GAHCHO KUÉ PROJECT

ENVIRONMENTAL IMPACT STATEMENT

SECTION 11.8

SUBJECT OF NOTE: TRAFFIC AND ROAD ISSUES

December 2010 **09-1365-1004**

TABLE OF CONTENTS

SECTION **PAGE**

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

11.8 SUBJECT OF NOTE: TRAFFIC AND ROAD ISSUES

11.8.1 Introduction

11.8.1.1 Context

This section of the environmental impact statement (EIS) for the Gahcho Kué Project (Project) consists solely of the Subject of Note: Traffic and Road Issues. The *Terms of Reference for the Gahcho Kué Environmental Impact Statement* (Terms of Reference), issued on October 5, 2007 by the Gahcho Kué Panel (2007) identified multiple concerns related to this subject of note:

> *"Traffic and other road related concerns were raised multiple times during environmental assessment scoping, and must be addressed specifically, even though aspects of this subject relate to other Key Lines of Inquiry and Subjects of Note."*

This subject of note addresses issues relating to traffic and roads associated with the Project. The topic of this subject of note overlaps to varying degrees with other key lines of inquiry and subjects of note. Additional information pertaining to traffic and roads is also included in the following key lines of inquiry and subjects of note:

- Caribou (Section 7);
- Vegetation (Section 11.7);
- Carnivore Mortality (Section 11.10);
- Other Ungulates (Section 11.11);
- Species at Risk and Birds (Section 11.12); and
- Impacts on Tourism Potential and Wilderness Character (Section 12.7.3).

Where there is overlap between this subject of note and another key line of inquiry or subject of note, information has been provided in both locations, as required by the final Terms of Reference.

11.8.1.2 Purpose and Scope

The purpose of the Subject of Note: Traffic and Road Issues is to meet the Terms of Reference for the EIS issued by the Gahcho Kué Panel. The table of concordance for the Terms of Reference for this subject of note is shown in Table 11.8-1. The entire Terms of Reference document is included in

Appendix 1.I of Section 1, Introduction, of this EIS. A complete table of concordance for the entire EIS and Terms of Reference is in Appendix 1.II of Section 1, Introduction.

This assessment provides information on potential environmental effects related to traffic and roads associated with the construction, operation, and closure and reclamation phases of the Project. It considers the cumulative effect of the Project in combination with other developments. Most, but not all, items in this section relate to assessing biophysical effects (e.g., erosion and sedimentation around portages, spills, water withdrawal, and effects on wildlife, vegetation, and the aquatic environment). The potential socio-economic effects of traffic and road issues are also summarized.

Information on ground and air traffic from existing diamond mines located in the Northwest Territories (NWT) was incorporated into this impact assessment. Changes in air traffic volume resulting from variation in ice road accessibility were considered.

A determination of significance has not been made specifically for traffic and road issues. Significance is not determined on the activity (e.g., traffic), but rather, on the component that is valued (e.g., caribou). The environmental consequence of the Project on a valued component (VC) considers the entire set of pathways that influence a particular endpoint (e.g., persistence of caribou populations). The effect of traffic and roads is only one of many factors that influence the persistence of a population. The determination of significance must be done, for this example, in the Key Line of Inquiry: Caribou.

Since aquatic impacts of traffic and the winter roads were not addressed in other key lines of inquiry, potential pathways to the aquatic environment were screened by a pathway analysis (Section 11.8.4.1) that determined qualitatively whether each pathway would lead to an actual change in the environment. Potential pathways to the terrestrial environment were initially screened in other key lines of inquiry or subjects of note (e.g., carnivores, caribou). The results of the screening are summarized here.

Terrestrial impacts were not classified (i.e., the impacts were not defined in terms of magnitude, duration, and geographic extent) in the Subject of Note: Traffic and Road Issues; rather, the classifications of terrestrial impacts, including their significance, are summarized here from other key lines of inquiry or subjects of note that examine pathways involving traffic and road issues.

Table 11.8-1 Terms of Reference Pertaining to Traffic and Road Issues

Final Terms of Reference Requirements		Applicable EIS Sub-section
Section	**Description**	
5.2.11 Biophysical Subjects of Note: Traffic and Road Issues	describe any efforts by the developer; other developers; or governments to monitor the environmental effects of the Tibbitt-to-Contwoyto Winter Road	11.8.2.6
	describe the results of these efforts and any plans for future monitoring	11.8.2.6; 11.8.9
	describe how changes in traffic volume and pattern may affect the environment; including caribou; erosion; and sedimentation around portages; vegetation; waterbodies; fish; spills; and water withdrawal	11.8.3.4; 11.8.4, 11.8.5, 11.8.6
	describe how construction and operation of the spur road may affect the environment, including caribou, erosion/sedimentation around portages, vegetation and benthic environment, spills, and water withdrawal	11.8.4, 11.8.5, 11.8.6
	describe the potential of the spur road to open a previously inaccessible area to hunters or recreational snowmobilers (any data collected during the advanced exploration stage on this issue should be presented)	11.8.7
	describe how the proposed development will alter traffic volumes and patterns on the Tibbitt-to-Contwoyto Winter Road and Ingraham Trail; including potential hazards to other road users and the transport of dangerous goods	11.8.3.2; 11.8.3.4
	describe increases in air traffic; including the estimated number of flights during construction; operation; and closure; broken down by season and type of aircraft (i.e., jet, large propeller; small airplane; and helicopter); this should be estimated based on experience with previous diamond mine developments; taking into consideration 'normal' winter road seasons; such as the 2006/07 season; as well as exceptional seasons such as the 2005/06 season that resulted in a significant increase in air traffic; and potential interactions with caribou (e.g. during spring migration)	11.8.3.3; 11.8.3.5; 11.8.6
	describe any potential effects related to the use of glycol on the airstrip	11.8.4.2.2
7 (7-1) Wildlife Issues	remaining wildlife issues pertaining to traffic and road concerns include - impacts from traffic on winter roads; - new access from spur road; and - aircraft traffic disturbance	11.8.4.3; 11.8.4.2

Table 11.8-1 Terms of Reference Pertaining to Traffic and Road Issues (continued)

Final Terms of Reference Requirements		Applicable EIS Sub-section
Section	**Description**	
3.2.7 Follow-up Programs	The EIS must include a description of any follow up programs, contingency plans, or adaptive management programs the developer proposes to employ before, during, and after the proposed development, for the purpose of recognizing and managing unpredicted problems. The EIS must explain how the developer proposes to verify impact predictions. The impact statement must also describe what alternative measures will be used in cases were a proposed mitigation measure does not produce the anticipated result.	11.8.2.6, 11.8.9
	The EIS must provide a review of relevant research, monitoring and follow up activities since the first diamond mine was permitted in the Slave Geological Province to the extent that the relevant information is publicly available. This review must focus on the verification of impact predictions and the effectiveness of mitigation measures proposed in previous diamond mine environmental impact assessments. In particular the developer must make every reasonable effort to verify and evaluate the effectiveness of any proposed mitigation measures that have been used, or are similar to those used at other diamond mining projects in the Mackenzie Valley.	11.8.2.6

Source: Terms of Reference for the Gahcho Kué Environmental Impact Statement (Gahcho Kué Panel 2007).

11.8.1.3 Study Area

11.8.1.3.1 General Location

The Project is situated north of the East Arm of Great Slave Lake in the NWT at Longitude 63° 26' North and Latitude 109° 12' West. The Project site is about 140 kilometres (km) northeast of the nearest community, Łutselk'e, and 280 km northeast of Yellowknife (Figure 11.1-1). Winter road access from Yellowknife to the Project will be along the existing Tibbitt-to-Contwoyto Winter Road and the Winter Access Road leading to the Project from the Tibbitt-to-Contwoyto Winter Road. Access will also be provided by aircraft.

The Tibbitt-to-Contwoyto Winter Road has been constructed annually since 1982. Prior to 2009, the 600 km winter road extended from the end of the Ingraham Trail, about 70 km northeast of Yellowknife at Tibbitt Lake in the NWT, to the Jericho Diamond Mine on Contwoyto Lake, Nunavut. Following closure of the Jericho Mine in 2009, the winter road extends to the BHP Billiton turn-off (Joint Venture 2010, internet site). The road is usually open from January to March. The primary use of this winter road is the re-supply of mines (e.g., Diavik, Ekati, and Snap Lake), exploration camps, and lodges near the winter road. The road is also open to the public.

The Winter Access Road to the Project (Winter Access Road) links the Project with the existing Tibbitt-to-Contwoyto Winter Road at MacKay Lake. More specifically, a 120 km Winter Access Road spur will be constructed each winter to connect the Project site to the Tibbitt-to-Contwoyto Winter Road at km 271, just north of Lake of the Enemy. The route crosses Reid, Munn, Margaret, and Murdock lakes as well as several smaller lakes and streams. The Winter Access Road will be constructed and operated in accordance with license and regulatory conditions and with appropriate updates and improvements as required. It is anticipated that the Winter Access Road will only be available for about ten weeks from January to April, on average.

11.8.1.3.2 Study Area Selection

To assess the potential effects of the Project on traffic and road issues, it is necessary to define appropriate spatial boundaries. The study area for this subject of note was identified in the Terms of Reference (Gahcho Kué Panel 2007) as follows:

> *"The geographical scope of this Subject of Note includes all access routes, including all waterbodies and land crossings used for the Tibbitt-to-Contwoyto winter road and the Mackay Lake access road (or any alternative or additional routes) and adjacent areas."*

The baseline study areas were initially established by each biophysical discipline based on the expected extent of Project-related effects on each environmental component (e.g., vegetation, wildlife). Study areas for the baseline work, therefore, varied according to discipline.

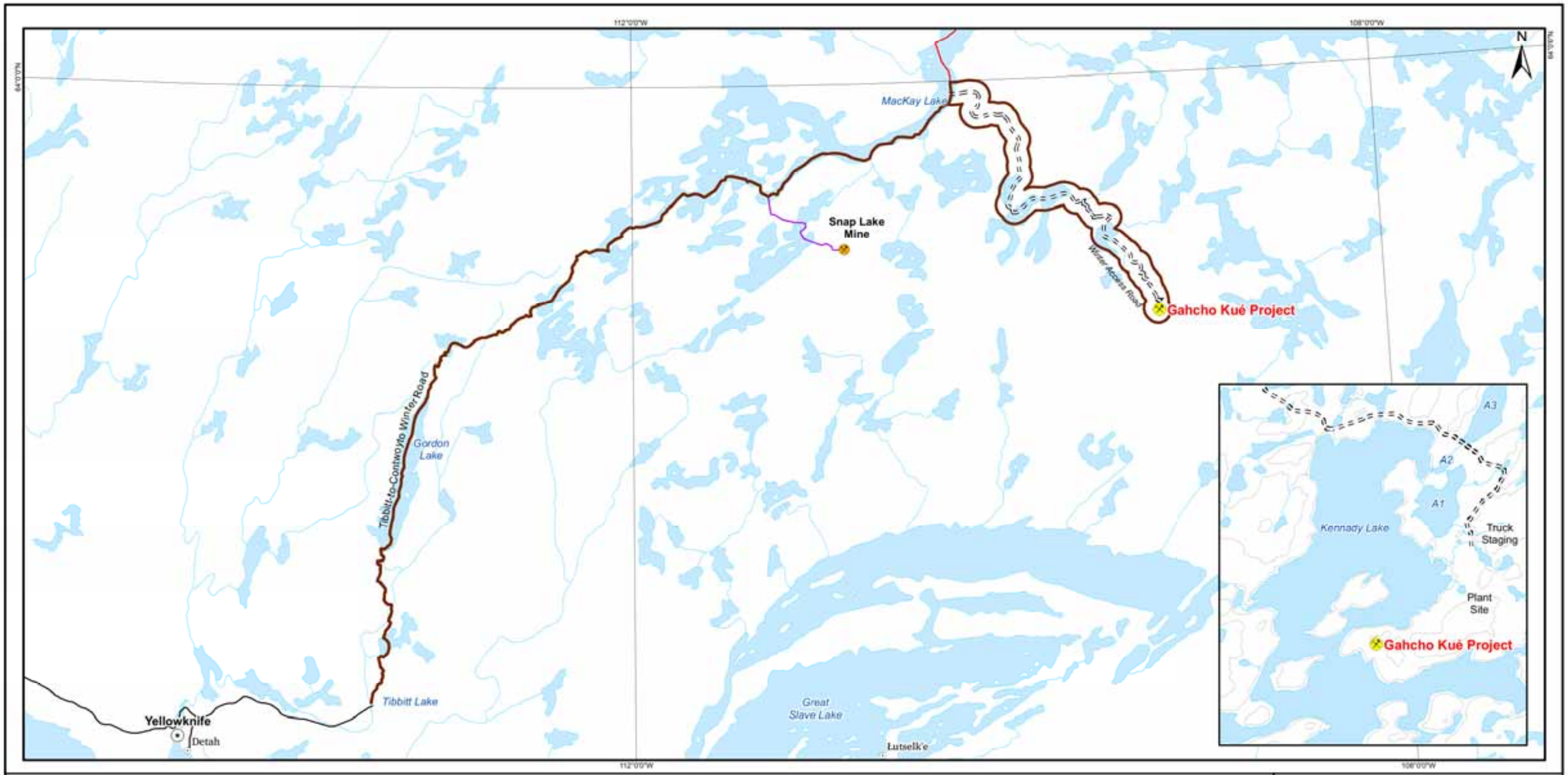
The wildlife and vegetation Regional Study Area (RSA) is a rectangle approximately 5,700 square kilometres (km^2) in size centred on the Project site. The wildlife baseline also has a Winter Access Road Study Area, which includes the route between the Project site and the Tibbitt-to-Contwoyto Winter Road (route length of 120 km) and a width of 6 km, for a total area of 1,020 km^2. The vegetation baseline study areas include the same RSA as the wildlife (hereafter referred to as the terrestrial baseline RSA), the Winter Access Road, and also the Tibbitt-to-Contwoyto Winter Road from the end of the Ingraham Trail to the beginning of the Winter Access Road at MacKay Lake.

