JERICHO DIAMOND PROJECT

ENVIRONMENTAL EFFECTS ASSESSMENT ON WILDLIFE

Prepared for: Tahera Corporation

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Revised November 2002

Executive Summary

The Jericho Diamond Project is located in the Willingham Hills, a rugged area of granite outcrop adjacent to the north end of Contwoyto Lake in the Kitikmeot Region of Nunavut. Baseline studies on wildlife and wildlife habitat in the area of the Jericho Diamond Project were conducted from 1995 to 2001. These studies included detailed ecosystem mapping, sampling for breeding birds, monitoring small mammal populations, locating nest sites and monitoring raptor productivity, monitoring carnivore dens, and conducting aerial surveys for large mammals and mapping caribou trails.

Ecosystem mapping showed the normal diversity of tundra plant communities dominate the landscape of the Project area. Lowlands are dominated by wet sedge meadows, tundra heath covers dry slopes with dry land sedges and tufted plants occur on dry ridges and crests. No rare or endangered plant species were reported.

The Project area supports a full complement of tundra wildlife species. Small mammals seem to be cyclic like elsewhere on the tundra. Passerine birds are present in normal abundance. Water fowl are relatively uncommon. Ground squirrels and Arctic hare are present. Carnivores were observed and fox and wolf dens were found. Muskox are present, but are not abundant. Caribou are common during spring migration and can be present in concentrated numbers for short periods of time (up to 24 hours) in the late-June through the mid-August period.

The development schedule, layout, and operating plan of the Jericho Diamond Project were reviewed with a view to assessing potential Project effects on wildlife and wildlife populations in the Project area. Site development and operations will require the permanent alteration of approximately 222 ha of tundra habitat. Wildlife like small mammals and small birds may be displaced, but effects on their populations will be minor. Likewise, raptor nest sites close to the Project site may be displaced, but environmental effects at the population level will be minor and last only for the life of the Project, estimated to be about eight years. In terms of caribou, special attention was paid to the site plan in relation to mass caribou movements. The combination of mine site configuration and natural topography is such that large numbers of caribou will be able to continue to migrate past the Project site with little risk to individual caribou and no measurable effects on the Bathurst herd..

It is believed that mitigative measures can be successfully undertaken to ensure the migration of caribou, in relation to the Jericho mine site. Specific recommendations for mitigation have been made within this report, which will aid in achieving this goal. Likewise, it is believed that the use of the Lupin winter road on Contwoyto Lake for bulk materials resupply will have no measurable effect on the Bathurst caribou herd. Overall, the Jericho Project will have only minor environmental effects on local wildlife populations with no cumulative environmental effects on wildlife and wildlife populations, operating in concert with other human activities in the region.

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1.0 Introduction

This environmental effects assessment of the Jericho Diamond Project and the local and regional wildlife populations of Nunavut is based on an review of the expected interactions of the Project with the wildlife in the Project area. The information on the wildlife populations in the Project area and the overall region of Nunavut is based on environmental baseline studies conducted in the Project area from 1995 – 2001. The environmental effects assessment examines interaction between the Project and the environment over the life of the Project including Project development and construction, Project operations including mining and processing, and Project closure and abandonment. Each of these phases includes transportation by air and seasonal resupply by winter road.

The assessment of environmental effects is developed and presented in a simple, direct and uncomplicated review of potential interactions between the Jericho Diamond Project and wildlife habitat in the Project area and wildlife inhabiting the surrounding lands. The objectives and methods of the assessment process are described; the wildlife species and related environmental components (collectively referred to as Valued Ecosystem Components - VECs) are enumerated. Terms used to describe environmental effects are defined. The types and significance of potential effects as a consequence of interactions that may affect the individual VECs are described and rated in the context of mitigation measures to be applied. Residual effects are described for interactions that may cause environmental effects regardless of the mitigation measures practised. Monitoring is described for caribou, a VEC of significant enduring value.

This environmental effects assessment for wildlife also responds to the direction provided by the Nunavut Water Board (NWB**)** Guidelines (draft) for the Proposed Jericho Project, September 8, 1999 (as amended by Nunavut Impact Review Board, April 2000). Replies to the NWB pursuant to these *Guidelines* from Indian and Northern Affairs Canada (DIAND; letter and attachment dated November 30, 1999), the Government of Nunavut Department of Sustainable Development (nd), Environment Canada (letter dated November 26, 1999), Kitikmeot Inuit Association (letter dated December 3, 1999), the critique of an earlier draft of the Project EIS (January 2001) by Wilkinson and Associates (dated June 15, 2001), and DIAND (letter dated September 8, 2001) were also considered. Updating this assessment in November 2002 also provided the opportunity to amplify on issues identified by Wilkinson (2001) as requiring clarification. This assessment also responds to constructive criticism offered by reviewers of the predecessor assessment for this Project (Hubert and Associates Ltd., 2000).

1.1 Environmental Effects Assessment Objectives

The objectives for this environmental effects assessment are twofold:

- to describe the nature and significance of potential interactions between the Jericho Diamond Project and the terrestrial environment and wildlife populations in order to provide a sound basis for the Nunavut Impact Review Board, the Nunavut Water Board, DIAND, the Government of Nunavut and the affected public to evaluate the environmental effects of the Project; and
- to describe the nature and significance of potential interactions between the Jericho Diamond Project and the terrestrial environment and wildlife populations in the Project

area to provide a sound base of information for planning, designing, building, operating, and decommissioning the Project.

1.2 Valued Ecosystem Components (VECs)

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 (ie., hearings, questionnaires, interviews, workshops, media reports, etc.) and through technical studies."
> (Beanlands and Duinker, 1983)

The terrestrial wildlife VECs considered in this environmental effects assessment were developed from the 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 Metall 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. These studies also examined specific interactions between the projects and individual VECs. The terrestrial VECs that emerge from these sources collectively are fairly consistent and include: terrestrial vegetation (as the key component of wildlife habitat), eskers, caribou, muskox, carnivores (including grizzly bear, wolves, fox, and wolverines), raptors, and migratory birds.

2.0 Methods of environmental effects assessment

The evaluation of potential environmental effects of the Project on VECs is based on the examination of the potential interactions (linkages) expected between the Project and the VECs. Individual elements of the Project will interact with VECs individually and in concert. These interactions are dissected and their effects on VECs enumerated and evaluated as to significance in time and space, both as direct Project specific environmental effects and as cumulative environmental effects. The predicted interactions examined are based on observations in the field during baseline studies, on the observations of field personnel as recorded in wildlife logs, and on relevant findings in reports and papers about the particular VEC in circumstances heavily influenced by industrial activity. Residual effects are described for the effects of interactions that may occur regardless of the mitigation measures practised. Where data gaps prevent reliable assessment, a monitoring effort is recommended to improve on available data and understanding.

2.1 Significance of environmental effects

It is important to state the degree of significance (levels) of environmental effects in terms of spatial (local / regional) and temporal (long-term / short-term) extent, and that the levels of environmental effect explicitly defined. Categories and levels of significance are offered below in the absence of directives on methods and categories for assessing and describing environmental effects in Nunavut. They are intended to provide criteria for classifying the environmental effects of the Jericho Diamond Project on VECs. While these definitions may seem relatively precise, the predictions of environmental effects are necessarily approximate. Seldom are environmental data sufficient to allow precise quantitative measurements and / or predictions on the effects of interactions between individual elements of a dynamic natural environment and human activities. Accordingly, the effects have been classified based on the informed judgement of experienced scientists and the results of previous studies and environmental reviews of mining projects in the region. In many cases these classifications are considered accurate and sound for the nature of the linkage, based on the available information, and our current understanding of the VECs in this environment.

The terms and their definitions used to describe environmental effects of the Jericho Diamond Project on VECs follow.

2.1.1 Spatial significance

Regional Significance - An environmental effect of regional significance would affect a broad area or resource base of common interest to a large number of people. For the purposes of this report, the area encompassing range of the Bathurst Caribou herd becomes the region of spatial significance. This can be described as the central barren lands. The core of the region is an unpopulated, relatively inaccessible area within the tundra biome, which is used at low intensity for resource harvesting by the Inuit communities to the north and northeast, and which supports caribou harvested by communities in the Northwest Territories to the south and southwest of the Project.

Local Significance - A local environmental effect is the consequence of an interaction within the outer limits of the Project footprint. Please see Figure 1 for the configuration of the Project infrastructure which is contained within a perimeter with an area of less than 900 ha. This area is

the extent of the ecological mapping completed by Canamera (1995) and includes the Project's site facilities.

2.1.2 Temporal significance

Levels of temporal effects to be used in this report are functionally similar to those used by the Diavik Diamonds Project (CEAA CSR, 1999). They relate to the functional phases of the Project rather than an absolute calendar time period.

Short-term: Environmental effects are considered short-term if they do not continue beyond the period of site development and construction, two years in the case of the Jericho Diamond Project.

Medium-term: Environmental effects are considered medium-term if they last only for the period of the Jericho Diamond Project (see discussion on "life of Project below"). Environmental effects that are tied to the life of the Project are considered to be reversible within a year or two after the end of the Project.

Long-term: Long term environmental effects are those judged to persist beyond the operations phase post-closure.

"Life of Project" is a useful concept to use to describe the duration of the interactions between the relatively small and short-lived Jericho Diamond Project and the VECs of the area and region. The duration of the Project from initial site development to closure is planned to be ten years (Tahera Corporation 2002 - Jericho Diamond Project: Project Description). Annual site activities will proceed on the following schedule:

Year 1	site development and construction; ore production from pit late in year.
Years 2 - 4	ore processing year round; open pit mining April to December.
Years 5 – 7	ore processing year round; underground mining year round.
Years 8 – 9	processing from ore stock pile.
Year 10	Project closure and site reclamation.

See Figure 1 for the configuration of local facilities to be developed and operated during the life of the Project.

2.1.3 Levels of significance

Major effect: An environmental effect is rated major when it is judged to result in a ten percent or greater change in the size of an animal population, or the size of a resource harvest.

Moderate effect: An environmental effect is rated moderate when it is judged to result in a one to ten percent change in the size of an animal population, or a resource harvest.

Minor effect: An environmental effect is rated minor when it is judged to result in a change in the animal population size, or resource harvest that is less than one percent. Changes of one percent in a free-ranging wildlife population in the Project area and region would be difficult, if not impossible, to detect

The definitions for levels of significance above were also used by the assessment for the Izok and Ulu projects cited above as well as the Diavik Diamonds Project for wildlife populations (1998;

and CEAA CSR, 1999). Also, this assessment will adopt the Diavik levels of significance for environmental effects on habitat:

high - change is greater than 30%;
moderate - change is 6 - 30%;
low - change is less than 5%.

Terms are combined as appropriate in composing statements that provide a summary conclusion for environmental effects of a particular aspect of the Project on a VEC. For example, an effect can be classified as local, of medium-term, and moderate. In such an interaction, the environmental effect would be restricted to the footprint of the Jericho Project, persist only during the period of Project operations, and affect up to (but not more than) ten percent of the VEC population, or change between six and 30 percent of the habitat in the local Project area.

The expected effectiveness of mitigation efforts for specified project design and operating procedures are considered in developing the statement that defines environmental effect of a particular interaction between the Project and VECs.

2.2 Mitigation

The most effective mitigation of environmental effects will be an operating ethic that reduces and avoids interactions to the maximum practical extent. This can be achieved by developing and implementing a comprehensive Environmental Management System (EMS) that would examine all potential interactions between the Project and the environment and develop mitigation measures for them. Every potential interaction that is the result of an accident or unintended event or combination of events (including weather) should have a contingency plan developed that aims to ensure that the effects of unintended interactions are kept to a minimum. The implementation of the EMS should follow, in a general sense, ISO 14000 objectives that assesses effectiveness of an EMS by measurable standards and emphasizes continuous improvement in EMS execution and performance (Cascio et al., 1996).

