area (Tahera 2003).	--
	Lupin	Contwoyto Lake watershed.	All phases of the Project (1982-2009).	Watershed where mine is located.	Partial spatial overlap; Potential temporal overlap
	Tibbitt-Contwoyto winter road	Includes the Contwoyto Lake watershed.	All phases of the Project.	Considered the watershed which overlaps with the watershed where the JDP will be situated.	Partial Spatial overlap; Potential temporal overlap
	Izok	Coppermine River drainage system.	All phases of the Project.	Watersheds where development will occur.	Never special; Potential temporal
	Ulu	Hood River drainage system.	All phases of the Project.	Watersheds where development will occur.	Never special; Potential temporal
	SLDP	Lockhart River watershed.	Construction, operation, and closure (~2003-2028).	The spatial boundary for hydrology and water quality was based on hydrologic and terrain studies. Results indicated that Snap Lake is located in the Lockhart River drainage basin. Water from Snap Lake drains into MacKay Lake which eventually drains into the East Arm of Great Slave Lake (at Reliance) via Aylmer Lake, Clinton-Colden Lake and Artillery Lake (DeBeers 2002).	Never special; Often temporal
	EKATI™ (including expansion)	Yamba/Exeter Watershed and Koala Watershed.	All phases of the Project (~1997-2037).	Watersheds where development will occur.	Never special; Often temporal

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	DDM	Drainage basin of Lac de Gras.	All phases of the Project (~2003-2033).	The regional study area was selected to present effects in a regional context which is most appropriate for assessing effects on fish populations in Lac de Gras and water quality in Lac de Gras as a whole. Given concerns raised, the regional study area was expanded to include the Coppermine River and the Echo Bay winter road for assessment of potential cumulative effects (Diavik 1998).	Never special; Often temporal
	DNP	Includes the Doris Lake and the adjacent Roberts Lake watersheds plus the outlet of Little Roberts Lake.	All phases of the Project (~2004-2036).	Includes the watersheds within the Projects area of direct impact.	Never special; Often temporal
Perma frost	JDP	Not considered	Not considered	Residual impacts on permafrost resulting from combined Project actions will be of low magnitude (see SRK submission). No linkage exists between effects on permafrost from the JDP and other actions.	--
	SLDP	The RSA is defined as the area within a 31 km radius of the centre of the active mine site.	Construction, operation, and closure (~2003-2028).	One RSA is defined for Terrestrial Resources since these resources are closely linked. The RSA is based on project-related effects and wildlife species attributes (DeBeers 2002).	None
	EKATI™ (including expansion)	Not considered.	Not considered.	The consideration of the combined effects of development activities on a stationary VEC such as permafrost is not considered applicable beyond the limits of the immediate development area. The residual effects of the proposed … development on permafrost have been determined to be negligible (BHP 2000).	None
	DDM	Not considered.	Not considered.	Likely no effects from changes to vegetation/terrain from winter projects and activities. Non-winter projects and activities insignificant residual effects.	None
	Lupin	Not considered.	Not considered.	Although information was not available on the permafrost conditions at Lupin residual effects of development on permafrost typically occur within the immediate development area. Given that Lupin is located 25 km SE from the JDP there in no linkage between effects of JDP and Lupin actions on permafrost.	None

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	Tibbitt-Contwoyto winter road	Not considered.	Not considered.	The rough base course of rock for the alignment will be laid down in winter and so reduce thaw penetration the following summer. The additional courses of -150 mm and -50 mm crushed rock are expected to ensure that the permafrost profile migrates into the base of the road to ensure terrain stability to the road bed (Bathurst Inlet Port and Road Joint Venture 2002).	None
	DNP	Hope Bay Belt.	Construction, operation, and closure (~2004-2006).	No component of the Doris North Project will have irreversible effects on permafrost. Furthermore, the permafrost in the Doris North Project area will not be affected by any other project in the region and so no cumulative effects on permafrost in the project area are expected.	None
	Izok	Not considered.	Not considered.	Residual effects will be limited to the mine footprint and adjacent area. No linkage exists between effects on permafrost from the Izok and JDP actions.	None
	Ulu	Not considered.	Not considered.	Residual effects will be limited to the mine footprint and adjacent area. No linkage exists between effects on permafrost from the Izok and JDP actions.	None
Terrestrial Vegetation and Eskers	JDP	The central barren lands area encompassing range of the Bathurst Caribou herd.	Construction, operation, and closure (~2003-2023).	An environmental effect of regional significance would affect a broad area or resource base of common interest to a large number of people (Tahera 2003).	--
	Lupin	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project (1982-2009).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Tibbitt-Contwoyto winter road	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project (indefinite).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Izok	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	Ulu	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	SLDP	The RSA is defined as the area within a 31 km radius of the centre of the active mine site.	Construction, operation, and closure (~2003-2028).	One RSA is defined for Terrestrial Resources since these resources are closely linked. The RSA is based on project-related effects and wildlife species attributes (DeBeers 2002).	Non spatial; Often temporal
	EKATI™ (including expansion)	Not considered.	Not considered.	Negligible ratings for all residual effects associated with vegetation, and the fact that these effects are not detectable at the WEMP boundary, warrant the elimination of vegetation from a more detailed cumulative effects assessment.	None
	DDM	Drainage basin of Lac de Gras.	Construction, operation, and closure (~2003-2023).	Study area was selected because it is representative of the areas that could be affected by the proposed project. The regional study area provides the context for understanding effects at the regional level (Diavik 1998).	Non spatial; Often temporal
	DNP	A narrow strip 30 km wide extending approximately 90 km inland from the coast of Roberts Bay centred on the Koignuk River.	All phases of the Project (~2004-2036).	Vegetation present in the Hope Bay study area (RSA) has been described in reports produced by Rescan in 1996 and 1997 through the application of a national classification system that provided a framework for describing ecological patterns across the country. The ecosystem classification is based on characteristic combinations of landforms, climates, soil and water conditions that support ecological units of vegetation and biota resulting in a specific association (Miramar 2003).	None spatial; Sometimes temporal.
Aquatic Habitat	JDP	Same as surface water.	All phases of the Project (~2004-2018).	Same as surface water	--
	Lupin	Contwoyto Lake watershed.	All phases of the Project (1982-2009).	Watershed where mine is located.	Partial spatial overlap; Potential temporal overlap
	Tibbitt-Contwoyto winter road	Includes the Contwoyto Lake watershed.	All phases of the Project.	Considered the watershed which overlaps with the watershed where the JDP will be situated.	Partial Spatial overlap; Potential temporal overlap

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	Izok	Coppermine River drainage system.	All phases of the Project.	Watersheds where development will occur.	Never special; Potential temporal
	Ulu	Hood River drainage system.	All phases of the Project.	Watersheds where development will occur.	Never special; Potential temporal
	SLDP	Lockhart River watershed.	Construction, operation, and closure (~2003-2028).	The spatial boundary for fish and fish habitat was based on hydrologic and terrain studies. Results indicated that Snap Lake is located in the Lockhart River drainage basin. Water from Snap Lake drains into MacKay Lake which eventually drains into the East Arm of Great Slave Lake (at Reliance) via Aylmer Lake, Clinton-Colden Lake and Artillery Lake (DeBeers 2002).	Never special; Sometimes temporal
	EKATI™ (including expansion)	Yamba/Exeter Watershed and Koala Watershed.	All phases of the Project (~1997-2037).	Watersheds where development will occur.	Never special; Sometimes temporal
	DDM	Drainage basin of Lac de Gras.	All phases of the Project (~2003-2033).	The regional study area was selected to present effects in a regional context which is most appropriate for assessing effects on fish populations in Lac de Gras and water quality in Lac de Gras as a whole. Given concerns raised, the regional study area was expanded to include the Coppermine River and the Echo Bay winter road for assessment of potential cumulative effects (Diavik 1998).	Never special; Sometimes temporal
	DNP	Includes the Doris Lake and the adjacent Roberts Lake watersheds plus the outlet of Little Roberts Lake.	All phases of the Project (~2004-2036).	Includes the watersheds within the Projects area of direct impact.	Never special; Often temporal
Aquatic Resources (Fish)	JDP	Same as surface water.	All phases of the Project (~2004-2018).	Same as surface water	--
	Lupin	Contwoyto Lake watershed.	All phases of the Project (1982-2009).	Watershed where mine is located.	Partial spatial overlap; Potential temporal overlap
	Tibbitt-Contwoyto winter road	Includes the Contwoyto Lake watershed.	All phases of the Project.	Considered the watershed which overlaps with the watershed where the JDP will be situated.	Partial Spatial overlap; Potential temporal overlap