The aquatic baseline RSA for all of the aquatic disciplines except hydrogeology is based on the Lockhart River watershed. The aquatic baseline also included a Winter Access Road Study Area. The Winter Access Road surveyed in the baseline reports is the winter road used during exploration; it is the same route as the Winter Access Road that will be used for the Project (Figure 11.8-1), except for the Kennady Lake crossing, which will be replaced by an overland route to the east of the lake. The route to be used during construction and operations will turn east at the north edge of Kennady Lake.

11.8.1.3.3 Traffic and Road Study Area

The Traffic and Road Study Area (Figure 11.8-1) comprises the Winter Access Road and the Tibbitt-to-Contwoyto Winter Road from Tibbitt Lake to MacKay Lake. The effects assessment for issues relating to traffic and roads was completed using this study area.

The portion of the Tibbitt-to-Contwoyto Winter Road that is included in the Subject of Note: Traffic and Road Issues, is 271 km in length, comprising the length of the Tibbitt-to-Contwoyto Winter Road from Tibbitt Lake to the point on MacKay Lake where it is intersected by the 120 km Winter Access Road. Since Project traffic will not be using the Tibbitt-to-Contwoyto Winter Road beyond the 271 km mark, the Traffic and Roads Study Area ends at that point.



LEGEND

- Gahcho Kué Project
- Existing Mine
- Territorial Capital
- Populated Place
- Highway
- Existing Winter Road
- = = Proposed Winter Access Road
- Watercourse
- Waterbody
- Traffic and Road Study Area

NOTES
Base data source: The Atlas of Canada

GAHCHO KUÉ PROJECT

Traffic and Road Study Area

PROJECTION: Canadian Lambert Conf. Conic	DATUM: NAD83	DE BEERS CANADA
Scale: 1:1,000,000 (20 10 0 20 Kilometres)		
FILE No: SON 11.7-001 - GIS		DATE: November 10, 2010
JOB NO: 09-1365-1004	REVISION NO: 1	Figure 11.8-1
OFFICE: GOLD-CAL	DRAWN: CW / CHECK: AL	

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This section of the route (up to km 271) represents the portion of the route in which the cumulative effects of the Project plus other past, present, or reasonably foreseeable future developments occur. The Existing Environment section (Section 11.8.2) focuses on baseline information that relates to the study area for the Subject of Note: Traffic and Road Issues. For each species or VC discussed, the data presented are preceded by an explanation of how the presented data relate to the Traffic and Roads Study Area.

The Winter Access Road extends 120 km from the Tibbitt-to-Contwoyto Winter Road at MacKay Lake southeast to Kennady Lake. The width of the biophysical effects that go beyond the Winter Access Road varies by the effect. The width shown in Figure 11.8-1 is 3 km on each side of the access road (total of 6 km), which is equal to the width used in the wildlife baseline.

11.8.1.4 Content

Section 11.8 provides details of the assessment related to traffic and road issues. The following briefly describes the content under each heading of this subject of note:

- **Existing Environment** summarizes baseline information relevant to the Tibbitt-to-Contwoyto Winter Road (from Tibbitt Lake to MacKay Lake) and the Winter Access Road, beginning with the general environmental setting in which the Project occurs, followed by a description of existing winter road and air access, and a description of the existing aquatic environments, terrestrial environments, and human resource users (Section 11.8.2).
- **Access and Transportation for the Project** summarizes the access and transportation planning for the Project, including proposed access routes and methods of transportation, describes projected changes to air and winter road traffic, examines the potential for winter road accidents, and considers exceptional winter road seasons (Section 11.8.3).
- **Pathway Analysis** identifies and validates linkages between traffic and roads and the corresponding potential residual effects on VCs of the aquatic and terrestrial ecosystems. Pathway analysis is a largely qualitative screening step to determine the existence and magnitude of environmental change caused by the Project. Primary pathways are then subject to an analysis of effects (Section 11.8.4).
- **Contribution of Traffic and Roads to Effects on the Environment and Related Effects to People** summarizes effects to VCs as analyzed in other key lines of inquiry and subjects of note
- Effects of these Project activities on primary pathways leading to VCs of an ecosystem are organized according to effects to the aquatic environment (e.g., fish and fish habitat, water quality), the terrestrial

environment (e.g., vegetation, and wildlife), and related effects to people (Section 11.8.5, 11.8.6 and 11.8.7).

- **Uncertainty** discusses sources of uncertainty surrounding the predictions of effects related to traffic and road issues, and how the assessment addresses those sources of uncertainty (Section 11.8.8).
- **Monitoring and Follow-up** describes recommended monitoring programs, contingency plans or adaptive management strategies related to traffic and road issues (Section 11.8.9).
- **References** lists all documents and other material used in the preparation of this section (Section 11.8.10).
- **Glossary, Acronyms, and Units** explains the meaning of scientific, technical, or other uncommon terms used in this section. In addition, acronyms and abbreviated units are defined (Section 11.8.11).

11.8.2 Existing Environment

11.8.2.1 General Setting

The Project is located in the subarctic tundra of the Slave Geological Province (SGP), north of the treeline, and near the southern limit of the zone of continuous permafrost. It is approximately 280 km northeast of Yellowknife, NWT, and about 140 km northeast of the Dene community of Łutselk'e, on the eastern arm of Great Slave Lake. It is situated at Kennady Lake, a headwater lake of the Lockhart River watershed. The Project is 84 km east of the Snap Lake Mine. The Diavik Diamond Mine and Ekati Diamond Mine are located about 127 km and 158 km northeast of Kennady Lake, respectively (Figure 11.1-1).

The Project is located within an area that is transitional between boreal and tundra conditions (Scott 1995; Bliss 2000). A distinction between boreal-like and tundra-like vegetation can be made based on ecoclimatic zones (or "ecozones"). Ecozones are broad geographical units defined according to general climate, vegetation, and terrain conditions (EcoRegions Working Group 1989). Ecozones are subdivided into relatively homogenous ecoregions based on additional biophysical attributes (Environment Canada 2004, internet site; Wiken 1986).

The Project is situated largely within the Taiga Shield Ecozone and corresponding Mackay Upland High Subarctic (HS) Ecoregion (Figure 11.8-2) (Ecosystem Classification Group 2008). A small portion of the Winter Access Road is within the Takijuq Lake Ecoregion of the Southern Arctic Ecozone. The boundary between these two ecozones represents the approximate limit of tree growth in the north. Tree cover becomes increasingly discontinuous, forming lichen woodlands and eventually open Arctic tundra.

LEGEND

- Gahcho Kué Project
- Existing Mine
- Territorial Capital
- Populated Place
- Highway
- Existing Winter Road
- Tibbitt-to-Contwoyto Winter Road
- Winter Access Road
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Taiga Shield Ecozone, Mackay Upland High Subarctic Ecoregion

NOTES

Base data source: The Atlas of Canada
Ecozone/Watershed source: GNWT

GAHCHO KUÉ PROJECT

Project Location In Relation to Ecoregion

PROJECTION: Canadian Lambert Conf. Conic	DATUM: NAD83	
Scale: 1:4,500,000 (50 25 0 50 Kilometres)		
FILE No: P-Other-040-GIS		DATE: November 9, 2010
JOB NO: 09-1365-1004	REVISION NO: 1	
OFFICE: GOLD-CAL	DRAWN: JH	CHECK: AL

De Beers Canada

Figure 11.8-2

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The portion of the Tibbitt-to-Contwoyto Winter Road from Tibbitt Lake to the south end of Gordon Lake (34 km) is within the Great Slave Upland High Boreal (HB) Ecoregion. This ecoregion is a bedrock dominated landscape that is mostly level and consists of a few hill systems. It contains numerous large lakes that occupy over 30 percent (%) of the area. The dominant landscape type is fractured bedrock plain with subdued topography. The dominant soil type is variable-textured Brunisols on glacial deposits between bedrock exposures and in fractures (Ecosystem Classification Group 2008).

Vegetation in the Great Slave Lake Upland HB Ecoregion consists of discontinuous forests of black spruce *(Picea marina).* and jack pine *(Pinus banksiana)* that occur between or on rock outcrops (Ecosystem Classification Group 2008).

The portion of the Tibbitt-to-Contwoyto Winter Road from the south end of Gordon Lake northward for 111 km to Drybones Lake is within the Great Slave Upland Low Subarctic (LS) Ecoregion. The Great Slave Upland LS Ecoregion consists of uplands, plateaus, and lowlands. Lakes are common in the lowlands, while rock outcrops are common in the uplands. Well-drained Brunisols on stony, non calcareous sandy loom to loamy sand till derived from granitic rock are the dominant soil. In the northeast part of the Ecoregion, soils may be affected by frost action (Turbic Crysols) where the parent materials are thin. The dominant tree species in the Great Slave Upland LS Ecoregion are black spruce and paper birch (*Betula papyrifera*). Dwarf birch (*Betula glandulosa*) and lichen is found on bedrock and outwash, and in denser stands on till deposits (Ecosystem Classification Group 2008).

The portion of the Tibbitt-to-Contwoyto Winter Road from Drybones Lake northward for 136 km to the intersection with the Winter Access Road is within the Mackay Upland High Subarctic (HS) Ecoregion. The Mackay Upland HS Ecoregion consists of mainly level to gently rolling terrain. More than 30% of the area is occupied by lakes, of which MacKay, Walmsley, Artillery and Camsell Lakes are the largest. Soils are noncalcareous sandy loam Brunisols, and Organic Crysols are associated with wetlands. The most common upland cover types are shrub tundra and open spruce woodlands. Other vegetation includes dwarf birch, mountain cranberry *(Vaccinium vitis-idaea)*, northern Labrador tea (*Ledum palustre*), common Labrador tea *(Ledum groenlandicum)* red bearberry *(Arctostaphylos rubra*), black crowberry *(Empetrum nigrum* ssp.*)* and lichens (Ecosystem Classification Group 2008).

A small portion of the Tibbitt-to-Contwoyto Winter Road and the Winter Access Road near Margaret Lake is within the Takijuq Lake Ecoregion of the Southern Arctic Ecozone (Figure 11.8-2). The terrain of the Takijuq Lake Upland

Ecoregion consists of broad, sloping uplands, plateaus, and lowlands. Unvegetated rock outcrops are common on upland terrain while lakes are common in the lowlands. Turbic and Static Cryosols are associated on upland sites with sandy, morainal, and glaciofluvial parent soil materials, while Organic Cryosols are the dominant lowland soils (Environment Canada 2004, internet site; CCEA 2005, internet site).

The vegetation of the Takijuq Lake Upland Ecoregion is also part of the tundra boreal forest transition, and is characterized by scrub birch (*Betula nana*), willows (*Salix* spp.), northern Labrador tea, and blueberries (*Vaccinium* spp.). Depressions and lowland habitats are dominated by willows, sphagnum mosses (*Sphagnum* spp.), and sedge (*Carex* spp.) tussocks. Isolated stands of spruce (*Picea* spp.) are present at the southern boundary of this ecoregion (Environment Canada 2004, internet site; CCEA 2005, internet site).

Both the Tibbitt-to-Contwoyto Winter Road and the Winter Access Road are located within the Great Slave Lake drainage basin. The Tibbitt-to-Contwoyto Winter Road traverses several large lakes in the section from Tibbitt Lake to MacKay Lake, including Gordon, Drybones, and Lockhart lakes. The most common as well as the most culturally and economically important fish species harvested in these lakes are lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), northern pike (*Esox lucius*), walleye (*Stizostedion vitreum*), and burbot (*Lota lota*)(EBA 2001a).

The Tibbitt-to-Contwoyto Winter Road and the Winter Access Road are located in forested, transitional, and tundra areas and wildlife species that are characteristic of all of these habitat types may occur near these road corridors. The region is home to several wide-ranging species including barren-ground caribou (*Rangifer tarandus groenlandicus*), muskoxen (*Ovibos moschatus*), wolverines (*Gulo gulo*), and wolves (*Canis lupis*).