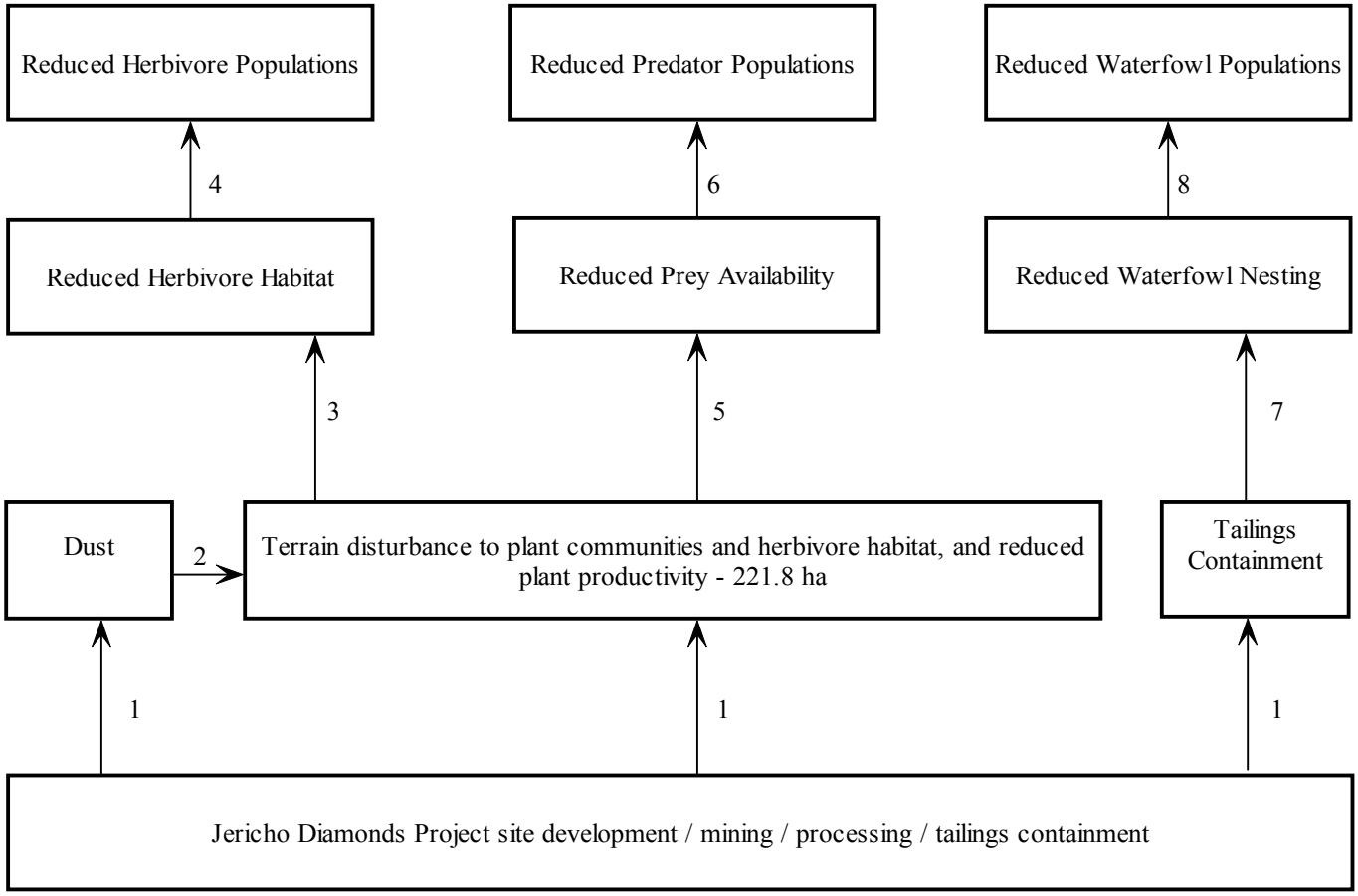
2.3 Cumulative effects

Cumulative environmental effects due to the Jericho Diamond Project are discussed in the context of other human activities in the local Project area or within the region. Figure 2 shows the locations of the commercial activities that occur within the "region" as it is defined for this assessment. Other mining operations nearby include Lupin, 28 km SE and Ulu, 60 km NE of the Jericho Project. Lupin may cease operations within the life of the Jericho Project and Ulu, a satellite gold deposit to Lupin operations, is presently on care and maintenance and could resume mining operations if the price of gold was to increase and so make that economic during the remaining life of Lupin (that could also extend the life of Lupin). Neither Lupin, nor Ulu operations would encroach on the day-to-day operating footprint of the Jericho Project and so will not be considered in the "local" context for assessing cumulative effects. The two diamond mines in the NWT, EKATI™, and Diavik, are expected to be operating year round well beyond the expected life of the Jericho Project. Three additional mining sites may be developed during the life of the Jericho Project; the Doris Hinge Gold Project northeast of Bathurst Inlet, the Snap Lake Diamond Project south of Lac du Gras, and the Bathurst Inlet Port and Road Project. The other significant commercial pursuit that occurs within the region is caribou hunting from outfitter Camps. The potential cumulative environmental effects of these concurrent mining and outfitting operations on affected VECs are reviewed. See Figure 2 for the geographic distribution of these projects and activities within the Project region.

3.0 Environmental effects assessment

3.1 Terrain disturbance, loss of vegetation, and loss of wildlife habitat.

Potential Jericho Project interactions with local terrain and wildlife habitat



1. The combined area of local plant community and habitat destruction required for mining, kimberlite processing, camp, waste rock disposal, local roads, airstrip, and related site facilities will cover up to 221.8 ha.
2. Dust from site development and seasonal pit mining operations, haul road and airstrip use will settle in nearby undisturbed plant communities.
3. The overall amount and quality of forage and habitat available to herbivore populations at the Jericho Project site may be reduced.
4. Reduced forage and forage quality may reduce herbivore productivity and abundance.
5. Reduced herbivore habitat may reduce prey abundance and availability.
6. Reduced prey availability and abundance may reduce local and regional predator populations.
7. Displacing Long Lake by tailings containment may reduce waterfowl nesting in the Project area.
8. Reduced waterfowl nesting in the Project area will reduce overall waterfowl populations.

Key question: Will terrain disturbance, disturbance of plant communities, and disturbing wildlife habitats by the Jericho Diamond Project diminish the biodiversity and carrying capacity for wildlife populations of the local area / the region?

Background

Vegetation is a VEC on its own merit, and it provides food and habitat for wildlife populations. Plants are the means of delivering energy from the sun on terrestrial ecosystems by growing plant tissue for consumption by herbivores, soil building invertebrates and micro-organisms. Heterogeneous habitats ensure overall biodiversity and so contribute to overall ecological health and stability. The plant communities in the local area around the Project have not previously been subjected to ongoing industrial activity and so should be considered "pristine" in the context of ecosystem health.

Plant communities and wildlife habitat types (ecological zones) in the Project area were studied, mapped and reported by Canamera (1995, 1996, and 1997) and by Burt (2000). The plant communities in the Project area are representative of the surrounding tundra biome. No rare or endangered plant species or plant communities were identified during vegetation studies in 1995 or 1999 (Burt 2000). Terrain disturbance caused by the Project will disturb terrain and areas of plant cover but will not diminish the overall biodiversity of the local tundra biome. The relative extent of terrestrial plant communities in the Project area (9 km^2 centered on the Jericho kimberlite pipe, not including the surface area of Carat Lake, described by Canamera 1995) are summarized in Table 1.

Table 1. Ecological zones in the Jericho Diamond Project area (Canamera, 1995).

Ecological Zone	Area (km^2)	% of study area
Dry rocky tundra	5.3	59
Dry barren land (heath) tundra	2.0	22
Esker/kame delta	0.8	9
Wet grass/sedge / wet birch	0.5	6
Cliff/rock hill	0.2	2
Moist birch meadow	0.1	1
Beach shoreline	0.1	1
Total	9.0 (900 ha)	100

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 2 below.

Table 2. Areas of surface disturbance and ecological zones affected.

Component	Ecological Zones[1] 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 (tailings pond)	2.07	0.9	9.6	10.9	11	0.14		34.6
Ex.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 Disturbed area	**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**	**18.9**	**100%**

Notes
1. WGBM = Wet grass/birch meadow; MBM = Moist birch meadow; DBT = Dry barren ground tundra; DRT = Dry rocky tundra; LK = Lake; CRH = cliffs/rocky hills; EKD = Esker kame deltas.
2. Based on maximum areas of surface disturbance

Discussion

Construction and operations of the Project will disturb or destroy 221.8 ha of terrestrial habitat. Will the effects be restricted to the area of disturbance or will dust cause environmental effects beyond the bounds of the disturbed terrain?

The local landscape in the Project area is snow covered for nine months of the year during which time the plants are dormant. Dust accumulation in the snow layer from winter operations will have little if any effect on the onset of the spring melt and run off. Summer blasting, mining, hauling, crushing, waste rock disposal, and stockpiling ore will be associated with the standard dust suppression activities on the roads and in the pit. Also, summer precipitation will wash dust from foliage and inhibit prolonged dust accumulation on plants. Studies at Lupin into the effects of dust on plant density and biodiversity near gravel roads showed “the effects of road dust on

tundra vegetation, in terms of total cover seems to be only minor" (Svoboda, 1998). It must be noted however that the nature of the road usage at Lupin was not described; a road used for local inspection or light load traffic at Lupin may not generate the same dust levels as an ore and / or waste rock haul road such as is proposed at Jericho. Dust accumulation from haul road traffic was studied in Alaskan oil fields. While some species were eliminated (some mosses and prostrate willows) under extreme dust accumulations (25 cm) others (upright willows) appeared to respond favourably. However, over time, under conditions of ongoing dust accumulations all vascular plants may be eliminated (McKendrick, 2000).

Dust generation has been examined for the Project and reported elsewhere (Tahera, 2002). An air quality assessment using numerical modelling was also conducted and is reported elsewhere (Levelton, 2002).

Long Lake will be filled in with tailings and no longer be a water body. On closure, the tailings containment area will be covered with natural aggregate and would appear like a sand and gravel pad not unlike an airstrip or floor of a gravel pit. Depending on the results of revegetation trials during mine operation, top soil stripped during site development may be placed on the reclaimed surface and the area may be replanted.

Mitigation and regeneration

Terrain disturbance for construction and operating the Project will involve constructing level building sites, ore storage sites, establishing waste rock disposal sites, building roads, extending and operating the airstrip, and operating and abandoning borrow sites for granular materials. The nature of terrain disturbance will be such that plant community regeneration will be very slow and take many years. The most direct mitigation practice in the Project EMS will be to reduce the disturbed surfaces to as small an area as possible. Surface materials on sites that are disturbed will be mineral and granular and therefore revegetation will not show any significant effect until the disturbed surfaces contain the organics and fine windblown debris necessary for moisture retention and true soil development that promotes seed germination and sustained growth. All soil that is stripped to develop the pit and other sites should be salvaged where practical for overall reclamation and revegetation purposes.

On closure, borrow areas and waste rock and overburden stockpiles stripped to expose the pit will be contoured and scarified for enhanced moisture and growing conditions for natural revegetation. On closure, all buildings and hardware will be removed, all pads and rock dumps contoured to ensure terrain stability, and scarified to revegetate naturally. Disturbed areas will take many years to revegetate because of the harsh growing conditions of disturbed sites. There are several low cost mitigation techniques that are available for incorporating into the Project EMS / Abandonment and Restoration Plan that could enhance the rate of recovery.

- Final surfaces should be scarified in a direction parallel to the topographic contour to intercept maximum organic debris and moisture.
- Slow release granular fertilizer should be spread to provide nutrients for windblown seeds should they germinate. With this activity, it is important to also apply fertilizer generously to adjacent undisturbed lands in order to stimulate additional seed production in the immediate area of the disturbance. Progressive reclamation will be initiated as soon as possible. For example, it should be possible to scarify, spread rocks, boulders,

and peat with fertilizer to the disturbed area adjacent to the airstrip and road sides well before closure.

Studies into the effectiveness of mitigation measures at Alaskan oil fields found that terrain disturbance and responses by local plant communities was roughly "analogous to changes induced by natural phenomena, and thus plant responses to them often mirror their responses to natural agents of disturbance..." (McKendrick, 2000). Natural regeneration can be accelerated by the application of various measures including fertilizers. Plant responses are variable and depend on factors like available nutrients and moisture. The Alaska research found that a long-term perspective is essential for finding effective solutions to vegetative responses to disturbance, calling for "at least a decade or, better yet, quarter and half centuries."

There is no way to mitigate the displacement of a water body with tailings and capping these with granular materials on closure.

Approximately 25 percent of the local habitat will be disturbed in the immediate area of the Jericho Diamond Project. Regardless of the effectiveness of mitigation measures the environmental effects of terrain disturbance at the Jericho Project site will persist as residual effects beyond the operations phase of the Project. According to the criteria established for this environmental effects assessment, **the environmental effects of terrain disturbance at the Jericho Diamond Project on plant communities and associated wildlife habitat will be local, moderate (>6% <30% local habitat disturbance) and long-term.**

The effects of dust generated by Project construction and operations on productivity of local vegetation will be local, of medium duration, and minor on the overall tundra biome.

Cumulative effects
The Comprehensive Study Review 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, 1999).

Local terrain disturbance at the Jericho Diamond Project on the plant communities and associated wildlife habitats will all be the direct result of exploration, construction, operations and closure of the Jericho Diamond Project. There will be no contribution to local terrain disturbance from non-Project sources, nor will the local effects of the Project cause any environmental effects beyond the local bounds of the Project area. **There will be no cumulative environmental effect on terrain, plant communities, and wildlife habitat by the Jericho Diamond Project.**

3.1.1 Environmental effects of terrain disturbance on wildlife populations

Key question: Will long-term loss of terrestrial habitat and plant communities caused by exploration, construction, operations, and closure at the Jericho Diamond Project reduce wildlife populations and cause reduced wildlife harvests?

Background
The distribution of wildlife in the Project area is, in part, a function of the natural habitats there. The minimum site criteria for a species' "key habitat" is "to support at least 1% of a national population" (Alexander et al., 1991). This definition has been used for assessing significance of migratory bird habitat in the NWT and is, in the case of this environmental assessment, extended to habitat of other species in the Project area and region. None of the non-migratory and resident wildlife species in the Project area are present in concentrations that represent 1% of their population. The Project area therefore does not meet the criteria for "key habitat" for the population of any of the bird species present. Furthermore, none of the lands required for the Project are designated to be "key migratory bird terrestrial habitat" (Alexander et al., 1991) or "wildlife areas of special interest" (Ferguson, 1987). Also, none of the wildlife populations in the Project area are declared as being threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2002). The wildlife populations of the area and region should be considered healthy in the context of overall ecosystem health. Muskox have made a remarkable recovery from lows in the early 1900's caused by excessive harvests; peregrine falcons generally are making a strong recovery, although the local *tundrius* subspecies was not as severely affected by global pesticide use as were more southerly *anatum* populations. Generally, the Project area supports healthy populations of the full complement of mainland tundra wildlife species.

Birds
The birds that breed in the Project area are primarily migratory species. Herbivorous bird species include geese and ptarmigan. Geese forage primarily on rhizomes and roots of wet sedge meadows and berries (Godfrey, 1966). Observations of geese in the Project area included both Canada geese and white-fronted geese. No breeding pairs or broods were observed within the footprint of the Jericho Project site in either 1999 or 2000; no waterfowl species were observed on Long Lake which is proposed for tailings containment or on any of the other ponds that may be altered by the Project construction or operations. Also, none of the habitat suitable for "grazing" by geese showed the characteristic signs of grazing by geese. Both Canada geese and white-fronted geese frequenting the Project area would be members of populations breeding throughout these species' tundra breeding ranges (Bellrose, 1976). Ptarmigan (the range of both the rock ptarmigan and willow ptarmigan includes the Project area) forage on buds and growing shoots. Ptarmigan nest throughout the tundra and migrate to the boreal forest for the coldest winter months.