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	Izok	Coppermine River drainage system.	All phases of the Project.	Watersheds where development will occur.	Never special; Potential temporal
	Ulu	Hood River drainage system.	All phases of the Project.	Watersheds where development will occur.	Never special; Potential temporal
	SLDP	Lockhart River watershed.	Construction, operation, and closure (~2003-2028).	Same as for aquatic habitat.	Never special; Often temporal
	EKATI™ (including expansion)	Yamba/Exeter Watershed and Koala Watershed.	All phases of the Project (~1997-2037).	Watersheds where development will occur.	Never special; Often temporal
	DDM	Drainage basin of Lac de Gras.	All phases of the Project (~2003-2033).	The regional study area was selected to present effects in a regional context which is most appropriate for assessing effects on fish populations in Lac de Gras and water quality in Lac de Gras as a whole. Given concerns raised, the regional study area was expanded to include the Coppermine River and the Echo Bay winter road for assessment of potential cumulative effects (Diavik 1998).	Never special; Often temporal
	DNP	Includes the Doris Lake and the adjacent Roberts Lake watersheds plus the outlet of Little Roberts Lake.	All phases of the Project (~2004-2036).	Includes the watersheds within the Projects area of direct impact.	Never special; Often temporal
Caribou	JDP	The central barren lands area encompassing range of the Bathurst Caribou herd.	Construction, operation, and closure (~2003-2023).	An environmental effect of regional significance would affect a broad area or resource base of common interest to a large number of people (Tahera 2003).	--
	Lupin	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project (1982-2009).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Tibbitt-Contwoyto winter road	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project (indefinite).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	Izok	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Ulu	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	SLDP	Slave Geological Province (SGP).	Construction, operation, and closure (~2003-2027).	Using the above definition of a biological population, the Bathurst caribou herd represents a single population. Annual migration and annual home range size in caribou are largely inseparable, and during the northern and southern migration caribou may be influenced by all projects within the SGP. Annual home range for the Bathurst caribou herd is approximately 250,000 km^2 (DeBeers 2002).	Partial spatial; Sometimes temporal
	EKATI™ (including expansion)	Bathurst herd migration corridor except for calving grounds around Bathurst Inlet or traditional wintering range below treeline.	All phases of mine development exploration to decommissioning (~1997-2037).	Temporal boundaries were selected to cover potential effects from development activities for the life of the proposed Sable, Pigeon and Beartooth development (BHP 2000).	Partial spatial; Sometimes temporal
	DDM	SGP	Construction, operation, and closure (~2003-2023).	Study area was selected to effectively represent and assess the diversity in patterns of use by wildlife. Regional study area provides a framework for assessing effects on species that have large seasonal ranges. Migratory species that use an area seasonally are also considered using these study area. Some projects outside of, but with activities occurring within, the regional study areas were included in cumulative effects assessment (Diavik 1998).	Partial spatial; Sometimes temporal
	DNP	A narrow strip 30 km wide extending approximately 90 km inland from the coast of Roberts Bay centred on the Koignuk River.	All phases of the Project (~2004-2036).	Based on wildlife studies conducted by Rescan of terrestrial wildlife in the Hope Bay belt during 1996 and 1997 which included a classification of bioterrain and terrestrial ecosystem units of the area.	Partial spatial; Sometimes temporal

VEC	Action	RSA	Duration	Rational	Overlap with JDP
Muskox	JDP	The central barren lands area encompassing range of the Bathurst Caribou herd.	Construction, operation, and closure (~2003-2023).	An environmental effect of regional significance would affect a broad area or resource base of common interest to a large number of people (Tahera 2003).	--
	Lupin	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project (1982-2009).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Tibbitt-Contwoyto winter road	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project (indefinite).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Izok	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Ulu	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	SLDP	Not considered.	Not considered.	Not included in cumulative effects assessment	not assessed
	EKATI™ (including expansion)	Not considered.	Not considered.	Not included in cumulative effects assessment	not assessed
	DDM	North to Yamba Lake; west to Destaffaney Lake; south to Mackay; and east to Glowworm and Afridi lakes.	Construction, operation, and closure (~2003-2023).	Study area was selected to effectively represent and assess the diversity in patterns of use by wildlife. Regional study area provides a framework for assessing effects on species that have large seasonal ranges. Migratory species that use an area seasonally are also considered using these study area. Some projects outside of, but with activities occurring within, the regional study area was included in cumulative effects assessment (Diavik 1998).	None spatial; Sometimes temporal

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	DNP	A narrow strip 30 km wide extending approximately 90 km inland from the coast of Roberts Bay centred on the Koignuk River.	All phases of the Project (~2004-2036).	Based on wildlife studies conducted by Rescan of terrestrial wildlife in the Hope Bay belt during 1996 and 1997 which included a classification of bioterrain and terrestrial ecosystem units of the area.	Partial spatial; Sometimes temporal
Carnivores (Including Grizzly Bear, Wolves, Fox, and Wolverines)	JDP	The central barren lands area encompassing range of the Bathurst Caribou herd.	Construction, operation, and closure (~2003-2023).	An environmental effect of regional significance would affect a broad area or resource base of common interest to a large number of people (Tahera 2003).	--
	Lupin	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project (1982-2009).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Tibbitt-Contwoyto winter road	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project (indefinite).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Izok	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Ulu	The central barren lands area encompassing range of the Bathurst Caribou herd.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	SLDP	SGP	Construction, operation, and closure (~2003-2027).	The large home range size and extensive movement of individual female and male grizzly bears among three potential population units (or sub-populations) suggests that barren ground grizzly bears in the SGP should be considered as one population (McLoughlin 2000). Although grizzly bears do not migrate, annual home range size of grizzly bears, particularly males, suggests that individuals could contact all projects within the CEA study area. Wolves typically move with the northern and southern migration of caribou, and recent genetic analysis suggests that sub-populations of tundra wolves may exist in the SGP (DeBeers 2002).	Partial spatial; Sometimes temporal
	EKATI™ (including expansion)	Annual home range for grizzly bears, wolves and wolverines.	All phases of mine development exploration to decommissioning (~1997-2037).	• Individuals that could encounter EKATI™ comprise populations that span beyond regional boundaries • They have annual home ranges that extend beyond the regional study area... • Grizzly bears and wolverines have low reproductive capacity. • The effects on these species from the proposed "development" are predicted to be of at least minor significance	Partial spatial; Sometimes temporal
	DDM	North to Yamba Lake; west to Destaffaney Lake; south to Mackay; and east to Glowworm and Afridi lakes.	Construction, operation, and closure (~2003-2023).	Same as for muskox.	None spatial; Sometimes temporal
	DNP	A narrow strip 30 km wide extending approximately 90 km inland from the coast of Roberts Bay centred on the Koignuk River.	All phases of the Project (~2004-2036).	Based on wildlife studies conducted by Rescan of terrestrial wildlife in the Hope Bay belt during 1996 and 1997 which included a classification of bioterrain and terrestrial ecosystem units of the area.	None spatial; Sometimes temporal.
Raptors	JDP	The central mainland tundra of North America.	Construction, operation, and closure (~2003-2023).	An environmental effect of regional significance area or resource base of common interest to a large number of people (Tahera 2003).	--
	Lupin	The central mainland tundra of North America.	All phases of the Project (1982-2009).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	Tibbitt-Contwoyto winter road	The central mainland tundra of North America.	All phases of the Project (indefinite).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Izok	The central mainland tundra of North America.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Ulu	The central mainland tundra of North America.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	SLDP	Annual home range size (breeding season: 23 – 319 ha).	Construction, operation, and closure (~2003-2027).	Breeding peregrine and gyrfalcons must return to the nest site after hunting prey for their offspring, which doubles the distance traveled. It is highly unlikely that an individual nesting within the potential zone of influence of the Snap Lake Diamond Project would fly the distance necessary to contact the Diavik mine (up to a 200 km round-trip) during a hunting excursion (DeBeers 2002).	None spatial; Sometimes temporal
	EKATI™ (including expansion)	Not considered.	Not considered.	Raptors were not selected for cumulative effects assessment because the proposed development, individual or in conjunction with existing and potential developments, is predicted to have a negligible effect on their population abundance or distribution (BHP 2000).	Not assessed
	DDM	North to Yamba Lake; west to Destaffaney Lake; south to Mackay; and east to Glowworm and Afridi lakes.	Construction, operation, and closure (~2003-2023).	Study area was selected to effectively represent and assess the diversity in patterns of use by wildlife. Regional study area provides a framework for assessing effects on species that have large seasonal ranges. Migratory species that use an area seasonally are also considered using these study area. Some projects outside of, but with activities occurring within, the regional study areas were included in cumulative effects assessment (Diavik 1998).	None spatial; Sometimes temporal
	DNP	A narrow strip 30 km wide extending approximately 90 km inland from the coast of Roberts Bay centred on the Koignuk River.	All phases of the Project (~2004-2036).	Based on wildlife studies conducted by Rescan of terrestrial wildlife in the Hope Bay belt during 1996 and 1997 which included a classification of bioterrain and terrestrial ecosystem units of the area.	None spatial; Sometimes temporal.
Migratory Birds	JDP	The central mainland tundra of North America.	Construction, operation, and closure (~2003-2023).	An environmental effect of regional significance area or resource base of common interest to a large number of people (Tahera 2003).	--

VEC	Action	RSA	Duration	Rational	Overlap with JDP
	Lupin	The central mainland tundra of North America.	All phases of the Project (1982-2009).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Tibbitt-Contwoyto winter road	The central mainland tundra of North America.	All phases of the Project (indefinite).	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Izok	The central mainland tundra of North America.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	Ulu	The central mainland tundra of North America.	All phases of the Project.	Based on the RSA chosen for JDP.	Partial Spatial; Sometimes temporal
	SLDP	Annual home range size, (breeding season: < 0.5 ha).	Construction, operation, and closure (~2003-2027).	Assuming that the RSA of the Snap Lake Diamond Project represents the northern limit of the annual home range of populations of raptors, small upland birds and water birds breeding within the RSA, then no other project, besides Snap Lake, should influence these populations during migration (DeBeers 2002).	None spatial; Sometimes temporal
	EKATI™ (including expansion)	Not considered.	Not considered.	Effects of development are predicted to be: • of very local extent; • essentially confined to the immediate footprints of individual developments; and • negligible.	Not assessed
	DDM	SGP	Construction, operation, and closure (~2003-2023).	Same as raptors.	Partial spatial, Sometimes temporal
	DNP	A narrow strip 30 km wide extending approximately 90 km inland from the coast of Roberts Bay centred on the Koignuk River.	All phases of the Project (~2004-2036).	Based on wildlife studies conducted by Rescan of terrestrial wildlife in the Hope Bay belt during 1996 and 1997 which included a classification of bioterrain and terrestrial ecosystem units of the area.	None spatial; Sometimes temporal.