Further details about the existing environment, including existing winter road and air access, aquatic and terrestrial environments, and the human resource users of the area are presented in the sections that follow. These sections summarize the baseline information that is required to understand the effects of traffic and roads on the existing biophysical environment, and related effects to people.

11.8.2.2 Existing Access

11.8.2.2.1 Tibbitt-to-Contwoyto Winter Road

The Tibbitt-to-Contwoyto Winter Road is managed by the Tibbitt-to-Contwoyto Winter Road Joint Venture (Joint Venture 2010, internet site). Current members of the Joint Venture are De Beers Canada Inc., BHP Billiton Diamonds Inc., and Diavik Diamond Mines Inc. The road is constructed by Nuna Logistics. Engineering and security services are provided by EBA Engineering Consultants Ltd. (EBA) and SecureCheck, respectively.

First constructed in 1982 to re-supply the Lupin Gold Mine at Contwoyto Lake in Nunavut, the Tibbitt-to-Contwoyto Winter Road has been as long as approximately 600 km (Joint Venture 2010, internet site). The road begins at Tibbitt Lake at the end of the Ingraham Trail in the NWT. It typically ended beyond Lupin at the Jericho Diamond Mine in Nunavut. However, given the closure of the Jericho Mine, the winter road has ended at the BHP Billiton turn-off for the last two years (Joint Venture 2010, internet site).

The Tibbitt-to-Contwoyto Winter Road traverses lakes, streams, boreal forest, and the forest/tundra transition zone. Eighty-five percent of the winter road is constructed on lake ice. Sixty-four numbered portages and about 73 km of vegetated terrain exist over its total length. Forty-five (or 65%) of the portages are within boreal forest areas. The road is 50 metres (m) wide on ice sections, and 12 m to 15 m wide on portage sections. Three support camps are located along the route, at Dome Lake (km 35), Lockhart Lake (km 170) and Lac de Gras (km 350) (Joint Venture 2010, internet site). The support camps provide maintenance (Dome Lake) and full catering and rest stops (Lockhart Lake and Lac de Gras). Meadows Station Security Check-in is located at approximately km 7.

The Tibbitt-to-Contwoyto Winter Road is open about ten weeks per year, typically from late January or early February to early or mid April. From 1999 to 2009, the road was in operation for an average of 64 days annually, ranging from about 50 days in 2006 to 80 days in 2002 (GNWT 2009, internet site). The winter of 2006 was one of the warmest on record, during which the Tibbitt-to-Contwoyto Winter Road never reached full load-bearing capacity (GNWT 2009, internet site).

Currently, three diamond mines (Ekati, Diavik, and Snap Lake) rely on the Tibbitt-to-Contwoyto Winter Road for transporting goods and equipment (GNWT 2009, internet site). Diesel fuel is the largest item trucked north on the road. Other supplies include cement, tires, ammonium nitrate for explosives manufacture, construction equipment and materials, and food. Historically, northbound truck

volumes on the Tibbitt-to-Contwoyto Winter Road have ranged from less than 500 in 1989 to 10,922 in 2007. Peaks in use occurred during years when diamond mines were being constructed, such as 1994 to 1997 (Ekati), 2000 to 2002 (Diavik), and 2004 to 2007 (Snap Lake) (Joint Venture 2008a, internet site).

The Traffic and Roads Study Area includes approximately the southern third of the Tibbitt-to-Contwoyto Winter Road, a distance of 271 km from Tibbitt Lake to MacKay Lake. Forty eight on-land portages occur on this section of the Tibbitt-to-Contwoyto Winter Road (EBA 2001b).

11.8.2.2.2 Gahcho Kué Project Winter Access Road

The Winter Access Road extends about 120 km from MacKay Lake to the Project site. It is the same as the Winter Access Road that was used during exploration work for the Project, except that it will no longer cross Kennady Lake. After reaching the north end of Kennady Lake the Winter Access Road will now turn east remain on land.

11.8.2.2.3 Air Access

In addition to using the Tibbitt-to-Contwoyto Winter Road, existing diamond mines in the region, including Ekati, Diavik, and Snap Lake have permanent airstrips for ear-round transport of both passengers and freight on Boeing 737, Hercules, or smaller aircraft. The Boeing 737 and Hercules flights to and from these mine sites originate and terminate at Yellowknife, while smaller aircrafts may arrive from and depart to smaller communities.

Aircraft arrivals and departures at Yellowknife Airport totaled 61,351 in 2006, 44,065 in 2004 and 40,548 in 2003 (LPS Aviation Inc. 2007, internet site; GNWT 2004, internet site). The largest contributors to the growth in air traffic over those years were air carrier activities, with many new charter and scheduled activities to support the expanding resource sector. The majority of these movements were destined to private resource aerodromes north of Yellowknife (LPS Aviation Inc. 2007, internet site). For example, the percentage of flights attributed to the Diavik Diamond Mine was 3.1% of the total Yellowknife arrivals and departures for each of 2003 and 2004 (GNWT 2004, internet site). The percentage of Yellowknife's flights attributed to the Ekati Diamond Mine dropped from 4.2% in 2003 to 3.8% in 2004 (GNWT 2004, internet site).

11.8.2.3 Aquatic Environment

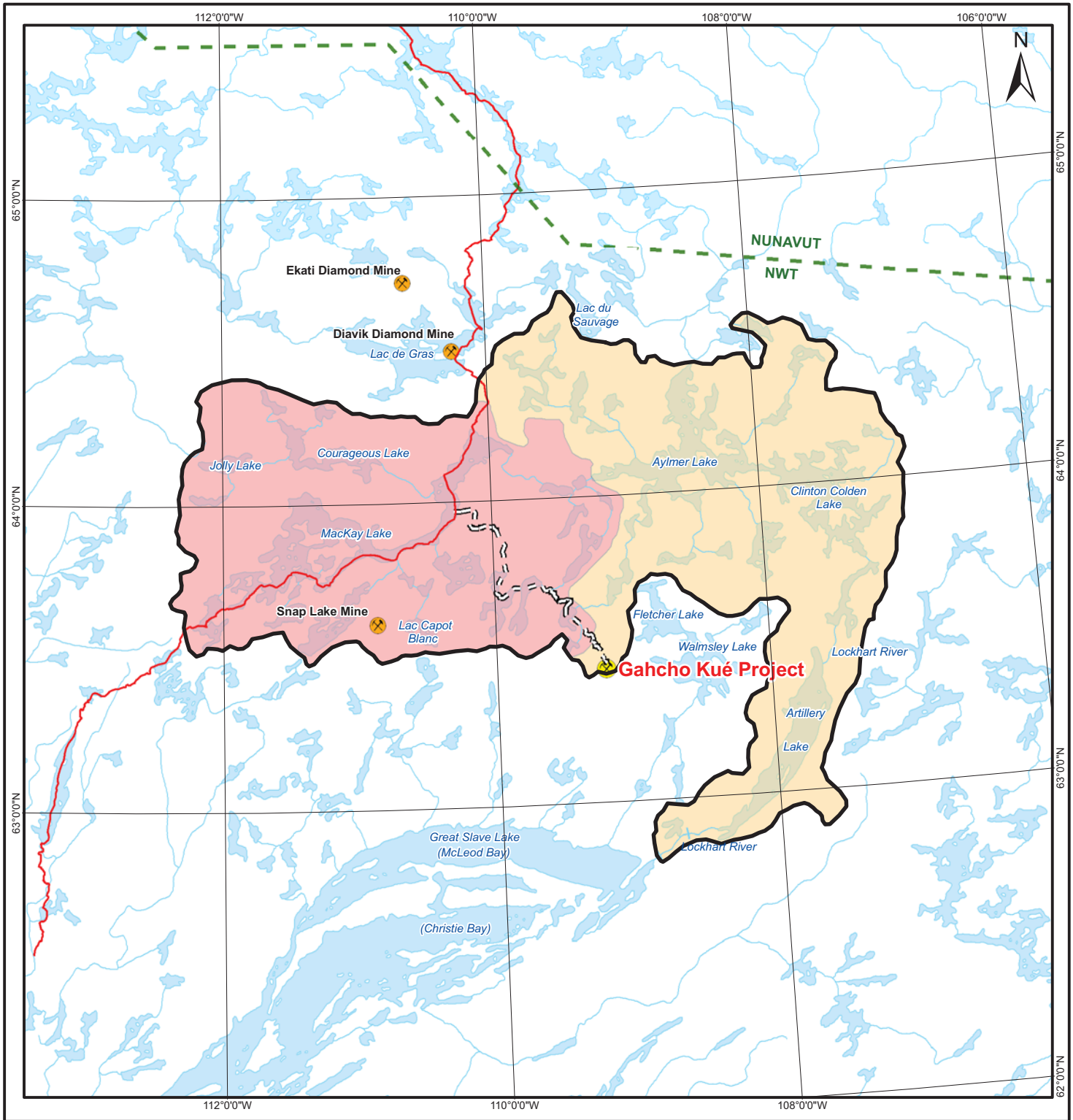
11.8.2.3.1 Aquatic Features within the Study Area

Existing information on the aquatic environment that is relevant to the Subject of Note: Traffic and Road Issues is summarized here from the fisheries and aquatic resources baseline for the Project (Annex J, Fisheries and Aquatic Resources Baseline), and from previous studies on the Tibbitt-to-Contwoyto Winter Road.

Project-related fisheries and aquatic resources baseline studies defined Regional and Winter Access Road study areas. The aquatics baseline RSA was identified as entire Lockhart River watershed, including Kennady Lake to its outlet at Great Slave Lake (Figure 11.8-3). This was considered to be the area within which any effects from the Project could potentially interact with other existing or proposed development projects to cumulatively affect water quality, hydrology, fisheries, and other aquatic resources. Results that are summarized here from the RSA focus on waterbodies that are intercepted by or adjacent to the Traffic and Roads study area.

The Winter Access Road Study Area for aquatics follows the same route as the Traffic and Roads Study Area. The Winter Access Road reaches the Project site via Reid, Munn, Margaret, and Murdock lakes, as well as several smaller lakes and streams, and overland portages. The entire Winter Access Road and part of the Tibbitt-to-Contwoyto Winter Road are located within the aquatics baseline RSA. Most of the Winter Access Road is located within the Upper Lockhart River watershed; a small portion near the Project site is within the Lower Lockhart River watershed (Figure 11.8-3).

Within a 6-km right-of-way (corridor) along the Winter Access Road, water covers about 37% of the corridor area (approximate corridor area = 700 km^2). Within a 2-km corridor, about 48% of the Winter Access Road is comprised of water (approximate corridor area = 238 km^2). Thirty three on-land portages occur on the Winter Access Road.



LEGEND

- Gahcho Kué Project
- Existing Mine
- Tibbitt-to-Contwoyto Winter Road
- Proposed Winter Access Road
- Watercourse
- Waterbody
- Territorial/Provincial Boundary
- Lower Lockhart River Watershed
- Upper Lockhart River Watershed
- Regional Study Area

NOTES

Base data source: The Atlas of Canada

GAHCHO KUÉ PROJECT

Fisheries and Aquatic Resource Baseline Regional Study Area

PROJECTION: Canadian Lambert Conf. Conic	DATUM: NAD83	
Scale: 1:2,000,000 (30 15 0 30 Kilometres)		
FILE No: SON-11.7-005-GIS		DATE: November 10, 2010
JOB NO: 09-1365-1004	REVISION NO: 5	
OFFICE: GOLD-CAL	DRAWN: CW / CHECK: AL	Figure 11.8-3

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11.8.2.3.2 Fisheries

Methods

Existing information on fisheries within the Traffic and Roads Study Area is summarized from Project baseline information for the aquatics RSA as well as from other literature. The aquatics baseline RSA data were obtained through a literature review. Information sources included:

- environmental impact assessments from other mining projects (e.g., Diavik Diamond Mine, Snap Lake Mine) in the region;
- species at risk databases, including *Species at Risk Act* (SARA);
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC);
- NWT Species Monitoring Information Base;
- existing government reports; and
- other documents related to the area of concern.

Because the traffic and Roads Study Area extends beyond the area that was studied for the aquatics baseline, information was also obtained from a study on the Tibbitt-to-Contwoyto Winter Road (EBA 2001a).

Project-specific baseline studies were conducted for the Winter Access Road. Fisheries inventories were not conducted at any site along the Winter Access Road. To be conservative, all lakes and streams along the route were assumed to be fish-bearing. In summer of 2004, aquatic habitat was assessed by flying the entire Winter Access Road route by helicopter. Photographs were taken at each end of each portage and aerial video of the entire route was recorded.

All portage sites were assessed for evidence of exploration phase impacts, as well as for shoreline gradient or substrate conditions that might require shoreline, bank, or in-stream modification. Substrate conditions in the lake immediately adjacent to the portage site were recorded and riparian habitat type was classified for the immediate area of the shoreline. A total of 33 portages occur on the Winter Access Road; their locations are shown in Figure 11.8-4.