The environmental effect of 221.8 ha habitat loss on herbivorous bird populations will be local, long-term, and minor.

Mammals
Herbivorous mammals in the Project area include small mammals, ground squirrels, Arctic hare and ungulates. None are classified as rare or endangered.

Microtine rodents
Trapping for small mammals at the Jericho site in 1999, 2000, and 2001 showed that both voles and lemmings are present in the local Project area. Tundra red-backed voles were most common in the dry barrenland tundra ecological zone. A single Greenland collared lemming was trapped near the airstrip in the esker / kame delta ecological zone in 1999 and again in 2000. Both small

rodent species are cyclic in abundance and are distributed throughout the tundra biome (Banfield, 1977). The abundance of these small rodents as reflected by the trap indices for 1999, 2000, 2001 suggests that the lemming population is currently very low and the red-backed vole population was in mid-cycle (Shank, 1997) with voles being more abundant in the dry barren land tundra than the rocky tundra. The microtine population cycles in adjacent ecological zones should be expected to be in synchrony (US Parks Service, 1996). Changes in the local habitat are unlikely to affect the duration or amplitude of the small mammal cycle in local microtine populations.

The environmental effect of 221.8 ha habitat loss to microtine rodent populations in the region will be local, long-term, and minor.

Arctic hare

Arctic hare are a year round resident of the Project area. The species is distributed throughout the mainland tundra and is found on most Arctic islands (Banfield, 1977). Pellet counts done in various habitats in the Project area in 1996 showed hare sign was most common (69 groups in 1000 plots) in dry rocky uplands but absent from wet meadows (Canamera, 1996). Hare fecal pellets were recorded at 3 of 1000 points on the airport esker and at 9 of 1000 points in dry barren land tundra in the area of the waste rock dump #1. It would seem that little if any of the local preferred hare habitat, as shown by pellet group distribution, will be affected by the Project.

The environmental effect of 221.8 ha habitat change on the Arctic hare population in the region will be local, long-term, and minor.

Muskox

Muskox are present in the region but not common within the local Project area. The aerial survey on May 9, 1999 showed herds of 5 and 25 on the northern flank of the Willingham Hills, more than 5 km north of the mine site. Summer observations of muskox showed only singles and pairs in the highlands between the Jericho Project site and Contwoyto Lake. The pellet group transects reported by Canamera from the 1996 field studies did not record any muskox pellets from the habitats that will be disturbed by mine development at Jericho. Muskox observations made at the Jericho site in June 1997 were similar to those of 1999 in that singles and small herds were observed in the highlands adjacent to the local the Project area.

The environmental effect of 221.8 ha habitat loss to the mainland muskox population will be local, long-term, and minor.

Caribou

Barren-ground caribou are the most abundant (seasonally and spatially) VEC species in the Project area. The most recent population size for the Bathurst Caribou Herd was estimated at 349,000 in 1996 (Gunn et al, 1997) and the population trend is stable (J. Dragon, NWT DRWED, pers. comm. in 2000). It ranges over 250,000+ km^2 in its annual cycle. More than half of its historic range is tundra stretching from Coronation Gulf (the northern extent) to the Coppermine River, Great Bear Lake and the treeline (the western extent), to a north / south line from the eastern extremity of Great Slave Lake to the Queen Maud Gulf coast at 100 degrees west (the eastern extent) and Great Slave Lake (the southern extent). The present annual harvest levels of 14,500 - 18,500 animals are sustainable at current population levels (Case et al. 1996). Habitat

disturbance throughout the summer range of the herd is isolated and contained to current and or abandoned mine sites. Active or approved mines on the Bathurst herd's range include EKATI™ Diamond Mine (10,960 ha under lease; BHP, 1998) with a proposed 25 year mine life; Diavik Diamond Mine (active terrestrial footprint of 1148 ha; CSR, 1999) with a 23 year mine life proposed; Lupin Mine (an active footprint of 1710.4 ha) with an expected active mine life of 25 + years extending to 2007 (Echo Bay Mines, 2002; unpublished) not including the proposed satellite Ulu deposit with an active footprint of 164 ha (Echo Bay Mines, 1997). By comparison, the Jericho Diamond Project active footprint of habitat alteration is designed to be contained within 222 ha. in a 10 year Project life.

The disturbance of the Jericho Diamond Project as proposed is less than 1.5% of the combined area of terrain alteration expected with the diamond mining operations at EKATI™ and Diavik. Furthermore, the Jericho Diamond Project will be abandoned and in the reclamation phase within the first half of the production life time of both EKATI™ and Diavik. The area of caribou range lost to habitat destruction at Jericho is less than .002% of the Bathurst herd's overall summer range. During periods of migration and summer movements, concentrations of up to 15% of the Bathurst Herd (Gunn, 1996 observation, unpublished) may be in the vicinity of the Project for brief periods of time as occurred June 30, 1996. It is inconceivable that the footprint of the Jericho Project could sustain 1% (3,500) of the Bathurst herd on an ongoing basis so it does not meet the threshold of "key habitat" as set out above. At current range wide densities (1.4 caribou / km^2) the displacement effect of the overall Project's terrain disturbance and terrestrial habitat loss would equal the year round current density requirements of 1.6 caribou or double that (3.2 caribou) for summer only.

The environmental effect of 221.8 ha habitat loss to the Bathurst caribou herd will be local, long-term, and minor.

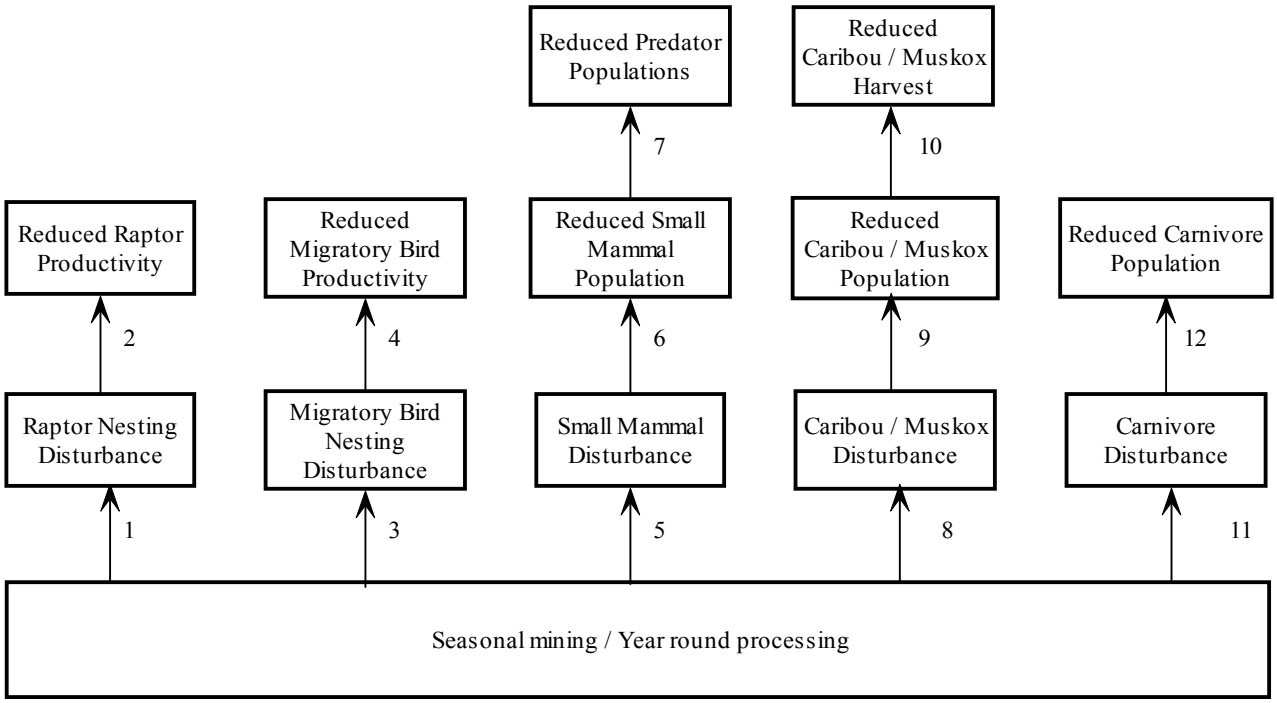
Cumulative effect of terrain disturbance and habitat loss

Local terrain disturbance on the plant communities and associated wildlife habitats will all be the direct result of activities and facilities required for construction, operations and closure of the Jericho Diamond Project. There will be no contribution to local terrain disturbance and habitat loss with effects on wildlife populations and on wildlife harvests from non-Project sources; likewise the local effects of the Project on terrain and wildlife habitat will not contribute to any environmental effects on wildlife habitats beyond the local bounds of the Project area.

The environmental effect of reducing wildlife habitat by 221.8 ha on the sustainable harvests of wildlife populations in the region will be regional, long-term and minor.

3.2 Environmental Effects of Project Construction, Operations, and Closure.

Potential Jericho Project interactions with wildlife populations



1. Mine construction and operations, and related activities will be conducted during raptors' spring nest site selection, breeding, nesting, and fledging periods.
2. Raptor nesting territories may be abandoned due to disturbance.
3. Mine construction and operations, and related activities will be conducted during migratory birds' spring breeding, nesting, brooding and fledgling periods.
4. Mine construction and operations, and related activities may cause disturbance and so reduce or displace migratory bird nesting activities.
5. Mine construction and operations, and related activities may disturb small mammal populations.
6. Disturbance to small mammal populations may cause reduced productivity and abundance.
7. Reduced small mammal productivity and abundance may affect carnivore and raptor populations.
8. Mine construction and operations, and related activities may disturb local muskox herds and the Bathurst caribou herd.
9. Disturbance to caribou / muskox populations may result in reduced caribou / muskox productivity and abundance.
10. Reduced productivity and abundance may result in reduced caribou / muskox harvests.

11. Mine construction and operations, and related activities may disturb local carnivores:
    - by disturbing denning habitat;
    - by causing den sites to be abandoned;
    - by habituating carnivores to camp garbage;
    - by accidental road kills which attract scavengers that may in turn become road kills, or associate human activities with food.
12. Direct interactions with local carnivores may result in reduced carnivore productivity and abundance:
    - by reduced survival of young animals;
    - by destroying nuisance animals attracted to the site by garbage.

Key question: Will construction, operations, and closure at the Jericho Diamond Project site change the distribution, abundance, and productivity of wildlife populations and the sustainability of wildlife harvests?

Background

Mine construction, operations, and closure will involve drilling, blasting, loading rock and hauling to either nearby waste rock sites or to an ore storage pad near the processing plant. Initially, all waste rock will be crushed for site development needs. Mining activities from the pit will be seasonal occurring in the April to December period for years one through four. All ore will be stockpiled as mining proceeds and be removed from the storage pad by loader and hauled to the processing plant as required. The throughput at the processing plant will be approximately 330,000 tonnes per year for year two through nine. All mine construction, operations, and closure activities will be contained within 222 ha. - see Figure 1 for the locations of the pit, ore pad and waste rock dumps. Crushing and processing will operate on a year round basis. A camp for an on site workforce of up to 100 persons will be established. It will be served by Hawker Siddley-class aircraft for crew changes and camp provisioning. Bulk consumables like fuel will be brought in on the Lupin winter road in the February / March period.

Aspects of Project construction, operations, and related support activities at the site that could be the source of disturbance effects on wildlife populations include:

- noise from blasting, loading, and site operations generally;
- mobile equipment traffic at the site;
- physical barriers to wildlife movements;
- garbage attracting scavengers;
- harassment by Project personnel.

Wildlife abundance in the area of the Jericho Diamond Project is seasonal. Birds are migratory and use the tundra for summer breeding and fledging. Mammals resident in the Project area on a year round basis are present in relatively low densities. High densities of caribou are probable for short durations (less than 24 hours) several times per year.

The frequency of direct interactions between wildlife and Project activities will vary in response to wildlife presence and abundance. For example, a raptor nest site that has been active in four of five years surveyed is located in a cliff above the winter road route crossing Lynne Lake; caribou are migratory and should be expected to be passing through the local area continuously during spring migration for most of May. They should also be expected in large numbers for

very brief periods any time from late June through to mid-August (post-calving period, and late summer). Year round residents of the Project area include small mammals which live under the snow in winter and in burrows in summer; ground squirrels hibernate for the winter and seem to be everywhere during the summer; Arctic hare can be seen in all seasons at locations that offer escape terrain or cover. At Lupin Arctic hare are a common site at several locations including the ball field below the dining hall and along the road from the airstrip to the camp (see also Appendix B in Mueller and Gunn, 1996). At Jericho, the roadway between the camp and airstrip was also a location for observing Arctic hare in 1999, 2000, and 2001. No carnivore dens are known to be located within the Jericho Project footprint.

Discussion

Raptors

The Project area includes or is adjacent to breeding territories of golden eagles, rough-legged hawks, peregrine falcons, and gyrfalcons. Jericho Diamond Project mine construction and operations will include seasonal mining operations beginning in April and continue into December. These activities will occur for the entire raptor breeding, nesting and fledgling period for the life of the Project.

Golden Eagles

Golden eagles are found in remote reaches throughout the northern hemisphere (Godfrey, 1986). Golden eagles arrive on their tundra breeding territories in April and stay until late September to mid-October (C. Shank, unpublished data). A single golden eagle was observed in the Project area in 1995 and 1999; and two active nests were occupied in the Project area in 2000. An active nest was noted at Contwoyto Point, some 7 km southeast of the Jericho Project mine site (site # 949 in GNWT data base; author's observation, July 1997). The raptor survey in 1995 found sign of an active golden eagle nest in the canyon 2.5 km northeast of Carat Camp, and again in 2000. 1995 was a period of intense exploration activity at Jericho with constant helicopter support in the area. None of the nest sites occupied by golden eagles in the study area occurred within 2 km of the Project's proposed facilities.