Based on the information presented in Table 2.2 only those actions with a spatial overlap where a linkage is present between the combined effect of other actions and those of JDP on each VEC assessed were considered further in this CEA. As the other actions move ahead Proponents might be required to conduct CEAs taking into consideration the most up to date available information to meet statutory requirements and best professional practices.

The actions carried forward in this CEA and VECs for which the cumulative effects of these actions will be assessed are included and identified as those containing a 'X' mark in Table 2.3 below.

Table 2.3: Summary of Actions and VECs Considered in the Cumulative Effects Assessment

VEC	JDP	Lupin	Tibbitt-Contwoyto winter road	Izok	Ulu	SLDP	EKATI™ (including expansion)	DDM	DNP
Surface Water (Water Quality, Quantity)	X	X	X						
Terrestrial Vegetation and Eskers	X	X	X	X	X				
Aquatic Habitat	X	X	X						
Aquatic Resources (Fish)	X	X	X						
Caribou	X	X	X	X	X	X	X	X	X
Muskox	X	X	X	X	X				
Carnivores (Including Grizzly Bear, Wolves, and Wolverines)	X	X	X	X	X	X	X		
Raptors	X	X	X	X	X				
Migratory Birds	X	X	X	X					

3.0 MITIGATION

The influence from each project on a component represents the effect following mitigation, i.e., residual effect. Mitigation was identified in the local environmental assessment for each project, except the Tibbitt-Contwoyto winter road, which has not undergone an EA (Snap Lake Diamond Project 2002). Specific mitigation for the components of JDP can be found in the January 2003, JDP FEIS. Examples of mitigation strategies include reducing the disturbed surfaces to as small an area as possible, where possible salvage soil for reclamation and revegetation purposes, adopting development and operating ethics that reduces and avoids interactions to the maximum practical extent, changing engineering systems, redesigning mining and operational plans, constructing deterrent structures near containment areas, waste

management practices, and water management (including implementation of sediment control measures during each phase of the project, construction of containment berms and managing surface runoff).

4.0 SUMMARY OF RESIDUAL EFFECTS ASSESSMENT

The following summaries of the residual effects assessed for the VECs and actions identified in Table 2. 3 above, were extracted from:

- Section 3.9 of Taheras 2003 FEIS report (Surface Water, and Terrestrial Vegetation and Eskers);
- Section 3.7 of P&E Environmental Consultants Ltd. 2002 Jericho Project Aquatic Biota EIA – Ammendment (Aquatic Resources (Fish)); and
- Section 4.0 of Hubert and Associates Ltd. 2002 Environmental Effects Assessment on Wildlife (Caribou, Muskox, Carnivores (Including Grizzly Bear, Wolves, and Wolverines), Raptors and Migratory Birds).

For the purpose of this summary the term wildlife will include caribou, muskox, carnivores (including grizzly bear, wolves, and wolverines), raptors and migratory birds.

4.1 Surface Water

4.1.1 Water Quantity (Hydrology)

Two main residual effects on drainage basins will result from the Jericho Project:

- Stream C1 will remain in its diversion channel through mine life and at closure; and
- Long Lake will be filled in with processed kimberlite during mine life and will be reclaimed to land on closure.

Natural runoff flow patterns around dumps and the Low Grade Ore Stockpile will be permanently altered, but without any substantial change in volume of runoff water. The ultimate water bodies will revert to those before mining on closure. Mitigation and management will prevent any additional residual impacts. Water management is discussed in the Project Description (Tahera FEIS, Appendix A.1).

The area of drainage affected by mining will be 1.52 km^2 or 0.6% of the total Carat drainage basin about the lake outlet. On a regional scale, temporary and residual effects on the drainage basin hydrology will be insignificant.

Withdrawal of water and some redirection of natural drainage patterns are required for plant and mine operation. As such, the changes, while insignificant, will remain throughout the eight year mine life. Upon closure, drainage patterns will be returned to as near pre-development as practical.

4.1.1.1 Frequency and Length of Occurrence

Life-of-mine changes in hydrology will be from construction through closure, or eight years. Frequency, with respect to accidents, cannot be predicted. Management of water control structures is designed to prevent accidents to the extent possible, but accidents, although of low probability, may still occur.

Changes in flow patterns in Stream C3 would occur once and be permanent.

4.1.1.2 Degree and Timeframe for Reversibility

Changes to site hydrology, resulting from mine construction, will be reversed at the end of mine life, except the PKCA system. Accidental changes will be remediated as soon as possible after the accident occurs. The principal change due to diamond processing infrastructure (the PKCA and modification of flows in Stream C3) will be permanent.

4.1.2 Water Quality

4.1.2.1 Mining

Assessment of Effects
The main effects on water quality from mining, as previously discussed, will be:

- Increase in suspended sediments;
- Increase in nitrogen; and
- Possible small increase in dissolved metals.

These effects will be managed through settling ponds, in the case of sediments, and through management of explosives use and directing runoff water appropriately, in the case of nitrogen (as discussed in the Environmental Management Plan, Appendix B.3.1).

Residual effects will include increases in water concentration of nitrogen compounds after dilution of runoff water. Sediment will also increase slightly over background, since Carat Lake normally has very low suspended sediment levels (typically below the CCME receiving environment guideline of 5 mg/L for clear waters). With normal mixing in Carat Lake, increases in nitrogen and suspended sediments over background will not be detectable where water enters Carat Lake.

Frequency and Length of Occurrence

Impacts from mining to water quality will occur annually throughout the year. Other than accidents, impacts on water quality from mining activities will be limited to those that result from discharges that meet water license discharge criteria, i.e., acceptable to regulatory agencies. Impacts will occur throughout mine life and for a short time after closure (post closure monitoring period) (see water quality impact assessment submission [AMEC 2003]).

Degree and Timeframe for Reversibility

All effects from normal mine operation will be completely reversible upon mine closure. Effects from accidental release of mine water to Carat Lake would be reversible as well, but would last only until the Lake flushed (approximately two years).

4.1.2.2 Diamond Processing

Assessment of Effects

Potential residual effects on water quality from diamond processing will be some increase in NH_4, Al, Cd, Cr, Cu and Ni, increased total dissolved solids, and increased alkalinity above background throughout mine life (see SRK discharge water quality model). Nitrogen loading to Lake C3 will be via discharge from the PKCA through Stream C3, unless spray irrigation is instituted as treatment. The addition of nitrogen will not be ecologically significant, i.e. affect aquatic plant and animal populations, if phosphorus remains limiting as indicated in the SRK submission. In 2003 Greisman *et. al.* conducted a dilution model which indicates that although the dilution ratio of Lake C3 will likely be very low during worst case low flows (particularly in close proximity to the inflow from the PKCA), the dilution in Carat Lake is very likely to remain above 100:1 and never below 120:1 at the intake at the end of the causeway. Since the area in close proximity to the inflow from the PKCA will have the lowest dilution it is like to be where most residual effects on water quality will occur.

Frequency and Length of Occurrence

Impacts on water quality from diamond processing will occur annually throughout the year. Impacts will last for the life of mine and for a short period after closure (post closure monitoring period). Impacts from normal operation will be within those allowed by the water license. The frequency and length of occurrence of accidents is difficult to predict, as previously discussed.

The impacts of a fine PK spill would be largely irreversible and would last beyond life of mine, except in areas where complete cleanup could be affected.

Degree and Timeframe for Reversibility

All impacts from normal operation will be completely reversible and will occur within the timeframe required to flush Lake C3 and Carat Lake (approximately two year or less for water quality). Long Lake will be permanently altered. The effects of accidents, especially PKCA dam failure may not be completely reversible, depending on the amount of fine PK that cannot be recovered after a spill. Deposits of PK will continue to leach for a number of years, and may generate suspended sediment until completely dispersed below storm wave action depths.