Results

Fish Presence

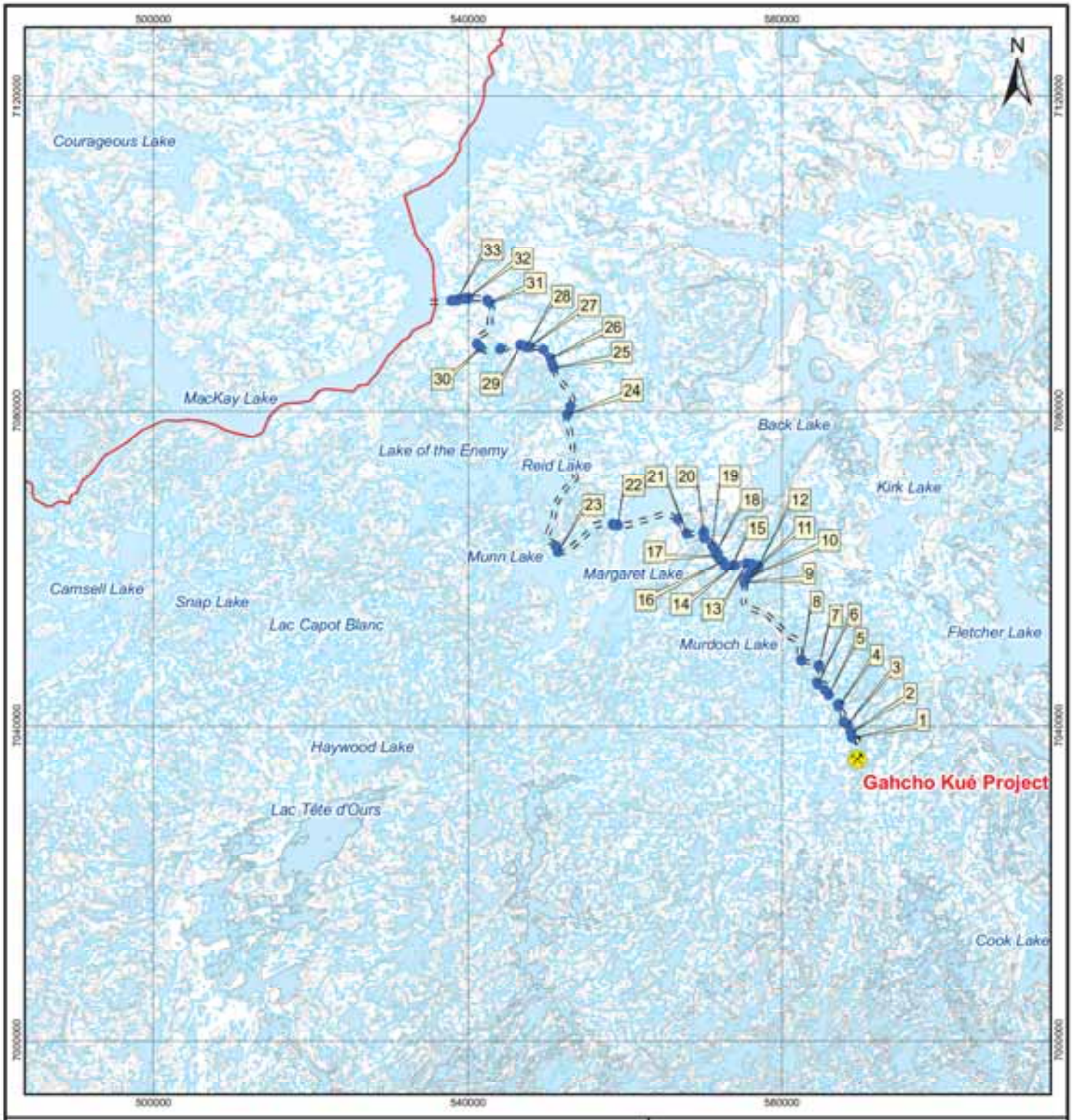
Fourteen freshwater fish species were documented in the RSA. These are Arctic lamprey (*Lampetra japonica*), Arctic grayling (*Thymallus arcticus*), burbot, lake chub (*Couesius plumbeus*), cisco (*Coregonus artedii*), lake trout, lake whitefish, least cisco (*Coregonus sardinella*), longnose sucker (*Catostomus catostomus*), ninespine stickleback (*Pungitius pungitius*), northern pike, round whitefish

(*Prosopium cylindraceum*), slimy sculpin (*Cottus cognatus)*, and white sucker (*Catostomus commersonii*). A summary of the occurrence of fish species found in the major lakes of the RSA is shown in Table 11.8-2.

None of the fish species known to occur within the RSA has been identified as red, blue, or yellow listed under COSEWIC. There are no fish species in the NWT that have been identified as a species-at-risk under the federal SARA. Arctic grayling are considered to be regionally sensitive due to increased pressures associated with resource development (i.e., forestry and mining) and climate change (GNWT 2007a). The regional status of slimy sculpin, Arctic lamprey, and round whitefish are currently undetermined and under review by the Government of the Northwest Territories (GNWT). All other species within the aquatics baseline RSA are considered to be secure at the regional level.

MacKay Lake is the largest lake in the RSA, with a surface area of 1,067 km^2. It is located north of Snap Lake, south of Courageous Lake, and northwest of the Project. The lake has been documented to support populations of Arctic grayling, lake trout, and lake whitefish, and is used by hunters and trappers for subsistence fishing (Stewart 1997). In addition, the lake supports an important lake trout sport fishery operating out of MacKay Lake Lodge.

Fish populations in MacKay Lake have been sampled previously for heavy metals and contaminants loads (Stewart 1997). In 1970, lake whitefish were sampled for organochlorines; low levels of DDT (dichlorodiphenyltrichloroethane) and dieldrin were detected. Arctic grayling, lake trout, and lake whitefish were sampled for mercury from 1971 to 1973. Mercury levels in all three species were found to be below the recommended safety guideline for commercial sale of less than 0.5 milligrams per kilogram (mg/kg) wet weight at the time (Stewart 1997).



LEGEND

- Gahcho Kué Project
- Tibbitt-to-Contwoyto Winter Road
- Proposed Winter Access Road
- Watercourse
- Waterbody
- Index Contour (100m interval)
- Intermediate Contour (20m interval)
- Portage Location (Start and End Points)
- 33 Portage Number

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

GAHCHO KUÉ PROJECT

Winter Access Road Portage Locations

PROJECTION: UTM Zone 12	DATUM: NAD83	
Scale: 1:700,000 (10 5 0 10 Kilometres)		
FILE No: SON-11.7-003-GIS		DATE: November 10, 2010
JOB NO: 09-1365-1004	REVISION NO: 1	
OFFICE: GOLD-CAL	DRAWN: CW / CHECK: AL	Figure 11.8-4

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Table 11.8-2 Known Fish Presence in Major Waterbodies in the Regional Study Area

Waterbody	Arctic Lamprey	Burbot	Arctic Grayling	Lake Chub	Lake Cisco	Lake Trout	Lake Whitefish	Least Cisco	Longnose Sucker	Ninespine Stickleback	Northern Pike	Round Whitefish	Slimy Sculpin	White Sucker
Artillery Lake	X					X								
Aylmer Lake			X			X								
Clinton-Colden Lake			X		X	X						X		
Courageous Lake		X	X			X		X	X	X		X	X	
Jolly Lake			X			X	X		X					
Lac Capot Blanc		X				X			X			X		
Lockhart River	X	X	X		X	X	X		X	X	X	X	X	X
MacKay Lake			X			X	X							
Snap Lake		X	X	X		X			X			X	X	

Sources: Golder (2002), Stewart (1997), Norecol (1987), and Moshenko (1980).

Note: X indicates fish species presence in a waterbody.

The RSA studied for the Project aquatics baseline did not include all of the Tibbitt-to-Contwoyto Winter Road corridor or adjacent areas south of Lockhart Lake. However, a study of the Tibbitt-to-Contwoyto Winter Road by EBA (2001a) indicated that the same species documented in the fisheries and aquatics baseline RSA are found in lakes along this southern portion of the winter road corridor. Tibbitt Lake and Gordon Lake have populations of lake whitefish, northern pike, and walleye, and Lockhart Lake has a lake whitefish population. Lake trout, Arctic grayling, and burbot are widely distributed and are found in most of the fish-bearing waterbodies along the Tibbitt-to-Contwoyto Winter Road corridor (EBA 2001a).

Habitat

Most of the streams and wetlands crossed by the Tibbitt-to-Contwoyto Winter Road freeze to the bottom during the winter. Fish living in shallow waters relocate to larger lakes for the winter (EBA 2001b).

The Winter Access Road will follow the route that has been used in previous winters for the exploration phase, except for the Kennady Lake crossing, which will become shorter. Table 11.8-3 summarizes the aquatic habitat categories for the 33 portages on the Winter Access Road.

Table 11.8-3 Aquatic Habitat Categories for the Winter Access Road Portages

Shoreline Type	Code	Description
Boulder Shoreline	B	shoreline comprised of bare substrates; predominantly boulders or boulders and cobbles; riparian habitat generally consists of open tundra
Vegetated Shoreline	V	shoreline an abrupt vegetated edge; no emergent vegetation present; riparian habitat generally consists of open tundra
Wetland Shoreline	W	shoreline a low-gradient wetland area; substrates generally fines; sedges and emergent vegetation extend into lake, although often only a narrow margin present

In general, lake shoreline habitats had shallow gradients and were classified into three categories: boulder, wetland, and vegetated shorelines. Of the 71 shorelines assessed, boulder (total of 29) and wetland (total of 27) shorelines were the most common types observed. Boulder shorelines had variable widths of exposed boulder/cobble substrates separating the margin of the lake from the open tundra vegetation. Wetland shorelines typically were characterized by fine organic sediments with inundated terrestrial or emergent aquatic vegetation. Gradient was lower at wetlands shorelines than at boulder shorelines. Vegetated shorelines were the least common type of lake shoreline (total of 15) and consisted of tundra vegetation growing to the edge. Where riparian shrubs or

trees were present along the Winter Access Road route, the road usually avoided such vegetation to prevent potential impacts.

Seventy-two individual lake shorelines and 10 stream crossings occur along the 33 portages of the Winter Access Road. Table 11.8-4 summarizes the aquatic habitats assessed along the Winter Access Road.

Table 11.8-4 Summary of Aquatic Habitats Assessed Along the Winter Access Road, 2004

Portage summary	total number of portages	33
	total lake shorelines	65
	small ponds along portages	6
	total shorelines along Winter Access Road route	72
Lake and pond shorelines	boulder shorelines	29
	wetland shorelines	27
	vegetated shorelines	15
	total shorelines assessed	71
Stream crossings	portages with stream crossings	10
	portages where route parallels stream	10

Evidence of existing impacts to aquatic habitat along lake shorelines and at stream crossings along the 33 portages was limited to three sites where the riparian vegetation (e.g., willows and sedges) had been compacted (portage 2, 19, and 31) and one site (portage 5) where previous construction activities have affected the active stream channel. Grading of esker material to reduce the road gradient at the approach to the portage displaced esker material into the stream channel. A ground-based assessment showed that introduction of material into the stream had reduced channel width and depth, resulting in concentrated flows and erosion along a 20 m section of bank. Approximately 475 square metres (m^2) of habitat was affected, with existing gravel, cobble, and boulder habitats downstream of the disturbance site embedded with fines and gravel materials from the esker. This area included an approximately 40 m^2 area of inundated vegetation habitat. Gradient decreases to near 0% about 80 m downstream of the disturbed esker site and no introduced sediments were observed beyond this point.

No other existing or potential sediment impacts or evidence of damage to riparian or inundated vegetation was observed along the existing Winter Access Road route. In general, routing of the existing Winter Access Road has limited in-stream and riparian degradation by limiting the number of stream crossings and avoiding lake shorelines where possible.

11.8.2.4 Terrestrial Environment

11.8.2.4.1 Vegetation and Soils

Methods

Baseline soils and vegetation studies for the Project used a variety of mapping and field survey methods. Baseline vegetation data were collected concurrently with terrain and soils data within the terrestrial RSA and Winter Access Road Study Area during July and August 2004 and July 2005. The Winter Access Road Study Area for the baseline studies included a 500 m buffer on each side of the road. The baseline study areas and methods are described in detail in the Subject of Note: Vegetation (Section 11.7) and Appendix 11.7.I, Geology, Terrain and Soils.

Results

Fifteen broad ecosystem units were described and mapped within the terrestrial baseline RSA (including one unclassified unit) and Winter Access Road Study Area. The dominant ecosystem units in the RSA are Deep Water (lakes) (17.0%), Sedge Wetland (9.9%), Tussock-hummock (9.1%), and Peat Bog (8.5%) (Table 11.8-5; Figure 11.8-5). Cloud cover impeded the classification process resulting in 6.4% of the RSA remaining unclassified.

For the Winter Access Road Study Area, Deep Water forms the vast majority (47.8%) of the Winter Access Road Study Area (Table 11.8-5; Figure 11.8-6). Shallow Water, Tussock-Hummock, and sedge wetland associations are the next largest units, covering approximately 9.5%, 6.5%, and 5.7% of the Winter Access Road Study Area, respectively. Approximately 0.4% of the Winter Access Road Study Area could not be classified due to cloud cover.