The environmental effects of construction, operations, and related support activities at the Jericho Project on the golden eagle population will be local, moderate, and minor. No residual effects are predicted.

Rough-legged Hawks

Rough-legged hawks breed throughout the mainland tundra plus several of the Arctic islands of North America (Godfrey, 1986). Rough-legged hawks arrive in their nesting territories in May and stay until early fall (Poole and Bromley, 1988). Active rough-legged hawk territories with nest and young have been observed in the local Project area on each of the five raptor surveys conducted in the Local Project area (Hubert and Associates Ltd., 2002). Rough-legged hawks breed throughout the tundra of North America. Their prey includes small rodents and their local abundance and breeding success responds to small mammal abundance (Shank, 1997). The variation observed in the number of active rough-leg nests in the Project area is therefore in part a reflection of prey abundance. A long-term numerical relationship of rough-legged hawk nests to small mammal density cannot be determined unless both are monitored concurrently. That relationship should be expected to continue during the life of the Project and after. Microtine

rodent abundance will likely be a stronger factor in determining rough-legged hawk breeding in the local area than Project activities.

Seven rough-leg territories were active in 1996, the highest of any of the five years surveyed and a year in which Carat Camp supported a large exploration program with up to three drills operating. Supporting these drills required steady helicopter traffic, sometimes with two helicopters. There were also frequent, sometimes daily, resupply flights landing at the airstrip upon its completion in early July, 1996. The nest site over the Project's proposed winter road route as it crosses Lynne Lake (J8) was occupied in 1997, and 1999. It is 2 km from the Jericho Project. Site J9 near Key Lake (0.5 km south of the pit) was occupied by rough-legs in 1996, 2000, and 2001.

Project construction and mining activities will be concentrated at the mine and diamond processing plant sites with much less activity at the airstrip. Winter road use will be completed by the time that the birds arrive in spring but sites J8 and J9 are less than 2 km from the Project site and disturbance may displace the birds from those territories. Unoccupied stick nest sites have been documented on each of the raptor surveys completed and so Project site activities or late season winter road use may displace birds from Lynne Lake (J8) and / or Key Lake (J9) to an unoccupied territory further from the Project site.

The environmental effects of construction, operations, and related support activities at the Jericho Project on the rough-legged hawk population will be local, moderate, and minor. No residual effects are predicted.

Peregrine Falcons

The *tundrius* peregrine falcon breeds throughout Nunavut, and the tundra of the Northwest Territories, Yukon, and Alaska (Godfrey, 1986)**.** Peregrine falcons arrive in their nesting territories in May and stay until early fall (Poole and Bromley, 1988)**.** Active peregrine territories or nests were recorded on every raptor nesting survey in the Project area. The nearest known peregrine territory is above Key Lake (J9), about 0.5 km south of the pit; it was occupied by peregrines in 1995 and 1999. Peregrines are raptors with a predominantly avian diet. However, a peak in nest site density in the Rankin Inlet population in 1985 was associated with a peak in rough-legged hawk nesting and so presumably a peak in the microtine cycle. Young ground squirrel remains were also found at Rankin Inlet peregrine nest sites (Court, et al., 1988a). The same number of peregrine falcons occupied territories in 1986 (26 pairs) but fledged 13 birds as compared to 61 the previous year. This drop in peregrine hatching success for 1986 was associated poor spring weather (Court et al., 1988b).

Peregrines tolerate intense interactions with man including capture and detainment on occupied breeding territories with successful return to the territory and breeding on release, in experiments conducted on the Keewatin population at Rankin Inlet (Johnstone, 1998). The activities at the Jericho Project may cause displacement of breeding pairs from the Key Lake site. Unoccupied raptor nest sites have been documented during each of the raptor nest surveys as reported (Hubert and Associates Ltd., 2002).

The environmental effects of construction, operations, and related support activities at the Jericho Project on the peregrine falcon population will be local, moderate, and minor. No residual effects are predicted.

Gyrfalcons

Gyrfalcons breed throughout the tundra of North America (Godfrey, 1986). Gyrfalcons occupy their breeding territories as early as February (Poole and Bromley, 1988) with nesting initiated as early as May 8 (Poole and Bromley, 1988b). Gyrfalcons have not been a regular feature in the raptor surveys of the Project area. In 1995 a pair fledged young near the southern edge of the Willingham Hills and in 1997 a single bird showed territorial behavior near the escarpment 2 km east of Carat Lake but no occupied nest was documented. Gyrfalcons prey on both birds and mammals. They appear to be an irregular occupant of the Project area so yearly interactions cannot be assumed.

The environmental effects of construction, operations, and related support activities at the Jericho Project on the gyrfalcon population will be local, moderate, and minor. No residual effects are predicted.

Summary: interactions between the Jericho Diamond Project and raptors.

The two largest raptors of the region, the golden eagle and gyrfalcon are not regular occupants of known nest sites in the Project area; peregrine falcons are known to be tolerant of human activities, and rough-legged hawks nesting activities seem directly correlated to small mammal population cycles. A site (J9) known to have been occupied by both rough-legs and peregrines is located approximately 0.5 km from the mine site with another known rough-leg site 2 km from the Project site over the winter road route. Surveys of known raptor nest sites in the Willingham Hills surrounding the Project area have shown unoccupied rough legged hawk and peregrine sites in each survey.

The environmental effects of construction, operations, and related support activities of the Jericho Diamond Project on raptor species will be local, will continue for the life of the Project, and have minor effects on the raptor populations of the mainland tundra of North America.

Mitigation measures

Notwithstanding the environmental effects of the Project on raptor populations that are expected to be minor, there are measures that can be implemented to reduce or eliminate effects that might otherwise occur. Guidelines for mitigating the effects of disturbance to nesting raptors were developed by Chris Shank, a raptor biologist then with the Wildlife Service, Government of the Northwest Territories (unpublished, 1988). These guidelines follow and are recommended for the Jericho Project EMS.

Guidelines for Mitigating Harassment of Nesting Raptors

Principle #1. Disturbance is most harmful early in the nesting period.

Commentary: Raptors act to maximize their chances of raising the greatest number of young possible. If they "decide" early in the breeding period that their nest is insecure, they might abandon it. Sometimes they will re-nest at another site but such "re-nests" usually

fledge fewer young than first nests. If nests are disturbed late in nesting, insufficient time remains for a re-nesting attempt and the parents accordingly have little to lose by sticking to their original nest site. Risk of nest abandonment therefore declines through the nesting period.

Management implications: When there is pressure to have restricted access for as short a time period as possible, restrictions should cover the courtship and incubation periods. Tourist viewing and photography of nests should be restricted to the mid- and late nestling periods.

Principle #2. Individuals show variability in their response to disturbance.

Commentary: A predominant finding of most harassment studies is that there is considerable variability in the response to disturbance between individuals and areas. These differences apparently result from differing genetic propensities of individuals, unique life experiences, and specific conditions such as vulnerability, body condition and so on.

Management Implications: To protect individuals and populations at the sensitive end of the disturbance spectrum, management practices must err on the conservative side. It therefore follows that most raptors should be over protected. This must be accepted and justified to the public. Managers and biologists should not be embarrassed by those instances of raptors nesting happily on bombing ranges. At the more discrete level, tourist operations should avoid particularly sensitive pairs and steer tourists toward pairs that are robust to disturbance.

Principle #3. Nest failures in several subsequent years can lead to territory abandonment.

Commentary: Experience shows that failure of a nest or breeding territory in several consecutive years often leads to abandonment of the breeding territory and loss of the breeding pair to the population. This is particularly evident at marginal nest sites; ones providing minimal protection. Nest failure and loss of a single year's breeding effort is regrettable but rarely of major significance to long-term population trend. However, loss of breeding pairs in low-density species like raptors can quickly lead to population decline.

Management Implications: Much stricter controls must be placed on persistent, resident disturbances than on those occurring during a single season. Tourist operations should not exist at a nest site in years immediately subsequent to a nest failure.

Principle #4. Approaches by animals, including humans, are among the most severe disturbances to nesting raptors.

Commentary: Raptors generally nest in cliffs or treetops as a means of providing their young protection from ground predators. This strategy is effective but costly with nest site availability acting to limit populations in many areas. Predation has exercised strong selective pressure on the reproductive strategy of raptors. This would appear to explain why raptors react so severely to approach from the ground by free moving animals.

Management Implications: Protective measures should emphasize mitigating the proximity of free moving people and perhaps place less emphasis on other disturbance sources such as vehicles and noises. Campsites should not be near nests whereas roads could be. Raptors must be provided protection from tourists and photographers as a matter of priority.

Principle #5. Startling nesting raptors leads to worse consequences than a deliberate, gradual disturbance.

Commentary: When startled, an incubating raptor leaps instantly from the nest. The sharp talons can puncture the eggs or slash the young. A gradually intensifying disturbance alerts the incubating bird gradually allowing a gentler and safer exit from the nest.

Management Implications: Tourists and photographers should be educated not to attempt to sneak up on raptor nests. Use of blinds or hides in close proximity to nests should be discouraged. Low level flights by supersonic aircraft can be expected to have far greater impacts on nesting raptors than have been documented in studies of disturbance by propeller and rotor winged aircraft.

Principle #6. Entering the nest near the time of fledgling often leads to premature nest departure.

Commentary: During the last week or so as nestlings, severe disturbance at the nest often causes young raptors to jump out of the nest. This can cause death from exposure, predation, and starvation, or from the fall itself.

Management Implications: Any activity entailing entry or close approach in the nest should be avoided late in the nestling stage. The most serious infringement of this principle is by bird-banders.

Chris Shank
Wildlife Management Division
Government of the NWT
Transcribed from a document dated: 88/11/07

Cumulative effects

The minor environmental effects of Project activities on the raptor populations over the life of the Project will be direct and no environmental effects by human sources from elsewhere in the region on raptors in the Project area can be foreseen; likewise no direct and / or indirect environmental effects by the Project on raptors beyond the Project area are expected.

Migratory birds

Migratory bird species are represented in the local fauna by individual breeding pairs of species that are generally distributed throughout the continental tundra biome and, for some species, beyond. None of the species known to breed in the Project area have been observed in large concentrations. Large concentrations of waterfowl have not been observed at either Carat Lake or nearby Contwoyto Lake (5 km). In 1999 a pair of loons and an oldsquaw nested in the outflow to Carat Lake; a pair of Arctic terns nested nearby. The loons were noted there again in 2000 and a pair of parasitic jaegers nested on the adjacent lowland. No nesting waterfowl were noted on the shores of Long Lake (proposed tailings containment) in either 1999 or 2000 during searches of the entire shoreline.

Interactions with migratory birds during construction, operations and related support activities will be of a passive nature. Direct interactions that could cause displacement of individual pairs of loons or oldsquaw nesting in the Project area on Carat Lake and its outflow are not required for any aspect of the Project. Operating plans and the Project EMS should include contingency

measures that ensure contaminants from accidental spills do not enter Carat Lake, its outflow parallel to the airstrip, or local ponds adjacent to the Project's perimeter.

The environmental effects of construction, operations, and related support activities of the Jericho Diamond Project on migratory birds will be local, will continue for the life of the Project, and have a minor effect on the migratory bird populations of the mainland tundra of North America. No residual environmental effects are predicted.

Cumulative effects
The minor environmental effects of Project activities on the migratory bird populations over the life of the Project will be direct and no environmental effects on migratory birds in the Project area by human sources from elsewhere in the region can be foreseen; likewise no direct and / or indirect environmental effects by the Project on migratory birds beyond the Project area are expected.

Small mammals - herbivores
Microtine rodents, hare, and ground squirrels occupy the Project area and are found throughout the tundra of Nunavut and beyond. They are local residents throughout the year but ground squirrels hibernate. The Jericho Project will have a direct effect on small mammal habitat as discussed above. Beyond that, the effects from Project activities on cyclic microtine populations will be direct but undetectable. Direct effects on ground squirrels will be those associated with ground squirrels' habituation to camp facilities as shelter and a source of scraps including food. Arctic hare will use the facilities sites in winter as shelter from the elements, and from predators in summer and winter. All small mammals active in the local Project area are potential road kills.

Mitigation measures
The Project EMS will set out standards for driving that would keep the road kills to a minimum. A fundamental feature of the Project EMS in this regard should be to accord all animals the "right-of-way" when encountered by vehicles of any size. In the event that accidents occur the remains of ground squirrels and hare should be collected immediately to avoid attracting scavengers which may associate human activity with food and then in turn risk becoming road kills. The remains of all road kills should be destroyed by incineration. Records should be kept of all incidents as these are instructive on conditions that may have contributed to the accident in the first place. Hunting small mammals by Project workers at the mine and surrounding area should be prohibited.

The environmental effects of construction, operation, and related support activities from the Jericho Diamond Project on small herbivore mammals will be local, and will be present for the life of the Project with minor effect on the small mammal populations of the mainland tundra. No residual environmental effects are predicted.

Cumulative effects
The minor environmental effects of Project activities on local small mammal populations over the life of the Project will be direct and no environmental effects on small mammals in the Project area by human sources from elsewhere in the region can be foreseen; likewise no environmental effects by the Project on small mammals beyond the Project area are expected.