4.1.2.3 Waste Water Treatment Plant

No residual effects are expected from normal operation of the waste water treatment plant, as there will be no direct discharge to the environment.

4.2 Terrestrial Vegetation and Eskers

The disturbance areas shown in Table 4.1 will all be residual, i.e. will occur with Project development. Consistent with good management practices in Arctic regions, including energy conservation and minimizing land disturbance, the footprint of the Project has been kept as small as practical. Ultimately, there needs to be a balance between minimizing disturbance that takes decades to naturally restore, and giving due regard to efficiency of operation and safety. Any significant further reduction in the proposed Jericho footprint would compromise the mine's ability to operate and the safety of personnel.

Table 4.1: Permanently Disturbed Areas

Mine Unit	Area(m^2)
Open Pit	100,700
Dump #1	217,000
Dump #2	210,900
Coarse Kimberlite	91,600
Low Grade Ore	108,000
TOTAL	728,200

Residual effects will last for the life of mine. These effects are significant in a local Jericho area context (see Ecological Zones, Map C), but are insignificant in a regional context, because of the relatively small areas affected, compared to the available habitat types in the region.

With reclamation, most of the disturbed area will slowly return to habitat approximately equivalent to that prior to disturbance. Meadows, located where waste rock dumps will be placed, will be lost. In time rock dumps will resemble rocky tundra on their sides and dry barren tundra on top surfaces, where soil will be placed as part of reclamation.

The open pit will become a lake once runoff and snow melt fill the cavity formed from ore removal. The PKCA, which is currently a mixture of lake, meadow, and tundra habitats, will become dry barren tundra and meadow habitat. A total of 11.6 ha of lake will be permanently lost. By comparison, the area of Carat Lake is 271 ha and Carat Lake is a very small lake on a regional scale. Approximately 10 ha of artificially-created lake will be added to the Jericho landscape, once the pit fills with water.

4.2.1 Frequency and Length of Occurrence

Essentially all disturbances, except for borrow pit areas, will occur during mine construction in Years 1 and 2. Disturbance in borrow areas will occur mostly during construction, but small amounts of fill material will be required periodically (e.g. to repair roads).

4.2.2 Degree and Timeframe for Reversibility

Disturbed areas will be reclaimed when no longer active (see previous discussion). It will, however, require decades for disturbed areas to return to their pre-mining level of vegetative cover, because of slow growth of plants in the Arctic. Some areas, such as dump slopes, will remain bare for many decades, until lichens establish. These areas will then be equivalent to rocky tundra, the most prevalent habitat type at Jericho.

4.3 Aquatic Resources (Fish)

The residual effects that remained following mitigation of the five project activities were evaluated to ascertain whether these effects were significant (P&E Environmental Consultants Ltd. 2002). For the purposes of the evaluation, a significant adverse effect is one that affects a fish community, in sufficient magnitude, duration, or frequency, as to cause a change in the community structure that would not allow that community to return to its former structure.

Based on this definition, four of the project activities were rated as not significant, which included the use of explosives, the diversion of Stream C1, the water withdrawal causeway, and discharge from the PKCA. Ratings of not significant were given because the adverse effects were not sufficient to cause a permanent change in the fish community residing in the receiving waterbody.

One of the project activities was deemed to cause significant adverse effects to the fish community: the PKCA. Significant adverse effects will result from the construction and operation of the PKCA because the fish community residing in the Long Lake System will be extirpated. It should be acknowledged that:

- the affected fish community consists of small, resident populations of slimy sculpin and burbot that are ubiquitous to the Jericho Site; and
- important hydrological features include:
  - a cascade on the Jericho River at the outlet to Jericho Lake that presents and major but not impassable barrier to upstream fish migration; and
  - an impassable waterfall on Stream C1 below the outlet to Lake C1.

Loss of this particular fish community will have no serious consequences to the ecological integrity of the aquatic system outside of the Long Lake System. Since Long Lake is isolated from Jericho River, no cumulative effects are likely to result from its loss.

4.4 Wildlife

During their 2002 Environmental Effects Assessment on Wildlife for the JDP Hubert and Associates Ltd. examined the interactions of construction, operations, transportation, and related support activities for the Jericho Project with wildlife over the life of the Project and assessed their environmental effects on wildlife populations. In all cases of raptor populations, migratory bird populations, small mammal populations, ungulate populations, and carnivore populations, the environmental effects were found to be contained to the area of the Project, or in the case of caribou, to the limit of the Bathurst herd's range. The environmental effects from the Project on wildlife do not extend beyond the life of the Project, and will not be detectable in any wildlife population. No residual effects are predicted (Hubert and Associates Ltd. 2002).

The sustainability of harvests on populations presently being harvested should not change as a consequence of the overall environmental effects from the Jericho Diamond Project. These findings are consistent with those of the environmental effects assessment of the Diavik Project which is approximately 170 km southeast of Jericho and is proposed to operate for 23 years and disturb an active footprint more than five times greater than that of the Jericho Project (CEAA, 1999).

4.5 Summary of Potential Residual Effects after Mitigation

A summary of potential residual effects after mitigation is presented in Table 4.2 below.

Table 4.2: Potential Residual Effects after Mitigation

VEC	Mine			
	Facilities Contributing to Effects	**Significance**	**Activities Contributing to Effects**	**Significance**
Water Quality	Open pit, waste dumps, overburden stockpile, C1 Diversion	Low	Trucking, dozing, blasting	Low
Hydrology	Open pit, waste dumps, overburden stockpile, C1 Diversion	Moderate	Trucking, dozing, blasting	Nil
Wildlife Habitat	Open pit, waste dumps, overburden stockpile, roads, airstrip	Moderate	Trucking, dozing, blasting	Moderate
Aquatic Habitat	Open pit, C1 Diversion	Low	Trucking, dozing, blasting	Nil
Wildlife	Open pit, waste dumps, overburden stockpile	Minor	Trucking, dozing, blasting	Moderate
Fish/Aquatic Organisms	Open pit, C1 Diversion	Nil	Trucking, dozing, blasting	Nil

VEC	Ore Processing			
	Facilities	Significance	Activities Contributing to Cumulative Effects	Significance
Water Quality	PKCA, ore stockpiles, coarse kimberlite	Low	Trucking, dozing, ore drying	Low
Hydrology	PKCA, water intake	Moderate	Trucking, dozing, ore drying	Nil
Wildlife Habitat	Ore stockpiles, plant, coarse kimberlite	Moderate	Trucking, dozing, ore drying	Nil
Aquatic Habitat	PKCA, water intake	High	Trucking, dozing, ore drying	Nil
Wildlife	Ore stockpiles, PKCA, coarse kimberlite	Minor	Trucking, dozing, ore drying	Nil
Fish/Aquatic Organisms	PKCA, water intake	High	Trucking, dozing, ore drying	Nil

5.0 CEA

5.1 Criteria and Ranking

The CEA criteria and ranking included below were explained in Section 3 of Appendix B.2.1 – Environmental Impact Assessment of the Tahera FEIS and are presented here for ease of reference.

A number of Project activities will cause residual effects and a number of VECs will be affected. This section discusses those residual effects. This document closely follows the environmental impact assessment outlined by the Canadian Environmental Assessment Agency (CEAA 1994, 1997), which provides a clear, well-defined system to classify residual environmental effects and a criteria rating system to ascertain their significance. Rating criteria developed under the Canadian Environmental Assessment Act (CEAA 1994) were employed to evaluate the significance of the residual environmental effects. The rating criteria used were:

- Magnitude,
- Geographic extent,
- Duration,
- Frequency,
- Reversibility,
- Ecological context,
- Level of confidence, and
- Certainty.

5.1.1 Magnitude

Magnitude describes the nature and extent of the environmental effect. The magnitude of an effect is quantified in terms of the amount of change in a parameter or variable from an appropriate threshold value, which may be represented by a guideline or baseline conditions. Three general categories of change to be employed are low, medium, and high. The definitions used to rate the magnitude will be specific to a particular effect and will depend on the type of effect, the methods available to measure the effect, and the accepted practices for a particular discipline.

5.1.2 Geographic Extent

Geographic extents are similar to the horizontal spatial boundaries of the assessment outlined in each impact section and, in general, vertically above. Geographic extent criteria differ among different VECs and are discussed under each.

5.1.3 Duration, Timing and Frequency

Duration is defined as a measure of the length of time that the potential effect could last. It is closely related to the project phase or activity that could cause the effect. The four project phases, which define the temporal boundaries related to duration, include construction, operation, closure, and post-closure. Duration criteria are discussed in each assessment where relevant.

- Short-term (L) - Effects lasting for less than one year (associated with the construction period, or other short-term activities).
- Mid-term (M) - Effects lasting from one to nine years (associated with the life of the mine).
- Long-term (H) - Effects lasting longer than 10 years (persisting beyond closure of the mine).

5.1.4 Frequency

Frequency is associated with duration and defines the number of occurrences that can be expected during each phase of the project and differs for each VEC.