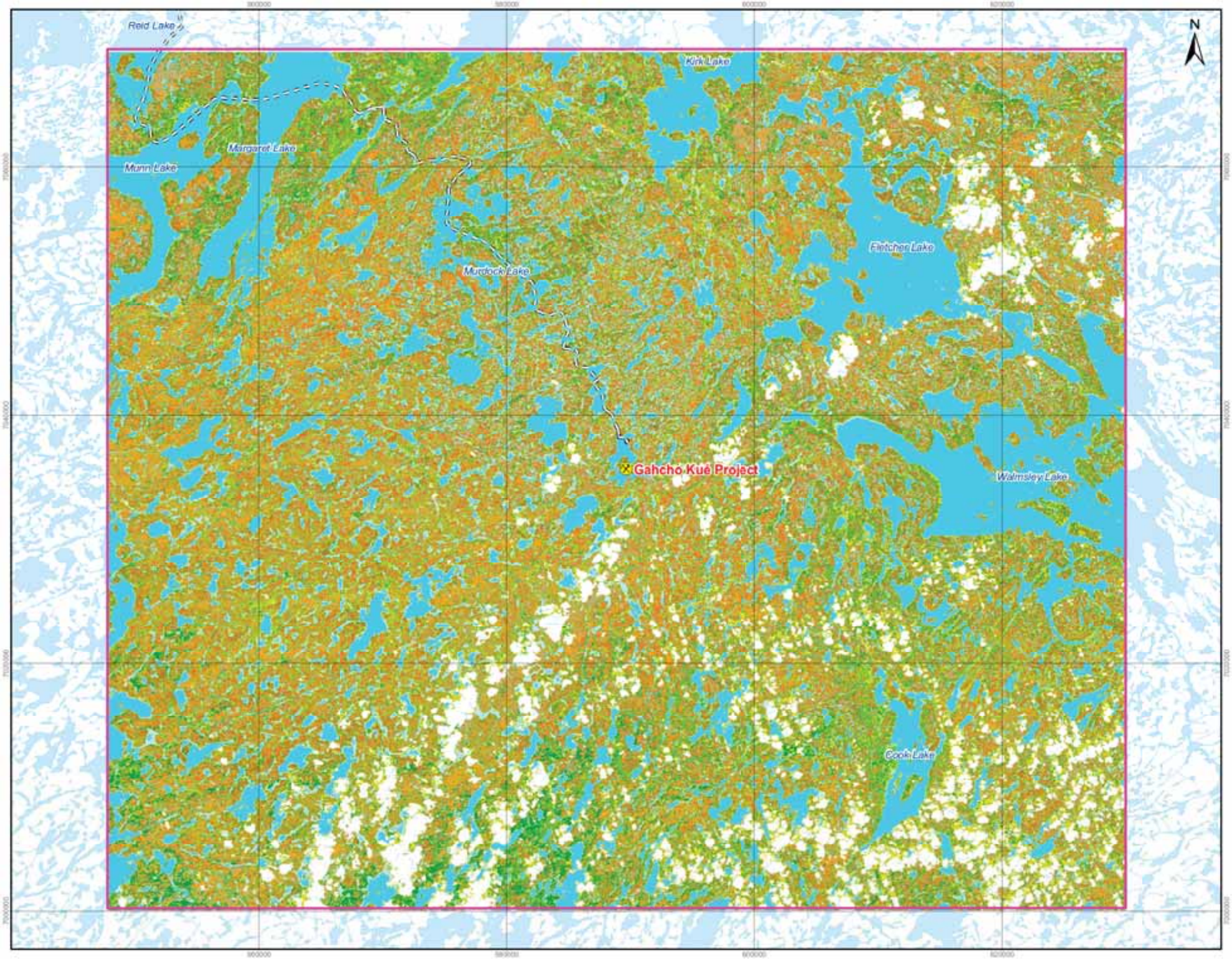
Nuna Logistics, the company that built the Winter Access Road in 2006, reported that typically there is no erosion on portages as the tundra is covered in snow and ice. On the Tibbitt-to-Contwoyto Winter Road, portages are typically covered in gravel, and hills are usually sanded. Large amounts of sand or gravel that get tracked over the lake ice from the portages are scooped up and placed back on the portage at the end of the winter road season. No hills occur on the Winter Access Road between MacKay Lake and the Project site, and therefore no gravel or sand is used (McHale 2008, pers. comm.).

Table 11.8-5 Distribution of Broad Ecosystem Units in the Regional Study Area and Winter Access Road Study Area

Broad Ecosystem Unit	Regional Study Area		Winter Access Road Study Area	
	Area (ha)	% of RSA	Area (ha)	% of Winter Road Study Area
Deep water	96,879.8	17.0	5,735.7	47.8
Sedge wetland	56,198.9	9.9	684.8	5.7
Tussock-hummock	51,645.7	9.1	779.1	6.5
Peat bog	48,333.6	8.5	587.3	4.9
Heath/boulder fields	44,502.4	7.8	425.5	3.5
Heath/bedrock	38,570.3	6.8	386.1	3.2
Shallow water	37,128.9	6.5	1,145.7	9.5
Unclassified	36,535.4	6.4	50.0	0.4
Spruce forest	32,359.6	5.7	353.6	2.9
Tall shrub riparian	31,324.1	5.5	362.8	3.0
Birch seep riparian	27,618.1	4.8	489.0	4.1
Bedrock association	24,677.7	4.3	220.5	1.8
Heath tundra	24,353.7	4.3	607.2	5.1
Boulder association	18,928.6	3.3	92.3	0.8
Esker complex	621.4	0.1	84.1	0.7
Total	**569,678.2**	**100.0**	**12,003.6**	**100.0**

Note: Some numbers are rounded to the nearest 10th decimal place for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

ha = hectares; % = percent; RSA = Regional Study Area.



LEGEND

- Gahcho Kué Project
- Proposed Winter Access Road
- Watercourse
- Waterbody
- Regional Study Area

Broad Ecosytem Unit

- Sedge Wetland
- Spruce Forest
- Heath Boulder
- Shallow Water
- Tall Shrub
- Peat Bog
- Boulder Association
- Deep Water
- Bedrock Association
- Tussock Hummok
- Heath Bedrock
- Birch Seep
- Esker Complex
- Heath Tundra
- Unclassified

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

GAHCHO KUÉ PROJECT

Broad Ecosystem Units in the Regional Study Area

PROJECTION: UTM Zone 12	DATUM: NAD83	
Scale: 1:300,000 (5 2.5 0 5 Kilometres)		DE BEERS CANADA
FILE No: SON-11.7-006-GIS		DATE: November 12, 2010
JOB NO: 09-1365-1004	REVISION NO: 1	Figure 11.8-5
OFFICE: GOLD-SAS	DRAWN: ANK / CHECK: PT	

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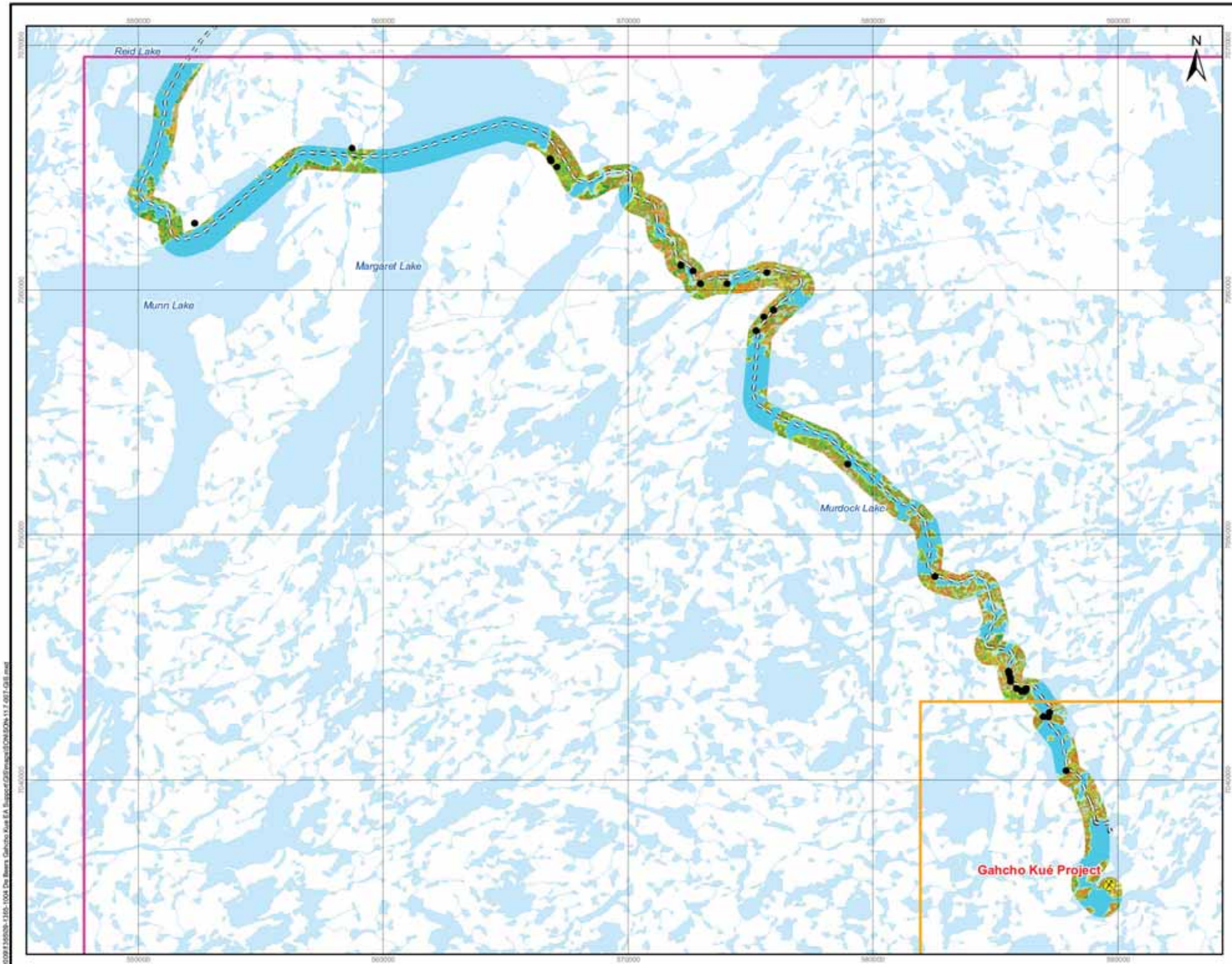

LEGEND

- Gahcho Kué Project
- Proposed Winter Access Road
- Watercourse
- Waterbody
- Sample Plot Location
- Local Study Area
- Regional Study Area

Broad Ecosytem Unit

- Sedge Wetland
- Spruce Forest
- Heath Boulder
- Shallow Water
- Tall Shrub
- Peat Bog
- Boulder Association
- Deep Water
- Bedrock Association
- Tussock Hummok
- Heath Bedrock
- Birch Seep
- Esker Complex
- Heath Tundra
- Unclassified

NOTES

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

GAHCHO KUÉ PROJECT

Broad Ecosystem Units and Sample Plot Locations in the Winter Access Road Study Area

PROJECTION: UTM Zone 12	DATUM: NAD83	DE BEERS CANADA
Scale: 1:150,000 (2 1 0 2 Kilometres)		
FILE No: SON-11.7-007-GIS		DATE: November 12, 2010
JOB NO: 09-1365-1004	REVISION NO: 1	Figure 11.8-6
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11.8.2.4.2 Wildlife

Methods

The baseline studies for wildlife were within the following spatial boundaries:

- Regional Study Area (RSA);
- Local Study Area (LSA);
- Tibbitt-to-Contwoyto Winter Road from Tibbitt Lake to MacKay Lake; and
- Winter Access Road Study Area.

The boundaries for most of the wildlife field work was based on the expected extent of the Project-related effects (i.e., the boundaries were set so that the expected effects would lie within the boundaries) as well as the life history attributes of species potentially inhabiting the region. The LSA was selected to assess the immediate direct and indirect effects of the Project on individual animals and wildlife habitat. The wildlife baseline RSA was selected to capture any effect that may extend beyond the LSA and subsequently influence the demography and distribution of populations. Wildlife baseline survey intensity varied within each spatial boundary, with broader studies completed within the RSA to assess seasonal distribution and movement, and detailed studies completed within the LSA to assess habitat importance.

The Winter Access Road Study Area was included in the wildlife baseline to identify potentially sensitive habitat within the associated rights-of-way. The spatial area included for this study area was the 120 km winter access from the existing Tibbitt-to-Contwoyto Winter Road, to the Project site at Kennady Lake. A corridor width of 3 km on either side of the road centre line was used for grizzly bears (*Ursos arctos*), wolves, wolverine, and foxes.