Muskox
Muskox are resident in the Project area and are found in low densities throughout most of the mainland tundra of Nunavut. An aerial survey of lands between Contwoyto Lake and Coronation Gulf in 1991 by the GNWT estimated a population of 1403 animals in an area of 16,000 km^2 (GNWT unpublished as cited in Metall, 1995). Muskox in low numbers were observed in the Project area during aerial surveys in 1999 and other overflights of the Project area since 1995. No observations of muskox were recorded for the area immediately adjacent Carat Lake or the airstrip. Summer observations of individuals and small herds in the highlands east of Carat Lake were common during flights between Carat Camp and Lupin in the summer of 1999. Winter herds of up to 25 animals were observed on the northern flank of the Willingham Hills in the spring of 2000. No muskox fecal pellets (winter form) or fecal chips (summer form) were recorded during habitat survey transects through the three dominant ecological zones in the area reported by Canamera (1996). These transects included examination of the areas adjacent to the proposed waste rock piles, the diamond processing plant site, and adjacent to the airstrip. Muskox are resident in the region but their use of the grounds in the immediate vicinity of the Jericho pipe, Carat Camp and airstrip seems to be infrequent. Notwithstanding their infrequent use, muskox show great tolerance to benign and passive interactions with human activity as has been demonstrated by years of observations at Lupin Mine. Also, no road accident involving muskox at Lupin has been reported (Hohnstein, 1996).

Mitigation measures
The Project EMS should set out standards for driving that prevent vehicle / wildlife accidents. A fundamental feature of the Project EMS in this regard should accord all animals the "right-of-way" when encountered by vehicles of any size.

The environmental effects of construction, operations, and related support activities from the Jericho Diamond Project on muskox will be local, persist for the life of the Project, and will have a minor effect on the muskox population in the region. No residual environmental effects are predicted.

Cumulative effects
The minor environmental effects of Project activities on the muskox population over the life of the Project will be direct and no environmental effects on muskox in the Project area by human sources from elsewhere in the region can be foreseen; likewise no environmental effects by the Project on muskox beyond the Project area are expected.

Caribou
The Jericho Diamond Project is located on the Bathurst caribou herd summer range. Large concentrations of caribou with and without calves have been observed passing through the Project area traveling both north and south in summer months. The Project is located near the apex of a very large lake (Contwoyto) and the movement of caribou through the Project area may be in part concentrations of caribou passing around the lake, rather than selecting the Willingham Hills for a specific summer destination. On only one occasion during the exploration phase of the Jericho Project was a large concentration of caribou observed to interrupt a summer migration to feed and rest in the Project area. This occurred June 26/27 1996 when a post-calving concentration estimated at 50,000 (+/-14% of the herd) spent 12 - 18 hours in the

immediate Project area. The observation and Project response was recorded by Tobias Vlasblom, the engineer supervising the airstrip construction: "Into the night shift, around 9 pm, a large herd of caribou appeared at the north end of the old Jericho camp, and all equipment was shut down." (The location mentioned is just north of the north end of the Jericho airstrip.) His observation for June 27 was also recorded: "The caribou that shut down operations yesterday moved southeast around 11 am and we were able to continue (airstrip construction) in the afternoon" (Jericho daily engineering report, unpublished). Similar observations have been made at Lupin. In June 1999 herds of 1000+ caribou passed between Lupin and Contwoyto Lake more or less continuously June 27, 28, 29 and 30. All were non breeding animals, with a high proportion of bulls and yearlings, moving northwesterly (author's observations and 1999 Jericho Project wildlife log; Appendix 1, Hubert and Associates Ltd., 2002).

These observations show that physical infrastructure like Lupin Mine and heavy construction equipment operations (Jericho airstrip construction) are not barriers to large aggregations of migrating caribou. These observations also show that large aggregations of caribou must be expected in the Project area during seasonal mining operations and that the Project's site configuration, operations plan, and EMS should be developed to accommodate an instantaneous influx of several thousand caribou.

Movement of caribou through the area during spring migration is significant but the observations made (Appendix 1, Hubert and Associates Ltd., 2002) suggest that spring migration through the Project area is characterized by a steady stream of smaller herds (100's) as opposed to the summer observations which are either that of small numbers (<10) moving very little, or very large herds (>1000) moving quickly.

The distribution of caribou trails in the Project area (Figure 8, Hubert and Associates Ltd., 2002) and the reports of observers show the distribution and direction of caribou movements during summer migration events. This information shows that it is possible (and necessary) to develop a cost effective Project site configuration plan that will not unduly hinder the movement of large numbers of caribou during the post-calving through late summer period. Figure 3 shows the predicted effect of the Project's site development may have on mass movements of caribou through the local Project area. At a regional scale it is noteworthy that mine construction and operations have been conducted at Lupin from 1980 to the present. In this period the Bathurst Herd increased from 100 - 120,000 in 1979 (Case et al., 1996) to 349,000 in 1996 (Gunn et al., 1997). Road development and operations in Alaska and Yukon also add information to that available from the NWT and Nunavut.

The Milne Point, Kuparuk and Prudhoe Bay oil fields in northern Alaska were developed on a known caribou calving and post calving grounds of the Central Arctic Herd. Caribou monitoring before and after oil field development (1978 - 81; 1982 - 1987) showed that the distribution of cows on the calving ground changed; cows with calves generally avoided areas within 2 km of a service road with "moderate to heavy traffic" for up to three weeks after the peak of calving. It is noteworthy that caribou in other sex and age classes used the area closer to the road avoided by cows with new born calves. Also, the area of the oil fields continued to be used as a calving ground after the oil fields were developed with roads, pump jacks, and pipelines built and operating. Perhaps most significant of all, the herd grew throughout this period from 6,000 in 1978 to 23,400 in 1992.

The Western Arctic Herd ranges over northwest Alaska. The Red Dog lead-zinc mine went into operation in 1989. The Red Dog ore body is owned by the Nana Corporation, one of the native corporations established in the Alaska land claim. The mine is operated by Teck-Cominco. It required a 100 km all-weather road to service the mine and remove the concentrate to a marine port on Kotzebue Sound. This road passes through winter range and crosses migration routes of the Western Arctic Herd with a traffic volume of at least 30 loaded trucks per day. Like the Central Arctic Herd, it has grown and multiplied by from 75,000 to 416,000 in the period between 1976 and 1991.

The Porcupine herd is shared between NWT, Yukon, and Alaska. The Dempster Highway cuts through its winter range and crosses several major migratory routes in the NWT and Yukon. Prior to construction and operation of the Dempster highway a lot of concern was expressed for the future of the herd. The road opened in 1979. In the first ten years of operations from 1979 - 1989 the herd increased by 60% from 106,000 to 163,500 (Murphy and Lawhead, 2000; Ballard et al., 2000).

Mitigation measures

The distribution and density of caribou trails in the Project area and adjacent lands in relation to proposed Project facilities was described in Hubert and Associates Ltd., 2002. The predicted responses of caribou movements in the Project area to the proposed Project site developments are also shown in Figure 3. While the site plan may facilitate unimpeded movement of large (>1000) concentrations of caribou through the Project area, mitigation measures are available to further reduce the risk of unintended interactions between caribou and Jericho Project activities.

Placing a "fence" of "oversize" waste rock south of Carat Lake should serve to deflect caribou movement from the southwest from passing through the Project's core operations area. The effectiveness of these waste rock barriers can be augmented by the deployment of low cost, low maintenance fences as described in studies by Gunn et al. (1997) at Lupin Mine. It was reported that rope festooned with rip stop nylon streamer flagging spaced 30 cm apart was an effective barrier to both passive and disturbance induced caribou movements. It is recommended that this technique be deployed at Jericho in a way that would guide caribou movements around the outer perimeter of the Jericho Project mine and processing plant site. Similarly, oversize waste rock deflectors should be set up beyond the north end of the airstrip to deflect caribou movements from the north around the eastern perimeter of the Project area. These measures are expected to be effective for directing caribou movement during migration events but not necessarily in the case of individual caribou or small bands (<10) that may take up temporary residence in the Project area for periods of a week or more during the snow free season. It may be impossible to avoid such caribou use inside the Project footprint perimeter as it will provide a haven from predators, provide a measure of insect relief, may support local sites with a lush growth around sites with altered moisture and nutrient regimes, and provide shade on "hot" days. In these situations it is important to examine the nature of the risk faced by the animals in interactions with normal mine site activities and adopt a strategy of co-existence.

Hunting caribou on and / or near the Project area by Project personnel should be prohibited.

The potential interaction between caribou and tailings ponds was raised in the "guidelines" (Nunavut Water Board, 1999). Observations of caribou on and near tailings at Lupin in August 1993 were reported by Mueller and Gunn (1996). No negative interactions were reported from analysis of 112 photographs taken by two remote cameras over a 12 day period between August 4 and 16, 1993.

The most common interaction with caribou in the Project area will likely be road traffic. Caribou should always have the right of way. During the study by Gunn et al. at Lupin, caribou "(spent) more time bedded in open developed area (airstrip / tailings)"... than on undeveloped (undisturbed) sites. The same must be expected at Jericho where individual caribou and perhaps cow / calf pairs will use the airstrip, roads, ore pads, and waste rock dumps as resting locations. Implementing the principle that "animals have the right of way" will ensure that negative effects will be kept to a minimum. Individual caribou will also graze within the Project footprint perimeter.

The pit slope for the top two benches will be 45 degrees and the benches separated by a 10 meter horizontal berm, rather benign topography compared to the natural landscape of the Willingham Hills just 3 km east of the airstrip. Nevertheless, a berm of waste rock should be constructed to surround the pit and serve as a visual barrier and so reduce the risk of impact or injury to caribou (reacting to a blast for example) that may approach the pit area.

It is also important to protect Project related structures from the effects of caribou traffic. The sedimentation ponds below the waste rock dumps are expected to be low profile aggregate berms placed to collect run off from the rock piles. Those structures are at risk of damage from trampling by caribou during a mass movement through a constricted corridor like the margin of Carat Lake. Effective caribou deflection devices will be required to protect the integrity of the sedimentation pond berms. Such devices notwithstanding, summer access to the sedimentation pond berms should be maintained so that berms can be upgraded in the event that a concentrated and sustained caribou migration between lakes and adjacent waste piles occur. Ongoing berm maintenance as required may be less costly and cause less long term terrain impact than erecting a caribou barrier or building indestructible berms.

Effective site planning, deployment of deflector fencing, and ensuring that caribou have the right of way over local road traffic will ensure that environmental effects of construction, operations, and related activities over the life of the Jericho Project will be local, of moderate duration, and minor on the Bathurst caribou herd, and the sustainability of the annual caribou harvest from the herd. No residual environmental effects on the Bathurst caribou herd are expected.

Cumulative effects

The minor environmental effects of Project activities on the Bathurst caribou herd over the life of the Project will be local and direct. No environmental effects on caribou in the Project area from other human sources can be foreseen, nor will the Project contribute to environmental effects on caribou elsewhere in the region. While cumulative effects on the Bathurst herd are not foreseen, the sustainable harvest from this resource is crucial to the well being of many Nunavut and NWT communities. It is recommended that the Jericho Project participate with the Government of Nunavut and other governments and industrial interests in monitoring the seasonal distribution,

productivity, and sustainability of the herd in relation to all human activities on the herd's annual range. The value of such collaboration has been demonstrated by the caribou telemetry data reported in Hubert and Associates Ltd. 2002. Tahera Corporation has been an active co-sponsor of the West Kitikmeot / Slave Study (WKSS) which coordinated the funding for telemetry collar deployment and data recovery. Continued cooperation and collaboration like that demonstrated by the WKSS may produce more, and perhaps more useful results for monies spent, than the individual efforts of parties working in isolation. The overall value of the Bathurst herd deserves no less.

Carnivores

Carnivore species whose ranges include the Project area are Arctic fox, red fox, wolf, wolverine and grizzly bear. Each of these species has been observed in the project area during the exploration phase of the Project. Several dens have been located nearby, but none within the active footprint of the mine and related facilities and infrastructure (Hubert and Associates Ltd., 2002).

Fox

Arctic fox and red fox have both been observed in the Project area, but only red fox have been found to occupy nearby dens. Arctic fox range over the tundra of the northern hemisphere while red fox are a ubiquitous species over most of continental Canada plus Southampton and Baffin Islands in Nunavut (Samuel and Nelson, 1982). Red fox have been observed in the area and a den, active in 1999 and 2000, is located in a sand ridge in the lowland approximately 0.5 km east of the airstrip. Red fox breed in winter and the young are born in late winter. Successful rearing of young is dependent on the abundance of prey species in the area; this was documented by MacPherson for Arctic fox near Baker Lake (1969) and should be expected for red fox on tundra ranges as well. As with rough-legged hawks, the most common prey for foxes in the Project area are microtine rodents whose population cycles will not be affected by the Project's operations.

Interactions between Project operations and fox should be minimal. Proposed Project operations have no need to disturb the area of the den nor is there a need for Project personnel to visit it.

Mitigation measures

Foxes are skillful scavengers as well as predators, and so care must be taken to dispose of all food scraps from the camp mess and from bag lunches away from camp. Foxes can also become habituated to "handouts" and so that practice must also be avoided to reduce interactions. Also, all food shipments to the airstrip or by winter road should be kept inaccessible to foxes or be attended while they are in transit from airstrip to camp. Unattended food shipments can quickly be scavenged by fox and so invite a repeat visit to sites and objects with associated smells and aromas. It is also essential that any road kills be disposed of immediately.

Foxes can also cause considerable damage to unoccupied camps by digging and chewing at buildings emanating food smells. It is recommended therefore that a camp attendant be present at times when operations may be suspended. Trapping foxes at Jericho by Project personnel should be prohibited.

It is noteworthy that rabies is endemic to Arctic fox populations (Burgess, 2000). Precautions appropriate to the risk of contracting rabies should be followed by site personnel especially if dogs will be allowed on site.

The environmental effects of construction, operations, and related support activities at the Jericho Diamond Project on the fox populations will be local, continue over the life of the Project, and be minor. No residual environmental effects are predicted.