5.1.5 Reversibility

Reversibility is the ability of communities to return to conditions that existed prior to the adverse environmental effect. The prediction of reversibility can be difficult, because environmental effects may, or may not, be reversible. Despite this, it is important to ascertain reversibility, because it has an important influence on the significance of an effect. Two rating criteria were used: reversible (R) and not reversible (NR).

5.1.6 Ecological Context or Effects on Ecosystem Functioning

Ecological context is a measure of the relative importance of the affected ecological component to the ecosystem, or the sensitivity of the ecosystem to disturbance. It indicates the degree to which an effect on the component would affect the ecosystem. The ecological context rating criteria are specific to each effect, but they can be grouped into three general categories: low (L), moderate (M), and high (H).

5.1.7 Level of Confidence

Using the rating criteria described in the preceding paragraphs, the significance of adverse environmental effects is evaluated based on a review of project specific data, relevant literature, and professional opinion. Based on recommendations by Barnes and Davey (1999), the assessment should also include a rating system that evaluates the level of confidence in the prediction of significance. Three rating criteria will be used to assess the level of confidence: low (L), moderate (M), and high (H).

5.1.8 Certainty

To arrive at a high level of confidence for a significance rating, it is usually desirable to apply rigorous scientific and/or statistical methods (quantitative approach). Where such methods are not feasible, professional judgement is usually employed (qualitative approach). Rating the certainty of the significance rating is an additional step that can be used to justify or substantiate the level of confidence in the evaluation. The three rating criteria that will be applied to each of the two certainty categories (quantitative and qualitative) are low (L), moderate (M), and high (H).

5.2 Water Quantity/Hydrology

5.2.1 Site Specific

The water balance information provided in Section 1.9 of the EIA (Tahera FEIS, Appendix B.2.1) lists all sources of water "use" for the Project, including runoff (the largest collective source of "use"). The water balance was updated by SRK (see supplemental information under seprate cover) but the project actual water use, meaning draw of water from Carat Lake, will remain the same and will be just less than 80,000 m^3 per year. The Project facilities using water will be:

- Open pit (very limited amount for drilling);
- Process plant (majority of water required – less than 30 m^3/hour); and
- Potable use (1.25 m^3/ hr or 30 m^3/day).

Water for dust control will be drawn from sediment control ponds or the pit sump, where possible. Some water may need to be drawn from Carat Lake during extended dry periods.

This will constitute a small part of the daily water requirement for process water. The majority of the water used (less about 10% by weight remaining with coarse PK – 37,668 m^3/yr) will be cycled through the PKCA and back to Carat Lake through Stream C3 and Lake C3. Thus, the site-specific impact on the water balance of Carat Lake and Lake C3 will be very small. Other water "use" as defined in the Project water licence is in fact potential change or contamination of water quality, and will not affect quantity, i.e. runoff may contain sediments or other contaminants from crossing the Project site, which by definition of a water licence is “use”. Should spray irrigation of some mine water be instituted, there would be a short-term water loss from this treatment of water (see the Tahera FIES, EIA report, Appendix B.2.1). The magnitude of the effect would depend on the amount of water spray irrigated.

5.2.2 Regional

The regional boundary for cumulative impacts can be taken to be the Carat Lake watershed, which was calculated by SRK (1998) to be 227 km^2, i.e., from headwaters of streams flowing into Carat Lake to the Burnside River. Total runoff for the basin, assuming an MAR of 190 mm would be over 43 million m^3. The total estimated Project actual use of water, i.e., the amount the Project would remove from the basin would be 37,668 m^3, plus an additional amount due to evaporation from ponds (the PKCA, or Long Lake, excepted since evaporation currently occurs from the surface), and a small amount due to miscellaneous absorption. This amounts to less than 0.1% of the total basin annual drainage, which is negligible. Lupin Mine, the closest industrial operation to Jericho, draws water from Contwoyto Lake. Contwoyto Lake discharges to the Burnside River, which joins the drainage basin (where Jericho is located) downstream of Kathawachaga Lake. The mean annual volume of water draining the Burnside has not been calculated, but it is well in excess of the mean annual volume from the drainage basin on which the Jericho Project is located. Thus, it can be concluded that no measurable cumulative effects will accrue to the water balance of the Burnside system from operation of both Lupin and Jericho mines.

5.3 Water Quality

5.3.1 Site Specific

Water quality impacts from mine discharge are discussed under separate cover.

Dilution modelling suggests that under worst case conditions CCME guidelines will be met at the outlet to Carat Lake, except for cadmium under extremely low flow conditions and with additional dilution in available through to the outlet of Jericho Lake, would be met at this point. The spatial boundaries for the local study area for water quality were set as the outlet to Jericho Lake rather than a fixed distance from Project activities. This boundary is taken to be the point where CCME guidelines are met or exceeded, and is, of course, downstream of the Project. The Ash, Key, and Lynne lakes drainage system, which empty into Contwoyto Lake, will not be affected by any Project discharge with the change in materials management to eliminate storage in that drainage basin. No water quality effects are possible above the main inlet to

Lake C3, since this is upstream of any Project-related discharge and too distance for fallout from airborne contaminants, i.e. nitrogen from explosives, to be measurable in the water column.

Without mitigation a number of sources of water discharge from the Project could act cumulatively to add both suspended sediment and nitrogen compounds to Carat Lake, Lake C1, and Lake C3, all of which are fish-bearing. The parameters of concern, as discussed in Section 1.11 of the EIA (Tahera FEIS, Appendix B.2.1) are NH_4, Al, Cd, Cr, Cu, and Ni concentrations and suspended sediments. All other parameters regulated or of concern for the protection of aquatic life will be within receiving environment guidelines. Metals are well within concentrations normally set for mine effluent discharge under the Metal Mines Effluent Regulation of the Fisheries Act. Suspended sediment will be brought to Water Licence concentrations prior to discharge by the use of settling ponds and flocculents (if necessary). That leaves nitrogen, i.e. ammonia, as a potential concern. While nitrate will be elevated, it is not forecast to reach receiving environment levels (CCME generation of nuisance algae or the proposed new limit of 13 mg/L). Phosphorus will be generated by sewage, but sewage will be directed to the PKCA where phosphorus will be absorbed (Graham 2002).

Under base assumptions, ammonia is only a problem in Pond B and the Pit sump, but it is very close at a number of locations, so worst case, storage in the tailings impoundment is needed. Assuming no degradation of ammonia there (a conservative assumption), ammonia at the settling pond will meet criteria. Under upper bound concentration assumptions, ammonia will exceed the limits for discharge at the settling pond, and will need to be treated. The concentrations will only be marginally above criteria for average discharges, so even a very poorly working land application is likely to targets (SRK discharge water quality submission).

From the above analysis and the fact that algal growth will be limited by phosphorus, it can be concluded that no significant cumulative effects will result from the combined discharges of nitrogen-bearing water from the Project site.

The level of confidence in this estimate is moderate, because it is based on model results and, to a lesser extent, the experience of EKATI™ Mine (which was used as a check on model results).

Nitrogen loading to Carat Lake will last life of mine. Once the open pit and underground phases of mining have ceased, water that flows north will be directed to the open pit, which will slowly fill (with all mine runoff directed to the open pit, estimated to be approximately 20 years). By the time the pit has filled, no more nitrogen will likely be available to leach. Some loading from the PKCA discharge and from water directed to the PKCA will continue beyond the life of mine for a few years. The extent of this post mining time period cannot be predicted with any confidence prior to mining, but will be predictable with a moderately high level of accuracy prior to closure because mine monitoring will have provided eight years of data on which to draw conclusions about leaching rates.

5.3.2 Regional

Regional boundaries for water quality could be taken to be the entire watershed on which the Project is located, i.e., the Burnside River system. However, this becomes meaningless in terms of measuring effects.

The closest mine to the Jericho Project is Lupin, which discharges effluent to Contwoyto Lake from both the tailings containment area and (in a separate stream) secondarily treated domestic sewage. Lupin Mine has demonstrated from their monitoring that discharges are not affecting water quality in Contwoyto Lake, 25 km from the nearest point where any runoff from the Jericho Project could physically affect Contwoyto Lake. Since no persistent xenobiotic organic chemicals are used at either Lupin or Jericho, no measurable cumulative effects on the water quality of Contwoyto Lake are possible from the two operations. Further, as the Jericho Project will not have any significant, measurable effects on water quantity beyond the local study area, no regional cumulative effects are possible.

5.4 Vegetation and Wildlife Habitat

5.4.1 Site Specific

Developing a mine and related infrastructure will require terrain disturbance and limited habitat destruction. Overall areas required for site development and ecological zones affected by site development are summarized in Table 5.2. The plant communities in the Project area are representative of the surrounding tundra biome. Terrain disturbance caused by the Project will result in terrain alteration and disturb areas of plant cover but will not diminish the overall biodiversity of the local tundra biome. Local terrain disturbance at the Jericho site on the plant communities and associated wildlife habitats will be all the direct result of activities and facilities required for the Jericho Diamond Project; there will be no contribution to local terrain disturbance from non-Project sources.