Baseline studies on wildlife species and wildlife habitat were completed from 1996 to 2005. Ground and aerial surveys were completed to provide estimates of the natural variation in wildlife presence, abundance, distribution, and movement. Information on caribou, grizzly bear, wolf, fox, wolverine, moose (*Alces alces*), muskoxen, upland breeding birds, waterbirds, and raptors was collected.

Baseline survey data were supplemented with ecological information from regional wildlife studies, published and unpublished scientific literature, discussions with wildlife experts, and traditional knowledge (TK). Traditional knowledge was included in the study of baseline conditions because many VCs are vital to the culture and health of the communities in the NWT. Traditional

knowledge information was obtained from the research, experience, and expertise of the Elders of Aboriginal people. This information was used to help describe wildlife and wildlife habitat near the Project, including the winter roads. Existing environmental information presented herein applies only to species' habitat use, population, behaviour or distribution, which may be impacted directly or indirectly by construction and operation of the Tibbitt-to-Contwoyto Winter Road or Winter Access Road. Details of the baseline data collection study methods and results for all wildlife are provided in Annex F, Wildlife Baseline.

Results

Caribou

Barren-ground caribou have a significant social, cultural, and economic value for the people and communities living in the Canadian Arctic. Aboriginal people have a strong connection with caribou, and rely on the animals for food, clothing, and cultural wellness. Caribou also influence the landscape through their movements and foraging, and provide food resources for predators and scavengers such as wolves, grizzly bears, wolverines, and foxes. As a result, the Bathurst, Ahiak, and Beverly herds are listed as *sensitive* (Working Group on General Status of NWT Species 2006). The Bathurst, Ahiak, and Beverly herds are not listed federally (COSEWIC 2009).

Barren-ground caribou populations with ranges that potentially overlap with the RSA are the Bathurst, Ahiak, and the Beverly herds. Caribou distribution for each herd was classified into six periods based on annual movement data from satellite-collared caribou (ENR 2010a, internet site). Of relevance to this subject of note, the winter dispersal period, identified as November 1 to April 30, is the only period that overlaps with the construction and operation of the Tibbitt-to-Contwoyto Winter Road and the Winter Access Road.

The estimated annual home range for the Bathurst herd is 309,000 km^2. Satellite collar data also indicates that the Bathurst population has the greatest likelihood of interacting with the Project. There were approximately 8,564 satellite locations for 92 collared cows from the Bathurst herd collected from January 1996 through March 2010. Of these, 25 collared cows or 27% of collared cows (and 290 point locations or 3% of point locations) were located within 10 km of the winter road between January and April when the winter road is potentially operational.

The Bathurst herd was present in the RSA during spring migration, summer dispersal, winter dispersal and rut/fall migration periods. In addition, the likelihood of the Bathurst herd occurring in the RSA was similar across the winter dispersal, northern migration, summer dispersal, and fall migration periods.

The estimated area of the annual home range of the Ahiak herd is 345,000 km^2. Based on approximately 6,240 point locations for 88 collared cows from January 2001 through October 2007, only three collared caribou from the Ahiak herd were recorded in the RSA during the winter dispersal period. Based on approximately 514 point locations for 15 collared cows between January and April of 2001 to 2007 two of the collared cows were within 10 km of the winter road.

The estimated annual home range for the Beverly herd is 282,000 km^2. Based on approximately 2,950 point locations for 19 collared cows from January 1995 through October 2007, one collared animal from the Beverly herd was recorded in the RSA during the winter dispersal period. These results are based on a maximum of one collared cow per year from January 1995 to May 2006, 5 to 6 collared animals from June 2006 to December 2006, and two cows during the late winter northern migration of 2007.

Based on approximately 12,860 point locations for 44 collared cows from January to April of 2008 to 2010, nine collared caribou from the combined Ahiak/Beverly herd (and 141 point locations) were recorded within 10 km of the winter road.

Habitat selection and behaviour of barren-ground caribou are frequently the result of their response to environmental conditions; therefore, caribou can be found in a variety of habitat types at any one time (Case et al. 1996). Analysis indicated that caribou were found more frequently than expected on frozen lakes during the northern migration, which were used for travel through the RSA.

Although aerial surveys were not completed during the winter dispersal period, satellite collar data indicates that, over the years, caribou from the Beverly (2006), Bathurst (1996, 2003, 2005, and 2006), and Ahiak (2002, 2006, and 2007) herds were present in the RSA (data courtesy of ENR [Department of Environment and Natural Resources of the Government of the Northwest Territories]). In addition, observations from wildlife log books recorded caribou in the LSA during the winter. Snow track surveys completed in late winter 2004 also provided evidence of caribou feeding and foraging in the LSA. However, few caribou were counted along the Winter Access Road Study Area in 2004 and 2005.

Current estimates for the Bathurst herd suggest that the population has declined almost 75% from their reported maximum population size in the late 1980s to 64,579 females in 2006 (Boulanger and Gunn 2007; Nishi et al. 2008). Gunn et al. (2005) reported an annual rate of decline of approximately 5% from

1996 to 2006. From 2006 to 2009, the population declined to an estimated 16,600 females (Adamcweski et al. 2009). Reduced fecundity and adult survival have been cited as contributing factors to the recent decline in herd size.

Changes in caribou behaviour are one type of predicted indirect effect from mine-related disturbance. Based on point observations of behaviour made during aerial surveys over the last decade, the majority of caribou groups have continued to exhibit feeding or resting behaviours throughout the region. Behavioural monitoring over a longer period (activity budget scan sampling of individuals) also indicated that resting or feeding behaviours were most common, even near airstrips or roads (Gunn et al. 1998; BHPB 2007). Likewise, statistical models indicate that point observations of caribou behaviour are largely driven by habitat type or insect activity, rather than distance to the mine developments (BHPB 2004; Golder 2008a, b).

Caribou mortality due to collisions with vehicles and aircraft represent direct effects from mine and mine-related developments (i.e., winter roads and airstrips). Caribou have been observed bedding or travelling on roads and airstrips. Road and airstrip traffic mitigation appear effective, as no caribou have been killed in vehicle or aircraft collisions at mine sites. The exception is the Tibbitt-to-Contwoyto Winter Road where five caribou were killed by a grocery truck (EBA 2001a).

Based on the reviewed TK and traditional land use (TLU) information, caribou is the most important resource harvested by Aboriginal groups with traditional lands near the Project, and as a result, they have developed a wealth of information about these animals (LKDFN 2003, 2005; Dogrib Treaty 11 Council 2001, 2002). According to the reviewed TK and TLU information, caribou migrate through the barrenland region twice a year: once in the fall and once in the spring, and that during these migrations the caribou pass through Kennady Lake, an Aboriginal place name for the area in which the Project is located (LKDFN 1999). Several people in the Deninu Kué First Nation (DKFN) community are concerned that they have to travel farther than they did in the past to harvest caribou and believe the species population is decreasing (DKFN 2007, internet site).

Case et al. (1996) estimated that between 14,500 and 18,500 Bathurst caribou were harvested annually from 1982 to 1995. However, there is some belief that these numbers are substantially overestimated, and that the harvest in more recent years is well below these values (Adamczewski et al. 2009).

Non-aboriginal harvest of caribou is regulated by ENR. Prior to January 1, 2010, resident hunters could harvest up to two barren-ground caribou, male only, each

year. The resident harvest occurred in two peaks: one in the fall when the caribou are near the treeline (August 15 to November 15), and another in winter when the herd is accessible by ice road (November 15 to April 30). Non-resident hunters could harvest in the winter by ice road. The numbers of barren-ground caribou harvested by resident hunters fluctuated annually from 1983 to 2008, peaking at 2,279 bulls during the 1990/1991 license season, and averaging 1,194 bulls across all years (± 660 Standard deviation).

In December 2009, interim emergency measures were put in place to help conserve the Bathurst herd (ENR 2009, internet site). Beginning January 1, 2010, barren ground caribou commercial/meat tag, resident and non-resident harvesting was closed in the North Slave and South Slave regions and all hunting (including Aboriginal hunting) was closed in a new no-hunting conservation zone established north of Yellowknife where the Bathurst herd winters (ENR 2009, internet site). The new zone includes the Tibbitt-to-Contwoyto Winter Road, the Winter Access Road, as well as all diamond mines in the NWT, including the Project. A current proposal under review suggests revising the annual allowable hunt to 300 animals for Aboriginal hunters in the current no hunting zone, but no resident or non-resident hunting in the North Slave and South Slave regions or the new conservation zone (ENR 2010b, internet site).

Residents of the NWT may also harvest caribou from the Beverly and Quamanirjuaq herds. In the NWT, the non-Aboriginal resident and non-resident harvest of these herds is extremely small as the Beverly herd seldom travels close to NWT communities (ENR 2010a, internet site).

The Ahiak herd is seasonally hunted by people from Gjoa Haven, Umingmaktok, Cambridge Bay, and Łutselk'e in some winters (ENR 2010a, internet site). No estimates on the number of animals harvested were available.

Barren-ground caribou have an important social, cultural, and economic value to residents of the NWT. The herds are hunted by Aboriginal and non-Aboriginal people from almost all communities. In the 21st century, the economies of many communities are made up of a mixture of the wage economy, the traditional/resource harvesting economy, and government transfer payments. Typically in many of these smaller communities, traditional harvesting continues to play an important role in the economy as well as in the social and physical well-being of the community (Parlee 1998; Fast and Berkes 1999). On average, value attained from wild meat and fish harvested from the land has been related to $10,000 per household (Usher 1989). Involvement in harvesting activities also provides the intangible benefit in contributing to their identity and reaffirming their connection with the land.

A large percentage of Łutselk'e adults (55% to 68%) and youth (26% to 27%) consume caribou meat on a regular basis. Over half of the adults and one-third of the youth surveyed ate six or more meals of caribou in a week. Caribou have been harvested less in the past few years because the herds are further from the community and it takes longer to reach them. Families and harvesters without access to snowmobiles and sufficient gas have difficulty reaching and harvesting from the herds (LKDFN 2005).

Muskoxen

Muskoxen are distributed across the tundra of the circumpolar Arctic (Gunn and Adamczewski 2003). Muskoxen distribution reflects the environmental conditions that support these animals, with the very northern and coastal parts of their range supporting the highest density (Sly et al. 2001). Lesser numbers are present in the Thelon Game Sanctuary and southwest to Artillery Lake (ENR 2010a, internet site). Unlike caribou, muskoxen do not undertake long migrations; Reynolds (1998) determined that the average size of core areas used by satellite-collared muskoxen in the winter seasons was 27 km^2 to 70 km^2.

Towards the end of March, muskoxen can be found on slopes (i.e., eskers) and plateaus where the vegetation has been exposed by wind (Sly et al. 2001), or by warm spring days. According to the Łutsel 'Ke Dene First Nation (LKDFN 2001), eskers are also important transportation corridors, as they offer easy travel and a windy refuge from mosquitoes. Esker surveys completed in the RSA in 2007 estimated muskoxen sign at 0.14 sign per km surveyed.

The muskoxen is currently listed as *secure* within the NWT (Working Group on General Status of NWT Species 2006, internet site), and is not listed federally as populations appear to be increasing (COSEWIC 2007). Wildlife Management Area U/MX/01 (which now includes the former Wildlife Management Area U/MX/02), is located east of the Project, near Aylmer Lake. In 1989, the population of muskoxen within the Wildlife Management Area U/MX/02 was estimated at 563 animals and no muskoxen were found within the RSA at that time. Surveys completed in 1991 (Wildlife Management Area U/MX/01), estimated that the density of muskoxen was highest along the eastern and northern edge of Aylmer Lake, and the population within the survey area was estimated at 161 animals. No muskoxen were found near the Project. Population surveys of the Wildlife Management Area U/MX/02 were repeated in 1998 (Bradley et al. 2001). Observers counted 1,162 muskoxen, and most animals appeared to be expanding west and northwest of Artillery Lake.

From 1995 to 2003, eight observations of muskoxen were recorded within the terrestrial baseline RSA during aerial surveys completed for caribou. Group size ranged from 1 to 47 individuals. In 2004 and 2005, muskoxen appeared to be

relatively common (15 observations total) and were observed within the RSA during all aerial surveys. Group size ranged from 1 to 92 individuals in 2004 and 2005. The higher number of muskoxen observed in 2004 and 2005 may be the result of the increased survey effort in these years or may reflect potential migration or movement into the RSA. Muskoxen were found within the RSA during October and September, suggesting that a portion of the muskoxen winter range may overlap with the RSA.

Muskoxen are sensitive to human disturbances, particularly during calving and post-calving periods (Miller and Gunn 1979). The muskoxen that were observed near the Project in the summer of 2004, however, foraged within a few hundred metres of camp and did not appear to be alarmed by human observers. In addition, there are no reported injuries/mortalities related to muskoxen reported for other developments in the NWT or Nunavut (Tahera 2007; BHPB 2010; DDMI 2010; De Beers 2010).