Cumulative effects
The minor environmental effects of Project activities on the fox populations over the life of the Project will be direct and no environmental effects on foxes in the Project area by human sources from elsewhere in the region can be foreseen; likewise no direct and / or indirect environmental effects by the Project on foxes beyond the Project area are expected.

Wolf
Wolf is also a species with a pan Arctic range and while extirpated from much of its southern range, wolves are an active and healthy element of the tundra ecosystem in the Project area. Wolves breed in winter and pups are born in early spring. Recent studies have shown that while wolves are distributed throughout NWT and Nunavut, there seem to be population units within the overall geographic range of the species. The genetics of wolves that range over the tundra are similar to wolves ranging along tree line but both are quite different from wolves of the boreal forest (Cluff et all. 2001).

Three wolf dens are known for the Project area; one 0.5 km northeast of the airstrip and another near Contwoyto Lake, east of the proposed pit. Neither den has been confirmed as being active in the course of the Project since 1995, but an obviously nursing female was observed on several occasions by the airstrip construction crew in 1996 (Tobias Vlasblom in Jericho daily engineering report, Canamera, 1996b unpublished). A den 6+ km north of the airstrip was active in 1999. None of the dens are within the active footprint of the mine and related facilities and infrastructure. As with fox, interactions with the Project should be passive, with no activity of the Project requiring direct exposure to any of the wolf dens in the area. Being a larger carnivore than the fox, the diet of wolves includes larger prey species from the area, principally caribou. Denning activity that does occur at the dens near to the Project area will be seasonal and coincide with early mining and late hauling activities. Wolves are also known to scavenge and so the same mitigation measures to be practiced by the Project for fox apply equally to wolf. It is also essential that road kills be disposed of promptly. Hunting wolves by Project personnel in the area of the Jericho Project site should be prohibited.

The environmental effects of construction, operations and related support activities by the Jericho Diamond Project on the wolf population over the life of the Project will be local, moderate, and minor. No residual environmental effects re predicted.

Cumulative effects
The minor environmental effects of Project activities on the wolf population over the life of the Project will be direct and no environmental effects on wolves in the Project area by human activities elsewhere in the region can be foreseen; likewise no direct and / or indirect environmental effects by the Project on wolves beyond the Project area are expected.

Wolverine
Wolverines are present throughout the tundra of Nunavut and NWT. Wolverines are solitary carnivores; are expert scavengers and successful predators (Wilson, 1982). Recent studies in the region have confirmed that males range over a larger area (404 km^2) than females (126 km^2) and that juveniles range over larger areas than mature animals (Lee, 1997; Mulders, 2000). Observations from a single den site showed that it was used repeatedly over a three year period. (Lee and Niptanatiak 1996; in Mulders, 2000). Wolverines have been observed in the Project area from time to time but no den has been found in or near the Project area.

Wolverines can also be very destructive of camps and caches and so it is recommended that the Jericho Project have a camp attendant present during times when activities at the Project site may be suspended. The same mitigation measures to be practiced by the Project for fox and wolf apply to wolverine. It is also essential that any road kills be disposed of immediately. Hunting in the Project area by Project personnel should be prohibited.

The environmental effects of Jericho Diamond Project construction, operations, and related support activities on the tundra wolverine population over the life of the Project will be local, moderate, and minor. No residual environmental effects are predicted.

Cumulative effects
The minor environmental effects of Project activities on the wolverine population over the life of the Project will be direct and no environmental effects on wolverine in the Project area from human activities elsewhere in the region can be foreseen; likewise no direct and / or indirect environmental effects by the Project on wolverine beyond the Project area are expected.

Grizzly Bear

> *The grizzly has been able to survive in North America only where spacious habitat has insulated it from excessive human-caused mortality. Its habitat has traditionally been protected by rugged physiography or inaccessibility. (Craighead and Mitchell, 1982).*

Grizzly bear range over the most of the mainland tundra of Nunavut, and throughout the NWT tundra and have been observed in the Project area from time to time. The large esker complex running northwest from the airstrip shows the remains of four grizzly dens.

Grizzlies den for the winter in October. In the area of the Project it is expected that well drained soils including esker habitat will be the preferred denning habitat. Males remain active later in the fall and emerge from winter dens earlier than females with cubs, which show up a month later (Craighead and Mitchell, 1982). Emergence from winter dens may coincide with both mining and hauling activities in the Project area.

Bear and the sign of bear have been observed at the Carat Lake camp but there have been no direct interactions with grizzly there since the camp was established in 1996. The camp management has always been diligent in incinerating kitchen garbage and an electric perimeter fence was erected around the camp in the summer of 1996. The experience and record at Lupin Mine shows that mining within the range of grizzly can proceed with little direct impact on the

grizzly population in the region (Metall, 1993). A nuisance situation arose only once in the history of the mine, and that at a time when the incinerator was in need of repair and the accumulated kitchen refuse attracted a female with cubs. This trio was captured and relocated by helicopter but returned to Lupin and were then destroyed. The overall history of Lupin's interactions with grizzly suggests that the site specific activities associated with a mine and camp do not *de facto* destroy the wilderness characteristics needed to sustain grizzly populations.

In the matter of denning habitat, there is no need or intention of taking granular material from the northwest esker complex where evidence of past grizzly denning has been observed.

The record of grizzly presence but absence of direct interactions with man at the Carat Lake camp is evidence of the effectiveness of the current practice of incineration and electric fencing. These practices should continue for the duration of Jericho Project operations.

Mitigation measures

1. A prompt road kill removal should be developed in the Jericho Project EMS.
2. A prompt and regular garbage disposal program for all perishable camp refuse and garbage should be implemented.
3. Back-up incineration capacity for garbage and road kill disposal should be in place to ensure equipment failure does not compromise the overall effectiveness of the bear deterrent program at the Jericho Project.
4. A bear response plan should be developed and all staff made aware of it. Notices of it would be posted at key points in camp, airstrip, and mine site. (This system has been effective at Lupin for many years.)
5. Hunting by Project personnel in the Project area should be prohibited.

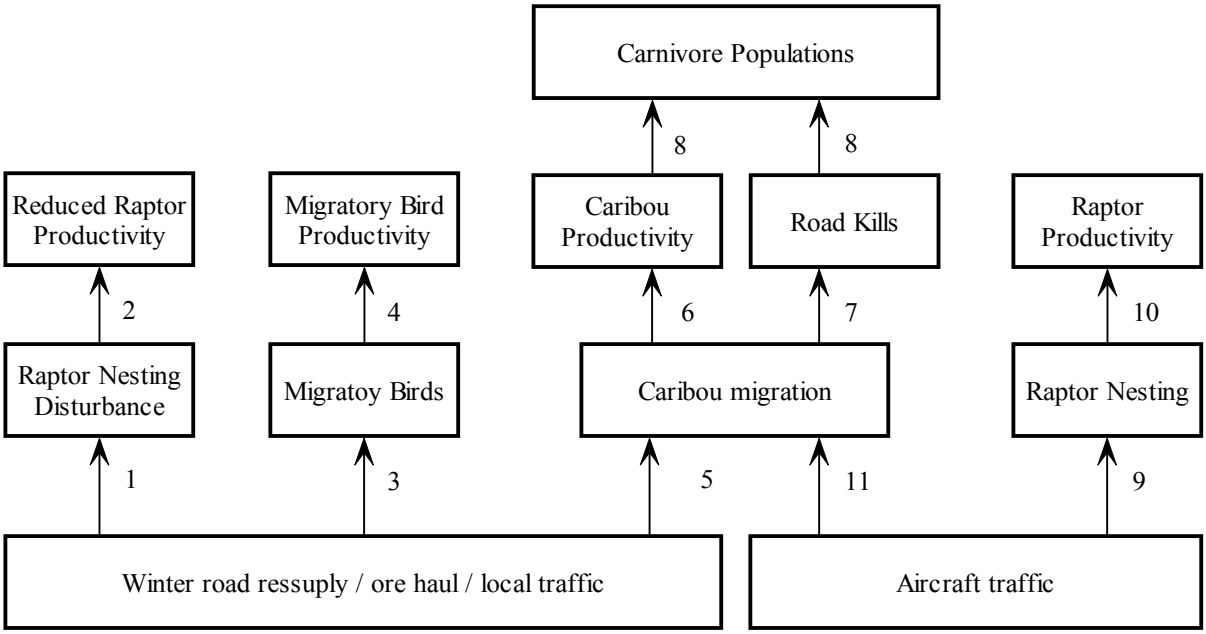
The environmental effects of construction, operations, and related support activities over the life of the Jericho Diamond Project will be local, and minor on grizzly bear abundance and distribution in the region. No residual environmental effects are predicted.

Cumulative effects

The minor environmental effects of Project activities on the grizzly population over the life of the Project will be direct and no environmental effects on grizzly in the Project area from human sources elsewhere in the region can be foreseen; likewise no direct and / or indirect environmental effects by the Project on grizzly beyond the Project area are expected.

3.3 Environmental effects of transportation services to the Jericho Diamond Project.

Potential Jericho Project transportation activities interactions with wildlife



1. The winter resupply by winter road may disturb spring raptor breeding and nesting.
2. Disturbances to raptor nesting may result in reduced raptor productivity.
3. The winter resupply may disturb migratory bird nesting.
4. Disturbances to migratory bird nesting may result in reduced productivity.
5. The winter resupply may disrupt caribou spring migration:
   - by affecting spring migration patterns on Contwoyto Lake and between Contwoyto Lake and the Project site on Carat Lake; and
   - by accidental collisions of trucks with caribou.
6. Disturbance to caribou may result in reduced caribou productivity.
7. Road kills will attract scavengers which may associate the winter road with food.
8. Scavengers may become nuisance wildlife and be destroyed and so reduce abundance and productivity of scavenger species (carnivores).
9. Summer aircraft movements at Jericho may affect raptor nesting success.
10. Summer disturbances to raptor nesting may reduce raptor productivity.
11. Aircraft movements at Jericho may disturb caribou.

Key question: Will the local road traffic, the seasonal winter road resupply, and / or ongoing air transport support for the Jericho Diamond Project, affect the distribution, abundance, and productivity of local and regional wildlife populations, and the annual harvests these populations sustain?

Background
Transportation support for the Project will have two main components:

- annual winter resupply of bulk materials like fuel from winter road now serving Lupin Mine;
- weekly flights to the Project site for crew change and camp provisioning.

Aspects of transportation activities that could be the source of environmental effects are:

- heavy truck traffic and related noise and motion on the winter road;
- collisions with wildlife on winter roads in the region and on service roads on the Project site;
- spills;
- noise of aircraft landing and departing from the airstrip.

Local traffic
Figure 1 shows the service and haul roads that will be developed in the Project area. Local traffic patterns will reflect the ongoing activities at the site and be similar to those observed at other northern mine sites. Heavy mine trucks will haul ore and waste rock from the pit; loaders will transfer ore from the ore storage pad; light vehicles will transfer personnel and materials around the site. Heavy equipment will maintain roads throughout the Project site.

Seasonal resupply by winter road
The Jericho Diamond Project will be served by the Lupin winter road for its annual resupply. The ice road serving the Jericho Project will be a 28 km extension on Contwoyto Lake and continue 3 km over the tundra to the Project site. In the event that the Ulu Project proceeds, the winter road serving Ulu would continue north from the Jericho turn-off to the northern tip of Contwoyto Lake. Jericho. The Ulu Project winter road resupply schedule would be similar to the winter road operations serving Jericho.

At present the winter road serving Lupin Mine originates at Tibbit Lake, 60 km east of Yellowknife. A Project Description to build and operate a port on Bathurst Inlet for resupplying bulk materials to Lupin Mine has been developed and submitted with a request for a review by the Nunavut Impact Review Board.

Winter road support for the Project, regardless of route, will produce local and regional interactions with VECs. The annual resupply for the Jericho Diamond Project by winter road will operate for as brief a period as possible during the late January to early April period every year. In total, 441 loads will be required for site construction and Project commissioning including 416 loads in Year 1, 17 loads in Year 2, and 8 loads in Year 3. A total of 312 loads will be required annually in Years 2 to 4 for resupply during open pit mining, 157 loads annually in Years 5 and 6 for resupply during underground mining**.** During the final two years of ore processing, 123 loads will be required. Decommissioning will require 179 loads if all buildings and industrial scrap are removed from the Jericho site.

Air support for camp provisioning and personnel rotation
The number of personnel on site will vary with the season and the mining methods. Initially, during the pit mining phase, onsite mining personnel will number 45 - 58 with another 28 in processing and site services. Pit mining operations will be conducted only in the April to

December period. Processing and site services will operate year round. During the underground mining phase, mining personnel will number 24. Weekly flights by mid-sized combi aircraft will range from one to three for the life of the Project.

Discussion

Raptors

The winter resupply haul route(s) do not pass near any of the known gyrfalcon or golden eagle nest sites in the Willingham Hills / Contwoyto Point area. The winter road route from Contwoyto Lake to the Project site follows Lynne Creek and crosses Lynne Lake, or in later years may go up from the Lynne Creek water course below Lynne Lake and join the road to the explosives storage sites. The original route passes directly under a rough-legged hawk nest site on Lynne Lake (J8) and two peregrine falcon nest sites (J6 and J7) overlooking the route below Lynne Lake; J7 is over the land portion of the winter road connector from Contwoyto Lake and J6 is roughly opposite the ice road's land fall near the mouth of Lynne Creek. (J8) Winter road transport activities serving Jericho will be completed for the season by the time rough-legged hawks and peregrine falcons undertake nesting (late May / early June). All birds will have departed by the time the winter road resupply resumes in late January. There are no raptor nest sites near the airstrip. None of the local roads used for day to day operations are near any of the known raptor nest sites.

Interactions between Jericho Project transportation activities and local raptors will be infrequent and the environmental effects on raptor populations will be local, extend for the life of the Project, and have a minor effect. No residual effects are predicted.