5.4.2 Regional

The Comprehensive Study Review (CSR) of the Diavik Project considered the combined effects of the EKATI™ and Diavik projects and found that there would be ".., no effects from changes to vegetation/terrain from winter projects and activities. Non-winter projects and activities (may contribute to) insignificant residual effects,"; Table 5.3; CSR, CEAA 1999). Adding Snap Lake would not significantly change this assessment. Non-winter activities effects from Snap Lake, as for EKATI™ and Diavik, are likely to be limited to the immediate area of the mine site.

Wildlife habitat in the region will be reduced by 221.8 ha. The environmental effect of this on the sustainable harvests of wildlife populations will be minor. The sustainability of harvests on populations presently being harvested should not change as a consequence of the overall environmental effects from the Jericho Diamond Project. These findings are consistent with those of the environmental effects assessment of the Diavik Project, which is approximately 170

km south of Jericho, proposed to operate for 23 years, and expected to disturb an active footprint more than five times greater than that of the Jericho Project (CEAA, 1999).

Table 5.2: Approximate Areas of Surface Disturbance by Ecological Zone 1

Component	Ecological Zones and Areas Affected (ha)[2]							
	WGBM	**MBM**	**DBT**	**DRT**	**LK**	**CRH**	**EKD**	**Total**
Mine								
Open Pit	2.7		3.7	3.7				10
Waste Rock Dumps	17.5		22	13				52.5
Overburden Stockpile		5.07	3	4.2				12.3
Low Grade Ore Stockpile		5.3	2.7	5.07				13.1
Coarse Kimberlite Stockpile	1.85		5.95	6.7	2.14			16.6
Roads								
Haul (22 m width)	0.7	0.4	0.9	0.9			1.1	4
Access (13 m width)	1.4		3.2	4.7		1.1		10.4
Airport (10 m width)							1.5	1.5
Airstrip							2.4	2.4
Plant-Related + Ore Stockpiles				22.7				22.7
PKCA	2.07	0.9	9.6	10.9	11	0.14		34.6
Expl Camp, Truck Wash, Explosives		0.3	0.2	2			3	5.5
Sediment Collection Ponds	0.5	0.6		1.1				2.2
Borrow Areas							34	34
Subtotal Disturbance	**26.72**	**12.57**	**51.25**	**74.97**	**13.14**	**1.24**	**42**	**221.8**
% of Total	**12.05%**	**5.67%**	**23.11%**	**33.80%**	**5.92%**	**0.56%**	**18.94%**	**100%**

Notes;
1 Based on maximum areal extent of surface disturbance
2 WGBM = Wet grass/birch meadow, MBM = Moist birch meadow, DBT = Dry barrenground tundra DRT = Dry rocky tundra, LK = Lake, CRH = Cliffs/rocky hills, EKD = Cliffs/rocky hills, Kame deltas

5.5 Aquatic Habitats

5.5.1 Site Specific

Table 5.3 indicates Project facilities and activities that may measurably affect aquatic habitats. Impact ratings in the table are relative to other impacts listed. Refer to the Aquatic Impact Assessment (Tahera FEIS, Appendix B.2.3) for a full discussion of site-specific impacts.

Examination of effects listed in Table 5.3 shows that sedimentation of water bodies from the site is the only cumulative effect that is likely. All drainage from controlled areas will be to sedimentation ponds or the PKCA. No water will be released to the environment that does not meet Project Water Licence criteria. Proposed water management practices are detailed in the Project Description (Tahera FEIS, Appendix A.1) and the Environmental Management Plan (Tahera FEIS, Appendix B.3.1). Given these practices, the potential for effects on aquatic habitats, other than loss of habitat from Project development previously discussed, is predicted

to be low. Furthermore, the greatest potential for sedimentation is to areas of streams that are not inhabited by fish; corrective action will be possible prior to sediment entering fish-bearing waters. The level of confidence in these predictions is high, because of redundancy built into management systems.

Table 5.3: Summary of Site-Specific Aquatic Habitat Cumulative Effects

Project Activity	Effect	Relative Significance
Water intake	Loss of shallow water habitat	Low because of small area
Roads	Sedimentation Flow reduction Spills degrade habitat with contaminants	Low; no fish bearing habitat crossed Low, no fish bearing habitat crossed Low because of frequency of occurrence
Runoff from disturbed areas	Sedimentation	Low with water management
C1 Diversion	Sedimentation Loss of habitat in original stream Gain in habitat in diversion	Low with water management Low because unused Moderate, if used
Fuel Farm	Escaped spills of petroleum to water bodies	Low because of frequency of occurrence
Ore and Waste Handling Stockpiles	Sedimentation from dust	Low because of the coarse nature of stockpiled materials
Discharge of PK Effluent to Stream C3	Loss of habitat due to dewatered during post construction and closure; improved habitat through augmented flows during operation	Low as stream is used opportunistically by small numbers of fish

5.5.2 Regional

The loss of fish habitat on a regional (watershed) scale, while measurable, will be insignificant (<<1% of total available habitat for any fish species). Effects that could potentially degrade fish habitat at the Jericho site will not extend beyond the site, i.e. beyond Carat Lake or the bay in Contwoyto Lake, where the winter road leaves the lake.

A statistically measurable cumulative effect on habitat is the increased potential for spills of materials carried on the Lupin winter road. These could be spills that enter water bodies due to incomplete clean up, or spills due to a truck going through a break in the ice. As discussed in Section 1.17, the potential for spills from the Jericho Project winter re-supply is very small. Second, the material with the greatest potential to affect aquatic habitats is petroleum, and because petroleum products are lighter than water, tanker trucks that might break through the ice float (Nuna Logistics, pers. comm. 2000). The tanker truck would be winched out of the lake (by a crawler tractor or similar) as quickly as possible. Thus very little, if any, product would be lost due to such an accident. A spill on ice would be completely cleaned up except under unusual circumstances. Therefore, the potential for contamination of aquatic habitat is much lower than indicated by the frequency of spill statistic. The cumulative effects from accidental spills that impact aquatic habitat are therefore negligible.

5.6 Aquatic Plants and Animals

5.6.1 Site Specific

Tables 5.3 and 5.4 summarize site-specific potential cumulative impacts on aquatic habitat and organisms.

Examination of Tables 5.3 and 5.4 indicates that there may be some reduction in affected fish populations, due to loss of habitat or reduction in quality of habitat combined with some potential for killing of fish or fish eggs from blasting activities. The fish species most at risk is the slimy sculpin. Because of the wide availability of suitable habitat in the Project area the cumulative effects will be low to moderate. Confidence in these predictions is high, because of the extensive database on fish populations and habitat at the Jericho site and because of the proposed redundancy in environmental control at Jericho.

Table 5.4: Summary of Site-Specific Potential Cumulative Impacts on Aquatic Organisms

Project Activity	Potential Effect	Relative Significance
Water Intake	Intrain fish in intake	Negligible because intake will be screened and low velocity
Blasting	Pressure effects may kill fish or eggs	Moderate, limited to C1 diversion and nearshore areas of Carat Lake
Angling	Deplete fish populations in site lakes	None, fishing will be prohibited in site lakes
Roads	Spills of harmful substances	Negligible (see Section 21.12)
C1 Diversion	Dry out and trap fish during low water	Low because of fish behaviour and lack of pool areas in the proposed diversion
Coversion of Long Lake	Eliminate a small population of slimy scuplins and burbot	High in Long Lake; moderate for the site
Fuel Farm Spill	Toxic substances enter water bodies	Low because of secondary containment and proposed management practices
Discharge of PK Effluent to Stream C3	Decreased water quality over natural background	Low as stream is used opportunistically by small numbers of fish

5.6.2 Regional

Some local reduction in population sizes of especially slimy sculpins can be expected from loss of habitat and degradation of some shallow water habitat that is not completely eliminated. This will be offset by gain in habitat in the diversion channel and possibly enhancement of flows in Stream C3. Because of the relatively small numbers of fish potentially affected at Jericho, the effects on the regional populations will be negligible.

6.0 MONITORING

Requirements for monitoring the biophysical resources (and socio-economic/cultural and heritage resources) throughout the mine life will be part of the terms and conditions appended to the Project's water licence and land leases. The Environmental Monitoring Plan is presented in Tahera FEIS, Appendix B.3.3 and summarized in Section 3.11 of the FEIS and the AMEC Supplemental Report provides additional commitments.

7.0 SUMMARY OF CUMULATIVE ENVIRONMENTAL EFFECTS

Elements of the Jericho Diamond Project that have the potential to act cumulatively on VECs are shown schematically in Figure 7.1. Table 7.1 summarizes the cumulative effects potential by multiple Project facilities and activities at the Jericho Project site.

Table7.2 lists regional potential cumulative effects from existing and potential projects considered for cumulative effects assessments. Also noted are which VECs might be affected by cumulative effects from a combination of the Jericho Project and other projects. The rationale for the list in Table 7.2 is based on the known project description of the activity in question, the potential area where a measurable effect could occur, and the nature of the VEC, particularly over what area it is found. Where all three have an area of overlap an effect could occur.

Overall, cumulative effects from the Jericho Project on a local scale will be minor. On a regional scale, cumulative effects will be negligible to minor.