Currently in the NWT, muskoxen are harvested under a quota system on three areas on the arctic islands and four areas on the mainland, including, U/MX/01 (ENR 2010a, internet site). In 1994, the quota for muskoxen was increased to, and currently remains at, 10,000 animals (ENR 2010a, internet site). Although efforts are underway to increase the market for muskoxen meat in southern Canada, it seems unlikely that the total quota will be reached (ENR 2010a, internet site).

Traditional knowledge indicates that muskoxen are using the Project area more heavily then in the past; however, one reviewed source suggested that the muskoxen were not native to the region (LKDFN 2005).

Moose

Traditional moose range encompassed suitable habitat south of the treeline throughout the NWT. However, since the early 1900s, moose have been seen at numerous locations on the tundra where adequate forage is available (ENR 2010a, internet site).

Moose populations in the NWT are listed as secure (Working Group on General Status of NWT Species 2006, internet site), and are not listed federally (COSEWIC 2009, internet site). Traditional knowledge indicates that moose are not common to the RSA, although, moose have occasionally been observed. From 1996 through 2005, 14 moose were recorded within the RSA, 13 of which have been recorded since 1999.

Currently in the NWT, moose are managed mostly by controlling the hunting season for resident and non-resident hunters (ENR 2010a, internet site). The estimated total NWT moose harvest is 1,000 to 2,000 animals per year, 80% to 90% of which is taken by General Hunting License holders who are able to hunt during any season. Traditional knowledge indicates that moose are harvested most commonly in the East Arm of Great Slave Lake around McLean Bay, the North Shore, Wildbread Bay, Basile Bay, Regina Bay, Stark Lake, Duhamel Lake, and several other places with bays and weeds (LKDFN 2005).

Grizzly Bear

Barren-ground grizzly bears (referred to in this section as grizzly bears) and bear sign have been documented in the RSA from 1999 through 2005. In 2004, eight different grizzly bears (five adults and three cubs) were observed within the RSA and a minimum of six different grizzly bears were present in 2005. The majority of the 24 den sites (19 inactive; 3 active, and 2 test dens) recorded during the 2004 and 2005 surveys were located adjacent to an esker. Esker use surveys completed in the RSA in 2007 documented 59 observations of grizzly bear sign on eskers, resulting in 0.76 sign per km surveyed. The finding that grizzly bears select eskers for dens was supported by traditional knowledge (LKDFN 2001). Traditional knowledge indicates that grizzly bears place their dens on the more windy west-facing slopes of eskers.

Grizzly bears are inactive during the winter, when they den and enter a dormant state, approximately from October to April (McLoughlin et al. 2002).

Wolverine

Wolverine, the largest member of the weasel family, has a circumpolar distribution in the tundra, taiga, plains, and boreal forests of North America (Weir 2004). The animals are an important cultural and economic resource for people of the NWT. Traditional knowledge indicates that wolverines were harvested primarily for their fur, although historically, they were sometimes killed as an emergency food source. Wolverines are annual residents in the RSA, and are listed as a species of special concern by COSEWIC (2009, internet site) and sensitive by the Working Group on General Status of NWT Species (2006, internet site). This species currently has no status under *Species at Risk Act* (SARA 2009, internet site).

Wolverines are highly adaptable animals that can alter their location and distribution over time, but often occur with large ungulate populations. Recent concerns regarding the potential cumulative direct and indirect effects on wolverine populations from human development, hunting, and trapping

(Johnson et al. 2005) have resulted in an increase in conservation efforts and planning for wolverine in northern Canada.

Wolverine populations generally exhibit low densities. For example, Boulanger and Mulders (2007) estimated that, on average, male densities were 2.64 (1.2 standard deviation [SD]) per 1,000 km^2 and female densities were 4.19 (1.29 SD) per 1,000 km^2 in the NWT during 2005 and 2006. These densities result in a total population size of 1,298 wolverine for a 190,000 km^2 study area (approximate size of the SGP).

Habitat within the RSA appears to provide adequate availability of potential den locations. Bedrock outcrops are relatively common, particularly farther south and west in the RSA. From 1999 to 2005, four wolverine dens were located within the RSA, ranging from 7 to 15 km from the Project camp.

In the RSA, 27 wolverines were documented during the period of 1998 through 2005. Wolverine activity and frequency of sightings coincided with the major spring and fall caribou migrations. `

Harvest kill rates through sport hunting and trapping of non-problem wolverine for subsistence are much higher than that for problem wolverine. For example, based on the reported number of wolverine tags issued to sport hunting outfitters in the North Slave Region (data from 1995 to 2002, and 2005, and 2006), the minimum number of tags issued during a year was 63 wolverine, whereas the maximum number of tags issued during a year was 451 wolverine (Carriere 2007 in Berens 2007, internet site). Further, annual subsistence trapping may range from 56 to 175 wolverine based on the reported number of wolverine pelts sold in the NWT from 1995 to 2002 (Statistics Canada 2008, internet site). During the winter of 2006/2007, 19 wolverine hides were submitted to ENR from Yellowknife residents, and a further 7 from Łutselk'e (ITT 2008).

However, harvesting pressure on NWT wolverines has been increasing. In some northern communities, the price for a wolverine pelt has risen to as high as $500. The use of snow machines has made it easier to hunt and trap wolverines. Residents can harvest one or more wolverine in accordance with the number of tags obtained (July 25 to April 30). Non-residents can harvest one wolverine (December 1 to March 15, and August 15 to October 31) (ENR 2010c, internet site). The estimated wolverine harvest to Yellowknife hunters showed an increase from eight in the 1992/1993 season to peaks of 23 in both the 1995/1996 and 1997/1998 seasons. From those peaks, the numbers trended downward to three in the 2005/2006 season.

Wolverine is prized by Aboriginal cultures for their fur, which provides excellent insulation and protection from the wind when used on clothing. Wolverine fur is used by both Inuit and Dene as trim on hoods and sleeves. Traditionally, the Denesǫłıne people travelled to the barrenlands to harvest wolverine, particularly in the area east of the Project (LKDFN 1999).

Wolf

Grey wolves are distributed over most of the NWT, and populations are considered to be "secure" in the NWT (Working Group on General Status of NWT Species 2006, internet site). Federally, the grey wolf is "not at risk" (COSEWIC 2009, internet site), and is not listed under SARA (SARA 2009, internet site). However, potential risks for the local population may arise from habitat removal and human disturbance (Clarke et al. 1996).

Wolves and wolf sign have been documented in the RSA since 1999. Few wolves are found in the RSA during winter, they occur seasonally in the RSA from March through October, coinciding with the caribou movements through the region. The winter movements of wolves may depend on the distribution of caribou and not on the location of traditional wintering areas. Walton (2000) found that collared wolves would winter in different areas from year-to-year in response to caribou movements. The straight-line distances from the den site of wolves to the most distant winter location averaged 500 km (Walton 2000; Cluff et al. 2002). A total of 46 wolves and 9 pups were recorded from 1999 to 2007 in the RSA.

Traditionally, wolves have been harvested for their pelts. The price of an individual wolf pelt has varied little over the last decade, with an average price of $215 each. The value of the annual wolf fur harvest has ranged from $10,000 to over $30,000 and is on average worth $22,200 (ENR 2010a, internet site).

The Denesǫłıne people travelled to the barrenlands to harvest wolf, along with other furbearing species, particularly in the area between Fletcher Lake and Walmsley Lake east of Gahcho Kué (LKDFN 1999). From 2003 to 2005, there has been a sizeable increase in the percentage of Denesǫline adults and youth who are trapping (LKDFN. 2005). During the 2006/2007 hunting season, no hides were submitted to ENR from Yellowknife residents, but three were submitted from Łutselk'e (ITT 2008).

The estimated wolf harvests to Yellowknife hunters increased from 19 in 1991/1992 to a peak of 81 in 1994/1995. From that point, the numbers trended downward to four in 2000/2001. Estimated harvests rose to 31 in 2001/2002 and declined to 14 in 2005/2006 (Carriere 2007 in Berens 2007, internet site).

Foxes

The Arctic fox (*Alopex lagopus*) and red fox (*Vulpes vulpes*) are the most abundant carnivores in the Arctic tundra; however, there is little information on the ecology and behaviour of these species in the SGP. Both species are considered "secure" in the NWT (Working Group on General Status of NWT Species 2006, internet site) although no discrete population estimates are available for either species. Neither of these fox species are listed federally (COSEWIC 2009, internet site; SARA 2009, internet site). Although harvest rates have diminished in recent years, they are still a highly sought-after species. Fox are harvested by both Aboriginals and local residents, and are a valuable subsistence and non-traditional resource in the NWT.

The Project lies within the range of both the Arctic and red fox. The Project is, however, at the southern extent of the Arctic fox range, and none were observed during the baseline studies. Red fox were found to be abundant, and were observed throughout the year. Between 1999 and 2007, 24 active fox dens were identified in the terrestrial baseline RSA, all of which were established on eskers or other glaciofluvial deposits such as kames. Mean distance of den sites from the Project from 1999 to 2005 was 23.5 km (minimum = 2 km; maximum = 38 km).

There are two distinct movement periods for both species of fox on the tundra: fall (August to late September) and winter through spring (January to March) (Eberhardt et al. 1982, 1983; Jones and Theberge 1982). The late winter and spring movement is related to the establishment of a breeding territory. Traditional knowledge suggests that Arctic fox migrate in a pattern similar to the caribou and these species' populations are interrelated (LKDFN 1999).

In the Arctic tundra, the distribution and population dynamics of fox is highly dependent on the spatial distribution and density of their prey (Anthony 1997; Jepsen et al. 2002). Fox populations in northern tundra environments fluctuate in response to the three- to four-year population cycle in microtine species (Hiruki and Stirling 1989; Smits and Slough 1993; Carriere 1999; Jepsen et al. 2002). Traditional knowledge holders stated that the Arctic fox population has declined (LKDFN 1999). Some traditional knowledge holders suggested that the decline of the Arctic fox population was a result of natural fluctuation, while other sources believed poison set to kill wolves was the cause (LKDFN 1999). Elders believed that mining activity was not likely affecting the Arctic fox populations (LKDFN 1999).

Arctic and red fox are an important furbearer, and an important source of income for the community of Łutselk'e (LKDFN 1999). During the winter of 2006/2007, 21 red fox hides and one cross fox were submitted to ENR from Yellowknife

residents, and two silver and one Arctic fox hide from Łutselk'e (ITT 2008), suggesting that the use of this furbearer has declined in recent years.

Upland Birds

Upland bird species that winter in the SGP include willow ptarmigan (*Lagopus lagopu*), rock ptarmigan (*Lagopus mutus*), hoary redpoll (*Carduelis hornemanni*), and boreal chickadee (*Poecile hudsonicus*). Hoary redpoll, willow ptarmigan, and boreal chickadee tend to move south into forested areas in winter. Snow bunting (*Plectrophenax nivalis*) may be present in the RSA during winter, although its winter range is typically further north. Common redpoll (*Carduelis flammea*) may also winter in the SGP, although the area is at the northern limit of its winter range.

Eleven upland bird species at risk (Territorial and Federal listed species) were observed in the RSA during baseline surveys for the Project, or are expected to occur in the RSA based on existing literature including existing traditional knowledge information. None of the eleven listed species (observed or expected to be within the RSA) winter in the RSA.

Raptors

Raptor species observed in the RSA during baseline studies include gyrfalcons (*Falco rusticolus*), peregrine falcon (*Falco peregrinus*), rough-legged hawk (*Buteo lagopus*), short-eared owl (*Asio flammeus*), bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), common raven (*Corvus corax*), merlin (*Falco columbarius*), northern hawk owl (*Surnia ulula*), northern harrier (*Circus cyaneus*), and snowy owl (*Bubo scandiacus*).

Within the RSA, raptor "species at risk" include the peregrine falcon and short-eared owl. The peregrine falcon *(anatum)* is a Schedule 1, threatened species under SARA, a species of special concern under COSEWIC, and sensitive under the Northwest Territories General Species Rank. The peregrine falcon *(tundrius)* is a Schedule 3 species of special concern under SARA, a species of special concern under COSEWIC, and sensitive under the Northwest Territories General Species Rank. Finally, the short-eared owl is a Schedule 3 species of special concern under SARA, special concern under COSEWIC, and sensitive under the Northwest Territories General Species Rank. These species likely do not occur in the area during winter months and therefore would not be affected by construction and operation of the Tibbitt-to-Contwoyto Winter Road or Winter Access Road.

11.8.2.5 Human Resource Users

11.8.2.5.1 Commercial Users of the Winter Road

Tibbitt-to-Contwoyto Winter Road

Past and present commercial users of the Tibbitt-to-Contwoyto Winter Road include the Lupin, Ekati, Diavik, Snap Lake, and Jericho mines, and mineral exploration traffic. Currently, the diamond mines rely heavily on the Tibbitt-to-Contwoyto Winter Road for transporting construction equipment, building materials, fuel, and food.