Cumulative effects

The environmental effects of Project transportation activities on the local raptor populations over the life of the Project will be direct and no environmental effects on local raptor populations from human sources from elsewhere in the region can be foreseen; likewise no direct and / or indirect environmental effects by the Project's transportation activities on raptors beyond the Project area are expected.

Migratory birds

Winter road activities serving Jericho will be completed for the season by the time migratory birds return to their summer breeding territories in the Jericho Project area (early June). All birds will have departed by the time the winter road resupply resumes in late January. Water fowl nesting occurrences on ponds near the airstrip have not been observed but a brood of oldsquaw ducks was seen there in August 1999.

Interactions between Jericho Project transportation activities and local migratory birds will be infrequent and the environmental effect on migratory bird populations will be local, medium term (life of Project), and minor. No residual environmental effects from the Project's transportation activities are predicted.

Cumulative effects

The environmental effects of Project transportation activities on the local migratory birds over the life of the Project will be direct and no environmental effects on migratory birds in the Project area from human sources from elsewhere in the region can be foreseen; likewise no direct

and / or indirect environmental effects by the Project's transportation activities on migratory birds beyond the Project area are expected.

Caribou

Data from aerial surveys and the observations of personnel at Carat Camp and Lupin describe the caribou spring migration through the Lupin / Jericho area beginning in mid-April 1999 (caribou were first recorded at Lupin 17 April; caribou tracks first noted at Jericho 21 April; Appendix 1, Hubert and Associates Ltd., 2002). The annual resupply on the Tibbit to Contwoyto winter road will be completed by mid-April. In 1999 the peak of the spring migration in the Jericho area seemed to occur 15 - 23 May (Appendix 1b; Hubert and Associates Ltd., 2002). The concentrations of bulls, yearlings and barren cows observed moving through the Lupin area in late June and early July 1999 seemed to follow the shoreline, even though the lake remained covered with ice.

Contwoyto Lake lies across a broad expanse (110 km) of the Bathurst herd's spring migration route (see Kelsall, 1968; Mueller and Gunn, 1996). In any given year thousands of caribou cows cross the spring ice of Contwoyto Lake en route to the calving ground. An ice road running the length of the lake from its southern apex to Lupin has operated yearly since 1983 (see Table 6.3.2-2 in Diavik CSR for 1983-1997 winter operating statistics, CEAA 1999). The mean "last truck" date for the period 1983-1997 was April 4. This is earlier than the observed spring migration period at Lupin and Jericho (1999 wildlife log in Appendix 1; Hubert and Associates Ltd., 2002) but the snow berm along the road way from clearing the right of way persists on the ice surface until break-up. Studies of interactions between caribou and transportation corridors have not shown that caribou change their migration route or distribution in response to transportation corridors alone (Bergerud et al. 1982: Alaska Data).

More recent data from Alaskan studies confirms the earlier work cited above. The Milne Point, Kuparuk and Prudhoe Bay oil fields in northern Alaska were developed on a known caribou calving and post calving grounds of the Central Arctic Herd. These oil fields are connected with a comprehensive network of all weather roads. Caribou monitoring before and after oil field development (1978-81; 1982-1987) showed that the distribution of cows on the calving ground changed; cows with calves generally avoided areas within 2 km of a service road with "moderate to heavy traffic" for up to three weeks after the peak of calving. It is noteworthy that caribou in other sex and age classes used the area closer to the road avoided by cows with new born calves. Also, the area of the oil fields continued to be used as a calving ground after the oil fields were developed with roads, pump jacks, and pipelines built and operating. Perhaps most significant of all, the herd grew throughout this period from 6,000 in 1978 to 23,400 in 1992.

The Western Arctic Herd ranges over northwest Alaska. The Red Dog lead-zinc mine went into operation in 1989. The Red Dog ore body is owned by the Nana Corporation, one of the native corporations established in the Alaska land claim. The mine is operated by Teck-Cominco. It required a 100 km all-weather road to service the mine and remove the concentrate to a marine port on Kotzebue Sound. This road, with a traffic volume of at least 30 loaded trucks per day, passes through winter range and crosses migration routes of the Western Arctic Herd. Like the Central Arctic Herd, it has grown and multiplied by from 75,000 to 416,000 in the period between 1976 and 1991.

The Porcupine herd is shared between NWT, Yukon, and Alaska. The Dempster highway cuts through its winter range and crosses several major migratory routes in the NWT and Yukon. Prior to Dempster Highway construction and operation a lot of concern was expressed for the future of the herd. The road opened in 1979. In the first ten years of operations from 1979-1989 the herd increased by 60% from 106,000 to 163,500 (Murphy and Lawhead, 2000; Ballard et al., 2000).

Caribou presence has been a feature of operations at Lupin in spring and summer for its entire operating history. The numbers of caribou present from year to year and from month to month are variable (Mueller and Gunn, 1996). Only three accidental caribou deaths have been reported by Echo Bay Mines at Lupin (Hohnstein, 1996); a far greater risk to both caribou and humans is expressed on the matter of caribou on the airstrip. That risk will be similar at the Jericho airstrip for the periods of spring migration through late summer when caribou should be expected in numbers ranging from individuals to thousands. Their presence will be similar to that observed at Carat Camp and Lupin; individual animals and small groups can take up temporary residence, and large numbers will pass through without any sign of forewarning.

Extensive studies into caribou reaction to aircraft have been made on different herds in the past 20 years. Perhaps the most detailed was the study of low level fighter jet training flights over the George River herd's range in northern Quebec. Training flights over the range were initiated in 1981 with 1500 flights increasing to over 6000 in 1988; and expected to increase further to 18,000 in 1996. The study compared caribou movements in areas of training flights to caribou movements not influenced by training flights; although overt responses by caribou to overflights were common, no significant (statistical) effects on daily activity levels or distance traveled were detected (Harrington and Lietch, 1991). The study found the "disturbance footprint" of a low level jet flight to be less than 500 m. The number of flights into the Project area will be considerably less than those reported above and will be low level only during approaches for landing and on climb-out after take-off.

Mitigation measures

Interactions between wildlife and Jericho Project transportation activities may occur during all seasons of the year:

- year round on local surface transport on local service and haul roads;
- on the winter resupply route between late January and early April;
- year round aircraft operations.

The primary mitigation measure for containing the effects of surface transport on service and haul road will be to give wildlife the right of way at all times.

Winter road operations will be contracted to carriers that have many years of experience on the Tibbit to Contwoyto winter road. These operations are subject to rigorous operating conditions including spill contingency and response plans. The Jericho Diamond Project should develop a similarly rigorous hazardous materials management and spill contingency plan for materials handling at the Project site.

Potential interactions between caribou and all forms of Jericho Project transportation equipment and services may take place during the late winter along the winter road, and at the Project site

during the spring migration through late summer period (April to September). The experience at Lupin shows that accidental deaths to caribou as a result of these interactions can be kept to a minimum. Several measures should be implemented through the Project EMS:

1. All trucks serving the Project should be equipped with radios so that drivers can alert each other of caribou (and other wildlife) either approaching or crossing the Project road network.
2. Transportation should be suspended on segments of road (and airstrip) when a significant number of caribou are present. "Significant" should be a predetermined number; 2000 is used by the Red Dog Project in Alaska (Delong Mountain Transportation Operating Plan - Road, n.d.).
3. A thorough visual check for caribou on and near the Jericho airstrip by ground staff should be made in advance of all aircraft landings and departures as is done at the Lupin airstrip by the communications person there.
4. All accidental road kills should be reported to the appropriate party(s) and removed for immediate disposal by incineration.
5. The Jericho Project should participate with the Government of Nunavut and other governments and industrial interests in monitoring the response of caribou and the nature of caribou / truck interactions in order to improve mitigation measures and winter road operating plans for all roads on caribou range.

Implementing these measures will ensure that road kills are avoided with no consequent effects on scavengers who would become at risk of a similar fate.

The environmental effect of Jericho Project transportation activities on the Bathurst caribou herd will be regional (spatial extent), medium term (for the life of the Project), and minor on the overall population.

Cumulative effects

The Tibbit to Contwoyto winter road stretches through the winter range of the Bathurst caribou herd and continues past the treeline where the herd congregates for the rut and continues onto the tundra summer range. The proposed Bathurst Inlet road crosses the herd's spring migration route and summer range. All commercial enterprises on the Bathurst caribou herd's range require transportation support, usually including winter road resupply and always aircraft for transferring personnel and provisioning camps. Other human activities throughout this range with potential environmental effects on caribou include other mines, both present (Lupin, EKATI™ and Diavik) and future (Ulu) and caribou sport hunting outfitter camps. The locations of commercial enterprises with a potential for environmental effects on the Bathurst caribou herd are shown on Figure 2. The mines on the caribou range operate year round. The winter road is in use from late January through mid-April every year; the outfitters' hunting camps operate from mid-August through early October. Table 3 provides data on harvests on the Bathurst range by outfitter supported hunters in the NWT in recent years.

Table 3. Potential and actual harvests by outfitter supported hunters on Bathurst caribou range in the NWT: 1999 – 2002.

Year	Allowable harvest	Actual harvest
1999	1077	889
2000	1094	921
2001	1342	1166
2002	1425	1150

Caribou outfitting in the Ktikmeot Region of Nunavut is presently not a major economic activity but it is expected to develop in the future. Several camps in the Ktikimeot Region hold licences to conduct outfitting (Figure 2) but no harvesting has been reported for recent years (Renald Gerard, pers. comm. 2002; Department of Sustainable Development, Government of Nunavut).

The interactions between Jericho Project surface transportation activities and caribou will occur during late winter and spring migration; interactions with Project aircraft activities could occur anytime between April and September. It is impossible to determine if any of the caribou involved in these interactions will also have interactions with other existing human land use activities on the Bathurst range. "During spring migration caribou cows are strongly motivated to reach the calving ground and apparently as they pass Lupin, they do not linger there" (Mueller and Gunn, 1996); they also presumably take the most energy efficient route to get to the calving ground. It is unlikely that caribou cows passing Lupin / Jericho on spring migration would also have passed through the EKATI™ and / or Diavik diamond projects; it may be however that cows which pass through the vicinity of the Jericho Project might also pass near to the Ulu Project site. Snap Lake is on the margins of the winter range and Hope Bay is outside the recent range of the Bathurst herd as defined by recent telemetry data from Bathurst caribou cows. Cumulative effects of successive and sequential interactions for a significant portion of the calving herd are not expected during spring migration. Similarly, it is unlikely that individual caribou cows will pass both Lupin and Jericho sites in a single spring migration period. During the remainder of the year however, it is possible and perhaps probable that individual caribou will interact with multiple mine sites and outfitter camps combined. Considering the daily movements of the animals during the summer period (13.52 and 5.32 km / day for post-calving and late summer seasons respectively), it is unlikely that interactions with mine activities at this time of year would persist for an extended period resulting in significant cumulative effects.

Future developments on the Bathurst herd's range during the life of the Jericho Diamond Project could include a diamond mine at Snap Lake near treeline south of Lac du Gras, the Ulu gold mine 100 km north of Jericho, the Hope Bay gold mine northeast of Bathurst Inlet, the Izok Lake Project approximately 50 km west of Jericho, and the Bathurst Inlet Port and Road Project spanning 211 km between Bathurst Inlet and the eastern shore of Contwoyto Lake. Caribou interacting with the Snap Lake Project on their winter range could also pass near EKATI™ and Diavik during the spring but that would reduce the probability of the same caribou also passing Jericho / Lupin. In the case of the Hope Bay gold mine its location is outside of the herd's current range but within 100 km of the margins of calving grounds used by the herd in a few years during the period from the mid-1960's to the early 1990's (Sutherland and Gunn, 1996). The future Izok Project is located in the path of spring migration from the western portion of the Bathurst herd's winter range, and in / near the area used during post calving in recent years and

also on the herd's summer range. The proposed road route from the future port on Bathurst Inlet crosses the spring migration corridor used by the Bathurst herd in recent years and is located on the herd's post calving and summer range.

It is unlikely that individual caribou will interact with both the Jericho Project and the Port and Road Project in the same season. The same holds for same season interactions with the Jericho and Hope Bay Projects and the Jericho and Snap Lake Projects. It is however possible that individual caribou could have same season interactions with the Jericho, Izok, Ulu, Lupin, EKATI™, and Diavik Projects in the course of the summer and fall. Examining the season by season movements of individual caribou cows providing telemetry data provides some insight into the frequency of same season interactions with more than one mining location on the Bathurst caribou range. The telemetry maps of 21 caribou were reviewed and showed that same season interactions at more than one location may have occurred at Lupin and Lac du Gras in 1997 on spring migration; at Jericho and Ulu in 1999 during late summer; at Jericho, Lupin, and Lac du Gras during post-calving in 1999; and at Lupin, Jericho, and Ulu on spring migration in 2000. (See Figures 7.1 - 7.11 in Hubert and Associates Ltd., 2002 for the overall geographic and seasonal distribution of the individual caribou cows as provided by their telemetry collar locations for the 1996 – 2000 period). It seems that the probability of multiple same season interactions by individual caribou with human activities on the Bathurst range will be relatively low.

It is difficult to envision the direct effects of caribou interactions with Jericho Project activities acting alone or in concert with other mines that could have a direct effect on the Bathurst caribou herd comparable to the extent that it could affect the total annual harvest from the herd. It is however very important that the herd is closely monitored so that any indirect effects of mining on the herd in concert with other activities are understood and measured in order to ensure the ongoing sustainability of the annual harvest.