Table 7.1: Site Cumulative Effects Potential after Mitigation

VEC	Mine			
	Facilities Contributing to Cumulative Effects	**Significance**	**Activities Contributing to Cumulative Effects**	**Significance**
Water Quality	Open pit, waste dumps, overburden stockpile, C1 Diversion	Low	Trucking, dozing, blasting	Low
Hydrology	Open pit, waste dumps, overburden stockpile, C1 Diversion	Moderate	Trucking, dozing, blasting	Nil
Terrestrial Vegetation and Eskers	Open pit, waste dumps, overburden stockpile, roads, airstrip	Moderate	Trucking, dozing, blasting	Moderate
Aquatic Habitat	Open pit, C1 Diversion	Low	Trucking, dozing, blasting	Nil
Aquatic Resources (Fish)	Open pit, C1 Diversion	Nil	Trucking, dozing, blasting	Nil

VEC	Ore Processing			
	Facilities	Significance	Activities Contributing to Cumulative Effects	Significance
Water Quality	PKCA, ore stockpiles, coarse kimberlite	Low	Trucking, dozing, ore drying	Low
Hydrology	PKCA, water intake	Moderate	Trucking, dozing, ore drying	Nil
Terrestrial Vegetation and Eskers	Ore stockpiles, plant, coarse kimberlite	Moderate	Trucking, dozing, ore drying	Nil
Aquatic Habitat	PKCA, water intake	High	Trucking, dozing, ore drying	Nil
Aquatic Resources (Fish)	PKCA, water intake	High	Trucking, dozing, ore drying	Nil

Table 7.2: Measurable Regional Cumulative Effects Potential

Effect	Lupin	Bathurst Contwoyto Road	Izok	Ulu	SLDP	EKATI™ (including expansion)	DDM	DNP
Air Quality[1]	No	Yes	No	No	No	No	No	No
Water Quality[2]	Unlikely	No	No	No	No	No	No	No
Hydrology[3]	No	No	No	No	No	No	No	No
Permafrost[4]	No	No	No	No	No	No	No	No
Wildlife Habitat[5]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aquatic Habitat[6]	Yes	No	No	No	No	No	No	No
Wildlife[7]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Fish/Aquatic Organisms[6]	Yes	No	No	No	No	No	No	No

Notes:

1 Excepting green house gases, principally CO_2. Cumulative contribution from all projects would be a small fraction of that of Nunavut and NWT communities.

2 All except Lupin are in entirely separate drainage systems.

3 See water quality note; Lupin's withdrawal of water from Contwoyto Lake would be unmeasurable at the Burnside River where the Jericho site drainage joins the system.

4 By its nature not subject to regional effects from mining.

5 For all sites except Lupin only applies to the Bathurst caribou herd. While the local disturbance of caribou habitat is measurable at each site, the cumulate total is a very small fraction of the total area occupied by the herd and is thus not significant.

6 Since Lupin and Jericho are in the Burnside River basin, effects on aquatic habitat are measurable for the basin, but are not significant given the very small area of disturbance compared to the total area of the drainage basin.

7 For all sites except Lupin only applies to the Bathurst caribou herd. Diavik and Ekati have shown that local effects on caribou could occur because of the presence of the proposed and existing, respectively, mines. Assuming the other projects listed would have a lesser effect than the two large diamond mines (because the projects are smaller), measurable effects could not be expected to extend beyond the local area and thus no measurable cumulative effects would occur.

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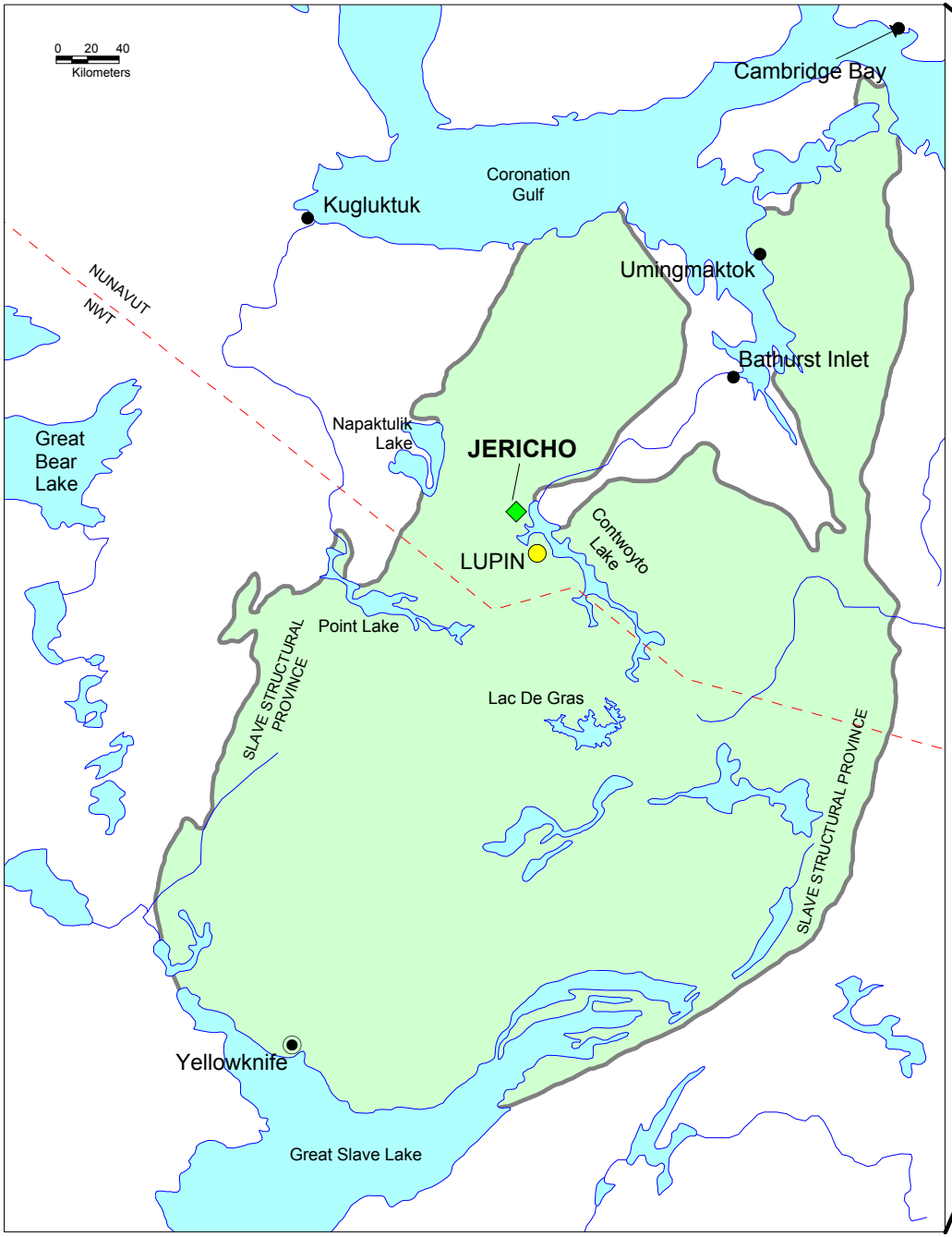
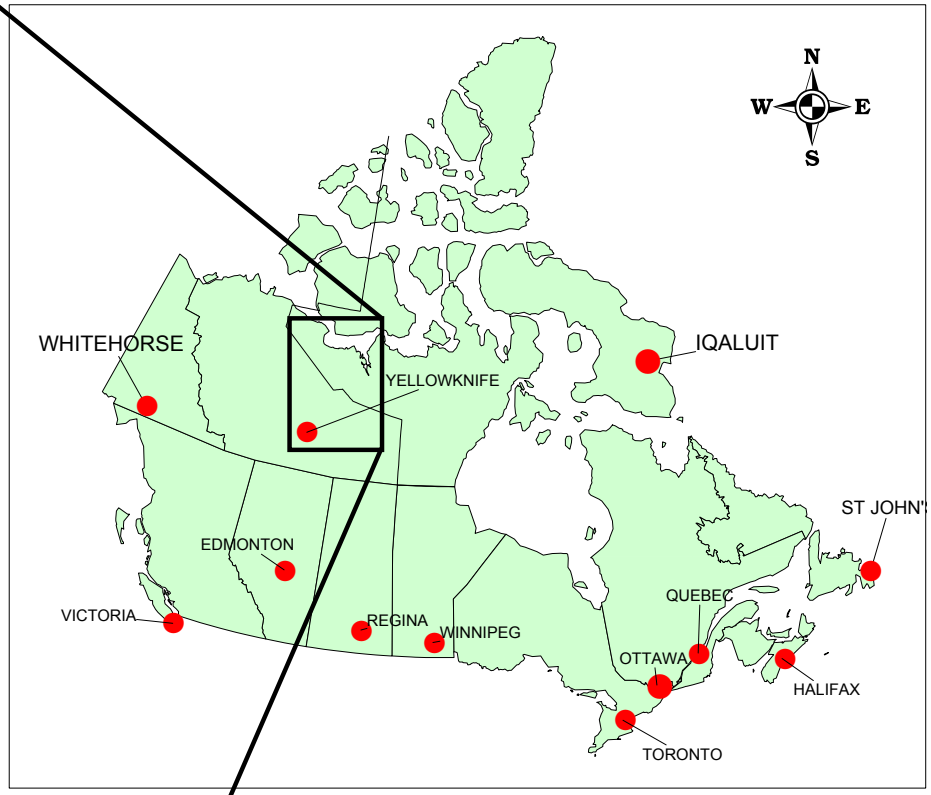
FIGURES





Property Location Map

30/6/2000	FIG 1.1
DRAFTED BY: MJ	
Office: Van	

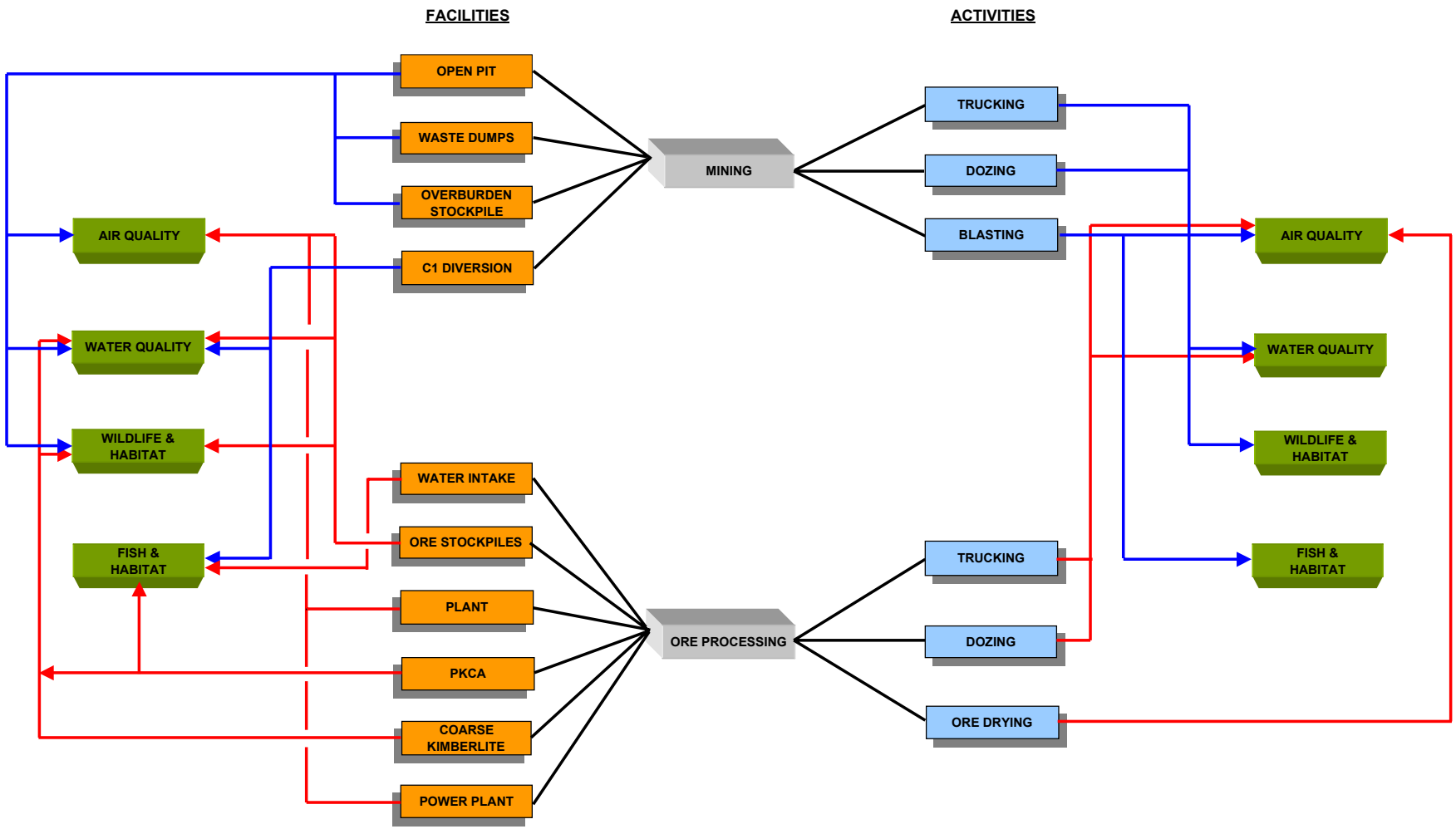
Tahera CORPORATION

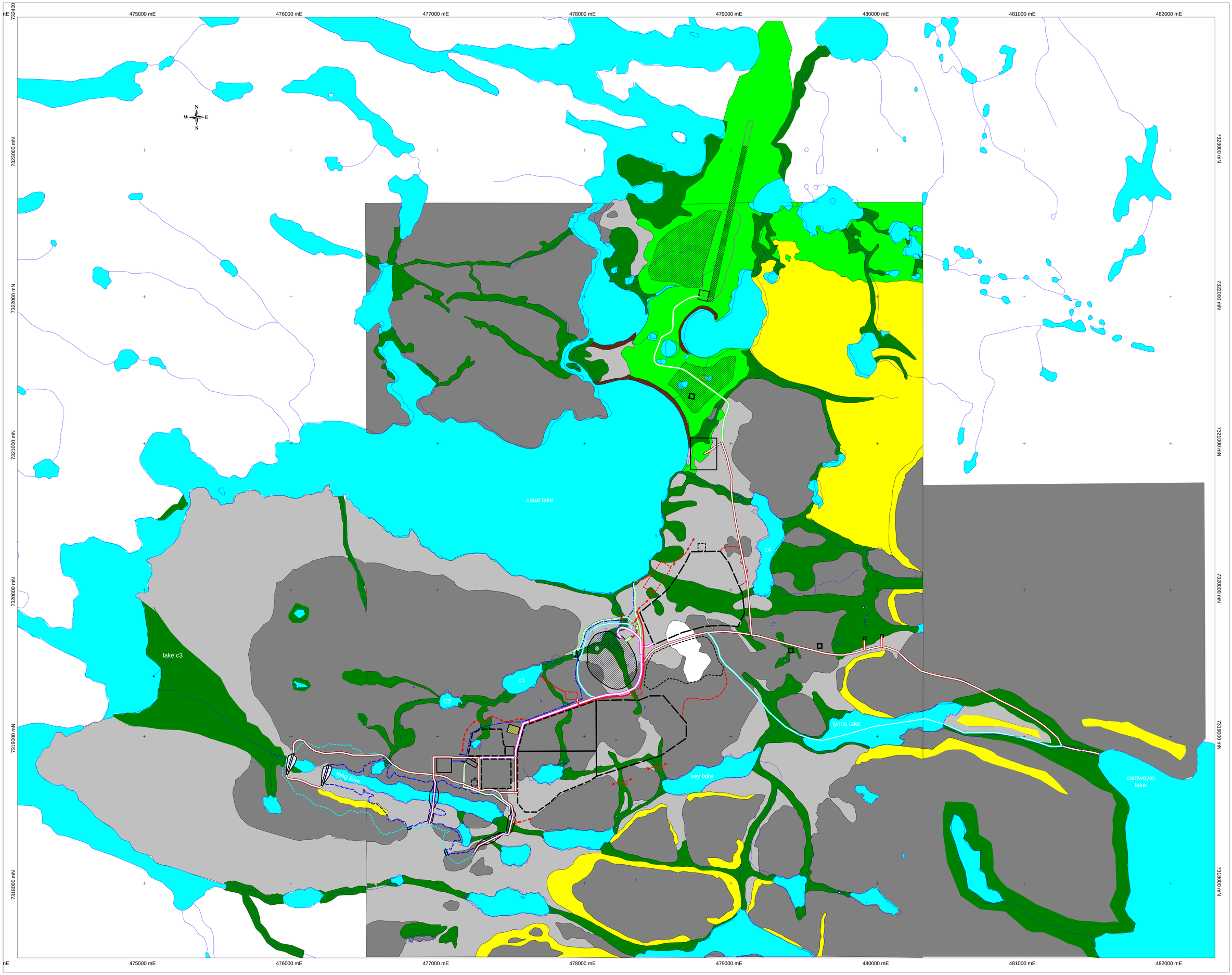
Tahera Corporation

FIGURE 2.1
LOCATION MAP
HYDRO AND MINESITES

Courtesy NT Power

FIGURE 7.1
SIMPLIFIED LOCAL CUMULATIVE EFFECTS LINKAGES





- Rock Tundra
  Dry Rock Tundra
- Land Tundra
  Dry Barren Land Tundra
- Water
  Water
- Wet Grass
  Wet Grass and Birch Meadows
- Cliff
  Cliff/Rocky Hill
- Esker
  Esker/Kame Delta
- Birch
  Birch Brush
- Beach
  Beach Shorline

Tahera Corporation

Map C
Ecological Zones Around Jericho Project Site

Date:27/4/2000	
Author: MJ	
Office: VAN	
Drawing:	
Scale: 1:10,000	Projection: UTM Zone 12 (NAD 27)

150 0 150 300
metres