Overall cumulative effects of interactions between caribou and mining activities on the Bathurst herd's range will be minor; however, the value of the Bathurst caribou herd to the lifestyle of Nunavut and NWT residents is such that the Jericho Project should participate in a caribou monitoring program with the Government of Nunavut and other governments and industry interests to ensure that the health of the herd is under ongoing surveillance in relation to all human activities on the herd's annual range. The value of such collaboration has been demonstrated by the WKSS; such ongoing cooperation between industry and government to improve the overall understanding of caribou is endorsed by Tahera Corporation.

Carnivores

The risk of interactions between Jericho Project transportation activities and carnivores is very low for all species. Foxes, wolves and wolverine will not linger or be attracted to the seasonal hauling activities. The winter hauling season will be over by the time grizzly emerge from their winter quarters; nevertheless the experience of truck operators in Alaska during pipeline construction is noteworthy. Indiscriminate feeding of bear by truck operators habituated bear to haul roads relatively quickly with dire consequences for bears (Follmann and Hechtel, 1990). Similar findings were reported by Schideler and Hechtel (2000) for grizzly in Arctic oil fields in Alaska where cubs that may have been habituated to human food sources were more vulnerable to hunters, camps, and settlements during their post-weaning periods. Strict adherence on "don't

feed the bears" and removal of road kills and gut piles of legally killed caribou, should there be any in the northern reaches of the winter road route, will reduce the risk of bear / truck and bear / camp interactions on winter haul road and at the Project camp.

The environmental effect of Jericho Project transportation activities on carnivores generally, and grizzly bear in particular will be local, medium term (for the life of the Project), and minor on the overall populations. **Residual environmental effects are not predicted.**

Cumulative effects
The minor environmental effects of Project transportation activities on the local carnivore populations over the life of the Project will be direct and no environmental effects on carnivore populations in the Project area from human sources from elsewhere in the region can be foreseen; likewise no direct and / or indirect environmental effects by the Project's transportation activities on carnivores beyond the Project area are expected.

3.4 Monitoring

The migratory nature of most wildlife populations represented in the Project area, the seasonal nature of the major Project components and the relatively short Project history combined present a set of variables that make definitive monitoring of Project / wildlife interactions very difficult. Two wildlife monitoring components however stand out as worthy of a monitoring effort to both test the predictive relevance of this environmental effects assessment, and to add to the overall knowledge of tundra ecosystems interacting with mining activities.

Monitoring annual raptor nesting patterns and numbers in relation to the proximity of mining activities, microtine cycles, and seasonal weather patterns can provide important information for long term land use management in areas of exceptional raptor breeding habitat. It will however probably not show definitive relationships in time to benefit the Jericho Project environmental management program.

The value of the Bathurst caribou herd to the lifestyle of Nunavut and NWT residents is such that the Jericho Project should participate in a caribou monitoring program with the Government of Nunavut and other governments and industry interests to ensure that the health of the herd is receiving ongoing surveillance in relation to all human activities on the herd's overall range.

Wildlife components of the Project EMS should require a record be kept of accidental deaths to wildlife from Project / wildlife interactions as these are instructive to improving the EMS and the progressive performance of the Project in preventing interactions with negative results to wildlife.

4.0 Summary - environmental effects of the Jericho Project on wildlife populations

The interactions of construction, operations, transportation, and related support activities for the Jericho Project with wildlife over the life of the Project were examined and their environmental effects on wildlife populations assessed. In all cases: 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. No measurable cumulative environmental effects are foreseen for wildlife populations in the Project area or region.

In the case of terrain disturbance and habitat alteration, it will take many years to revegetate the 222 ha that will be disturbed at the Project site by natural processes. No cumulative environmental effects are foreseen if progressive terrain disturbance from permafrost degradation and erosion post-closure are prevented.

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).

Table 4. Summary: environmental effects from Jericho Diamond Project on wildlife populations

VEC / Activity	Site development	Mining: April - Dec.	Winter road transport: Jan. - April	Air transport: year round
Habitat effects Cumulative effects	local / long term nil	minor nil	minor nil	minor nil
Raptors effects Cumulative effects	minor nil	minor nil	minor nil	minor nil
Migratory Birds effects Cumulative effects	minor nil	minor nil	minor nil	minor nil
Small Mammal effects Cumulative effects	minor nil	minor nil	minor nil	minor nil
Muskox effects Cumulative effects	minor nil	minor nil	minor nil	minor nil
Caribou effects Cumulative effects	minor minor	minor minor	minor minor	minor minor
Carnivores effects Cumulative effects	minor nil	minor nil	minor nil	minor nil

476000 mE 477000 mE 478000 mE 479000 mE 480000 mE 481000 mE 482000 mE 483000 mE 484000 mE 485000 mE

7323000 mN 7322000 mN 7321000 mN 7320000 mN 7319000 mN 7318000 mN

Carat Lake

Contwoyto Lake

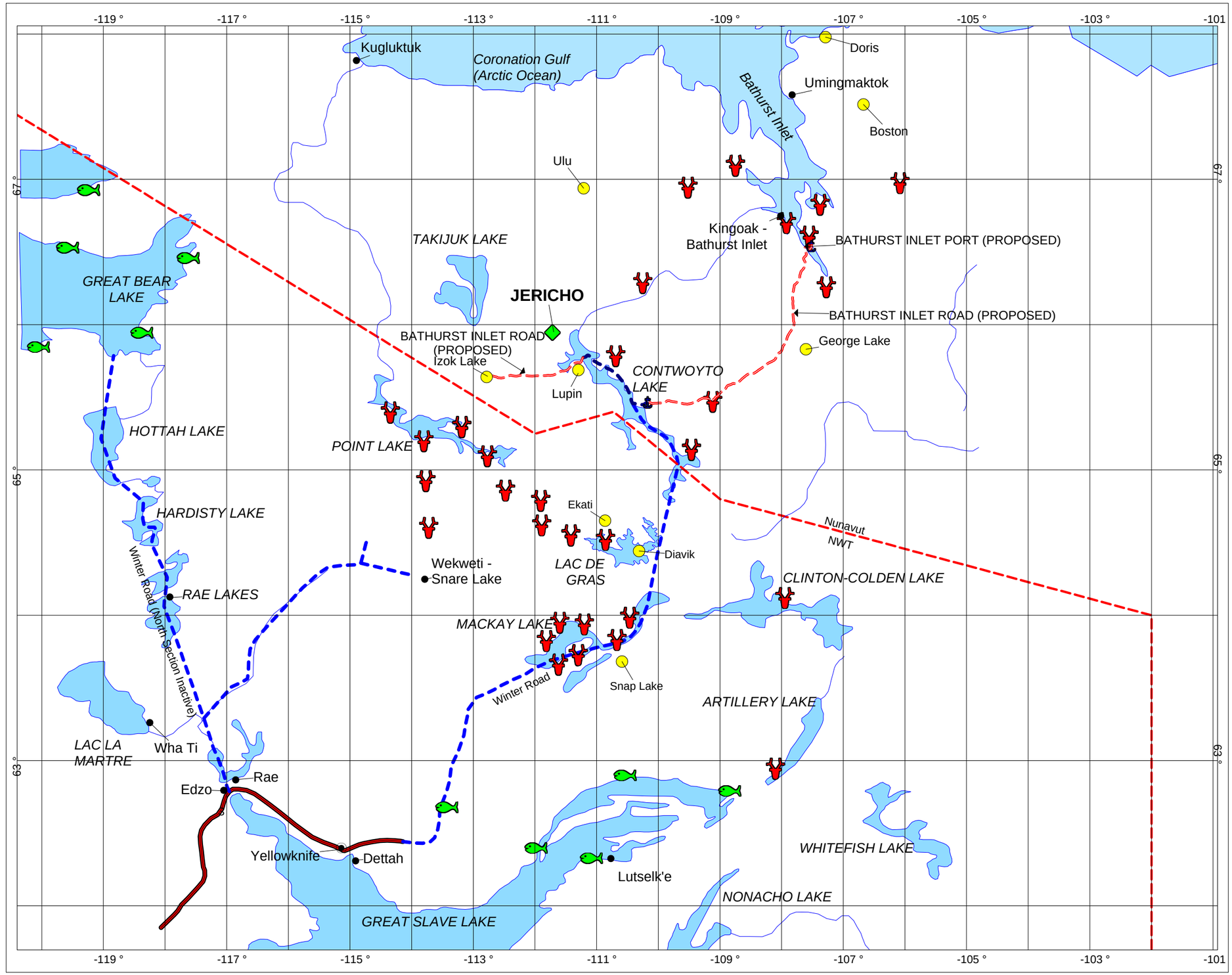
EXTENSION
EXISTING AIRSTRIP
BORROW AREA D
EXISTING BORROW AREA C
EXISTING AIRSTRIP TERMINAL BUILDING
EXISTING LAYDOWN
EXISTING TANK FARM
EXISTING BORROW AREA A
EXISTING LAYDOWN AREA
EXISTING AIRSTRIP ROAD
EXISTING CARAT CAMP
CROWN LAND JULIT SURFACE RIGHTS
WATER INTAKE
SEDIMENT CONTROL POND
SEDIMENT BERM
INDUSTRIAL LANDFILL
PUMP HOUSE
AIRSTRIP ROAD
ENERGY DISSIPATION POND
WASTE DUMP SITE 1 6.9MT
PIT SEDIMENT COLLECTION POND
EXPLOSIVES MAGAZINE
CONTWOYTO LAKE ROAD
AMMONIUM NITRATE STORAGE
WATER ACCESS ROAD
C1 DIKE
EXPLOSIVES TRUCK WASH
WATER PIPELINE
OVERBURDEN STOCKPILE 1.6MT
SEDIMENT COLLECTION POND
WATER MANAGEMENT DITCH
PIT-CAMP ROAD
WINTER ACCESS ROAD (CONSTRUCTION)
FUEL FARM
POLISHING POND
PKCA ROAD
POWER STATION
PROCESSING PLANT
CENTRAL LOBE ORE STOCKPILE 500,000T
LOW GRADE STOCKPILE 1.7MT
MINING LAYDOWN
WASTE DUMP SITE 2 6.0 MT
ACCOMMODATION
NORTHERN LOBE STOCKPILE 500,000T
COARSE TAILINGS STOCKPILE 2.2MT
SEDIMENT BERMS AND COLLECTION PONDS
TAILINGS CELL 2
PROCESSING LAYDOWN
RECLAIMED TAILINGS
TAILINGS CELL 1
BERM AND COLLECTION POND (PUMPED TO TAILINGS)
LONG LAKE TAILINGS CONTAINMENT AREA
CROWN LAND JULIT SURFACE RIGHTS

N W E S

Tahera Corporation

FIG 1	Jericho Diamonds Project Site facilities and related infrastructure
Date: 20/12/2000	
Author: SK/MJ	
Office: VAN	
Scale: 1:25000	Projection: UTM Zone 12 (NAD 27 for Canada)

250 0 250 500
metres



LEGEND

- Town
- City
- Jericho Kimberlite
- Mineral Deposit
- All Weather Road or Hwy
- Winter Road
- Fishing Lodge
- Hunting Camp

Bathurst Port & Road Facilities

- Proposed Port (Contwoyto & Bathurst Inlet)
- Proposed Road (Ice Road & Barge)
- Proposed Road (All Weather)

N W E S

Tahera Corporation

FIG 2	COMMUNITIES, MINES AND HUNTING AND FISHING CAMPS ON THE RANGE OF THE BATHURST CARIBOU HERD
Date:19/12/2002	
Author: MJ	
Office: VAN	
Scale: 1:3000000	Projection: Longitude / Latitude (NAD 27 for Canada)

25 0 25 50
kilometres

476000 mE 477000 mE 478000 mE 479000 mE 480000 mE 481000 mE 482000 mE 483000 mE 484000 mE 485000 mE

7323000 mN 7322000 mN 7321000 mN 7320000 mN 7319000 mN 7318000 mN

Carat Lake

Contwoyto Lake

EXISTING BORROW AREA B

EXISTING BORROW AREA C

EXISTING AIRSTRIP LAYDOWN

EXISTING TANK FARM

EXISTING BORROW AREA A

EXISTING LAYDOWN AREA

EXISTING AIRSTRIP ROAD

EXISTING CARAT CAMP

INDUSTRIAL LANDFILL

WATER INTAKE

SEDIMENT CONTROL POND

PUMP HOUSE

WASTE DUMP SITE 1 6.9 MT

PIT SEDIMENT COLLECTION POND

AIRSTRIP ROAD

CONTWOYTO LAKE ROAD

EXPLOSIVES MAGAZINE

AMMONIUM NITRATE STORAGE

OVERBURDEN STOCKPILE 45MT

WATER PIPELINE

SEDIMENT COLLECTION POND 1

WATER MANAGEMENT DITCH

PIT-CAMP ROAD

FUEL FARM

POWER STATION

CENTRAL ORE STOCKPILE 500,000T

PROCESSING PLANT

ACCOMMODATION

POLISHING POND

PKCA ROAD

LOW GRADE STOCKPILE 1.7MT

MINING LAYDOWN

WASTE DUMP SITE 2 6.0 MT

COARSE TAILINGS STOCKPILE 2.2MT

NORTHERN LOBE STOCKPILE 500,000T

PROCESS LAYDOWN

TAILINGS CELL 2

TAILINGS CELL 1

TAILINGS

LONG LAKE TAILINGS CONTAINMENT AREA

WINTER ACCESS ROAD CONSTRUCTION

SEDIMENT COLLECTION POND

N W E S

Legend
Trails / Meter

- > 0.5
- 0.25 - 0.5
- 0.075 - 0.25
- < 0.075
- Regional Study Waypoint
- Jericho Detail Study Waypoint
- Interpretted Caribou Corridor

Tahera Corporation

FIG 3	Caribou Movement Routes Expected In Vicinity Of Jeicho Project Site
Date: 20/12/2000	
Author: SK/MJ	
Office: VAN	
Scale: 1:25000	Projection: UTM Zone 12 (NAD 27 for Canada)

250 0 250 500
metres

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