Table 11.8-6 presents information on the annual operating period of the Tibbitt-to-Contwoyto Winter Road and the number of northbound and southbound trucks from 2000 to 2010 (Joint Venture 2010, internet site). In 2010, the Tibbitt-to-Contwoyto Winter Road opened to regular traffic on January 29 and closed on March 24, with 3,506 northbound truckloads and 424 southbound backhauls occurring over the season (Joint Venture 2010, internet site). The number of trucks on the winter road peaked in 2007, with 10,922 northbound and 818 southbound (Table 11.8-6). In 2006, which was one of the warmest winters on record, the winter road season was approximately 50 days, and did not reach its full load-bearing capacity. The increased truck volume for 2007 included equipment and materials that were not transported in 2006 due to early closure (GNWT 2007b).

Table 11.8-6 Number of North and Southbound Truck Loads on the Tibbitt-to-Contwoyto Winter Road, 2000 to 2010

Year	Operating Period	Number of Northbound Trucks	Number of Southbound Backhauls
2010	February. 4 to March. 24	3,506	424
2009	February. 1 to March. 22	4,847	530
2008	January. 29 to March. 31	7,484	890
2007	January. 27 to April. 9	10,922	818
2006	February. 5 to March. 26[(a)]	6,841	469
2005	January. 26 to April. 5	7,607	243
2004	January. 28 to March. 31	5,091	165
2003	February. 1 to April. 2	5,243	883
2002	January. 26 to April. 16	7,735	433
2001	February. 1 to April. 13	7,981	201
2000	January. 29 to April. 3	3,703	135

Source: Joint Venture (2010, internet site).
(a) Road shut down early due to thin ice conditions.
Jan. = January; Feb. = February; Mar. = March; Apr. = April

Table 11.8-7 summarizes commercial truck volume and tonnage on the Tibbitt-to-Contwoyto Winter Road by various mining companies from 1998 to 2009 (GNWT 2007b and 2009, internet site). In 2010, a total of 3506 trucks were dispatched north, carrying 121,000 tonnes (Joint Venture 2010, internet site). From 2007 to 2009, Diavik Diamond Mine was the largest single user of the Tibbitt-to-Contwoyto Winter Road. In addition to supplies to support day-to-day mining operations from open pits, Diavik Diamond Mine trucked additional loads of fuel, cement, explosives, materials, and equipment to support construction for underground mining (DDMI 2008, internet site). With the closure of the Jericho Diamond Mine owned by Tahera, the Tibbitt-to-Contwoyto Winter Road was not built to that mine in 2009 or 2010 (Joint Venture 2010, internet site).

Table 11.8-7 Traffic Volume on the Tibbitt-to-Contwoyto Winter Road, 1998 to 2009

Year	Load [(a)]	Lupin Mine	Ekati Diamond Mine	Diavik Diamond Mine	Snap Lake Mine	Jericho Diamond Mine	Mineral Exploration Traffic	Total
1998	tonnage	4,220	73,712	0	0	0	4,056	81,988
	# trucks	112	2,431					2,543
1999	tonnage	3,356	41,453	0	n/a	0	12,399	57,208
	# trucks	85	1,759					1,844
2000	tonnage	21,672	66,609	25,068	0	0	12,031	125,380
	# trucks	557	3,402					3,959
2001	tonnage	26,239	99,297	111,506	0	0	8,545	245,587
	# trucks	688	2,912	4,127	0	0	363	8,090
2002	tonnage	27,315	132,077	93,009	0	0	3,083	255,484
	# trucks	698	3913	3,339	0	0	218	8,168
2003	tonnage	27,832	101,990	67,394	0	0	1,602	198,818
	# trucks	702	3,003	2,202	0	0	87	5,994
2004	tonnage	11,097	105,127	53,960	6,852	0	2,108	179,144
	# trucks	288	2,984	1,572	295	0	117	5,256
2005	tonnage	7,709	117,661	94,303	18,089	0	14,771	252,533
	# trucks	251	3,434	2,848	703	0	614	7,850
2006	tonnage	1,071	82,447	55,750	34,852	7,821	2,435	184,376
	# trucks	35	3,152	2,094	1,623	258	148	7,310
2007	tonnage	2,059	121,716	133,267	64,505	17,566	4,172	343,285
	# trucks	55	3,937	4,573	2,355	500	236	11,656
2008	tonnage	0	72,233	138,051	43,244	2,300	2,513	258,341
	# trucks	0	1,840	4,239	1,250	49	77	7,455
2009	tonnage	0	58,544	91,362	22,884	0	405	173,195
	# trucks	0	1,663	2,779	904	0	31	5,377

Source: GNWT (2009, internet site) and GNWT (2007b).

(a) For each year, the number of trucks indicated are loaded truckloads, and represents one-way traffic. To determine the total truck traffic, these numbers should be multiplied by 2.

= number

Winter Access Road

The Winter Access Road will essentially be the same as that used for exploration during 2001, 2002, and 2006. Truck volume for each of these years is shown in Table 11.8-8, based on information provided to De Beers from the Joint Venture (2008b). It is assumed that these numbers represent northbound loads only. The road has not been installed since 2006.

Table 11.8-8 Number of Trucks Recorded on the Winter Access Road

Year	Number of Trucks
2001	64
2002	12
2006	44

Source: Joint Venture (2008b).

11.8.2.5.2 Non-commercial Users of the Tibbitt-to-Contwoyto Winter Road

In addition to providing access to the region for mining-related activities, the Tibbitt-to-Contwoyto Winter Road offers winter access to remote areas for a variety of other activities. Other activities include camping, fishing, hunting, and woodcutting. Table 11.8-9 shows the reported non-commercial traffic on the Tibbitt-to-Contwoyto Winter Road for the years 2004 to 2006.

Each year from 2004 to 2006, hunting was the most common activity of winter road users, followed by sightseeing and fishing. There has been a decrease each year in both the number of people and number of vehicles using the winter road for such recreational purposes (Table 11.8-9). Reported persons and vehicles using the winter road for recreational purposes in 2006 were both about 50% lower than numbers reported for 2004 (Ziemann 2007, internet site).

Table 11.8-9 Reported Non-commercial Traffic on the Tibbitt-to-Contwoyto Winter Road, 2004 to 2006

Activity	2004		2005		2006	
	Number Persons	Number Vehicles	Number Persons	Number Vehicles	Number Persons	Number Vehicles
Camping	109	55	77	30	82	39
Fishing	384	180	334	135	157	62
Hunting	1,206	573	731	326	640	284
Other	12	8	6	8	1	1
Sightseeing	420	201	337	144	190	78
Unknown	134	102	30	25	30	24
Wood cutting	19	13	14	8	8	2
Working	5	4	0	0	0	0
Total	**2,289**	**1,136**	**1,529**	**676**	**1,108**	**490**

Source: Ziemann (2007 internet site).

Hunters now use a combination of truck and snowmobile along the Tibbitt-to-Contwoyto Winter Road to access new hunting areas. A local tour operator has observed snowmobile tracks at various places along the length of the winter road (Jaeb 2007, pers. comm.), but there is no way to determine whether they are related to traditional or non-traditional hunting.

True North Safaris offers tours of the winter road for sight-seeing, snowmobiling, wildlife viewing, and aurora viewing. MacKay Lake Lodge also offers wildlife viewing from the Tibbitt-to-Contwoyto Winter Road. The wildlife viewed includes muskoxen, wolf, and ptarmigan (See EIS Section 12.7.3). Tours do not go to the mine sites, as they are not open to the public (Jaeb 2007, pers. comm.). Most people and vehicles using the winter road were from Yellowknife (Table 11.8-10).

Table 11.8-10 Tibbitt-to-Contwoyto Winter Road Person Count and Vehicle Use by Community

Community of Residence for Traveller	2004		2005		2006	
	Number Persons	Number Vehicles	Number Persons	Number Vehicles	Number Persons	Number Vehicles
Detah	106	51	84	48	32	16
Fort Providence	8	3	0	0	0	0
Fort Resolution	5	3	16	7	0	0
Fort Simpson	8	4	0	0	0	0
Fort Smith	27	9	68	30	22	14
Hay River	34	15	55	19	14	5
Łutselk'e	0	0	6	2	0	0
N'Dilo	80	28	34	12	34	8
Behchokǫ̀	18	8	4	2	2	1
Rae Lakes	0	0	4	2	0	0
Unknown	141	109	34	28	35	26
Yellowknife	1,848	897	1,188	514	931	406
Out of Territory	6	3	30	10	33	13
Out of Country	8	6	6	2	5	1
Total	**2,289**	**1,136**	**1,529**	**676**	**1,108**	**490**

Source: Ziemann (2007 internet site).

The *Tibbitt Lake to Contwoyto Winter Road Monitoring Station Report* (Ziemann 2007, internet site) tracked seven harvested wildlife species from 2004 to 2006. Table 11.8-11 shows harvests along the winter road, by species.

Table 11.8-11 Wildlife Harvested on the Tibbitt-to-Contwoyto Winter Road, 2004 to 2006

Wildlife	2004	2005	2006
	Number Harvested	Number Harvested	Number Harvested
Caribou	538	494	255
Grouse	0	1	0
Hare	0	1	0
Ptarmigan	5	0	0
Moose	0	2	0
Wolf	9	3	3
Wolverine	0	1	2
Total	**552**	**502**	**260**

Source: Ziemann (2007 internet site).

Table 11.8-11 identifies that caribou are the focus of hunting along the Tibbitt-to-Contwoyto Winter Road. However, harvest levels have shown an annual decline from 538 in 2004 to 255 in 2006. General Hunting Licence holders accounted for 44%, 63%, and 58% of the caribou harvest in 2004, 2005, and 2006, respectively (Table 11.8-12).

Table 11.8-12 Caribou Harvested by Hunter Type along the Tibbitt-to-Contwoyto Winter Road

Hunter Type	2004	2005	2006
	Number Harvested	Number Harvested	Number Harvested
General hunting licence	236	312	148
Resident hunting licence	143	88	90
Unknown	159	94	17
Total	**538**	**494**	**255**

Source: Ziemann (2007 internet site).

11.8.2.5.3 Winter Road Accidents and Spills

The potential exists for accidents (e.g., collisions among humans and/or wildlife) and spills of hazardous materials to occur on the Tibbitt-to-Contwoyto Winter Road. However, available information indicates that these incidents are relatively rare. For example, in 2007, when traffic was at its peak, about 11,700 truckloads were hauled with nine minor incidents resulting in one minor injury (Joint Venture 2010, internet site). Eight of the accidents involved collisions between two vehicles, and one involved a single vehicle breaking through the ice. In the same year, five incidents/accidents occurred on Highway 4 (Ingraham Trail). No significant safety or environmental consequences resulted from any of these accidents (Joint Venture 2008a, internet site). In 2010, De Beers has the following traffic incidents on record for the Tibbitt-to-Contwoyto Winter Road in

2010: one wildlife incident; two trucks - off road (no spills or injuries); and one detained driver.

The Joint Venture has implemented various measures to minimize disturbance and collision mortality for caribou and other wildlife along the road (Joint Venture 2009, internet site):

- All wildlife has the right-of-way on the Winter Road. Vehicles are required to slow down or stop and wait to permit the free and unrestricted movement of wildlife across the Winter Road at any location.
- The speed limits for commercial trucks travelling along the Winter Road are kept low. For example, the speed limit on the winter road ranges from 10 km per hour to a maximum of 40 km per hour for empty trucks.
- Drivers are required to maintain at least 500 m spacing when traveling in convoys. The slow speed limits and spacing between trucks provide caribou with time to see the trucks from a distance, and give drivers time to react to any caribou on the Winter Road.
- Caribou may not cross the road if they cannot see over a snow bank. In areas and times of known caribou distribution and occurrence, snow bank height is managed to allow caribou passage.

Since the Joint Venture was formed in 1999 and took over management of the Tibbitt-to-Contwoyto Winter Road, only two wildlife incidents are on record (Mandeville 2010, pers. comm.; Joint Venture 2009, internet site). More specifically, in 2010 one wildlife incident was reported and in 1999 a collision between a commercial truck and six caribou occurred. In 1996, prior to the Joint Venture, a wolverine was killed by a pick-up truck.

Several spills have been reported on the Tibbitt-to-Contwoyto Winter Road, although large spills (i.e., over 1,000 litres [L]) have been rare. From 2006 to 2009, five spills involving oil or diesel fuel occurred either on the Tibbitt-to-Contwoyto Winter Road or nearby; spill volumes were typically 200 L or less, with one exception. In 2008, 14,500 L of diesel fuel were spilled at Portage 32 on the Tibbitt-to-Contwoyto Winter Road. In 2007, a spill of ammonium nitrate also occurred on the Tibbitt-to-Contwoyto Winter Road. From 2002 through 2005, seven spills over 1,000 L were recorded for the Tibbitt-to-Contwoyto Winter Road. No petroleum spills over 1,000 L occurred on this Winter Access Road from 1999 to 2002.

11.8.2.6 Regional Effects Monitoring and Research Programs

As a partner in the Joint Venture, De Beers now participates in and approves of monitoring related to the aquatic or terrestrial environmental effects of the Tibbitt-to-Contwoyto Winter Road. De Beers has staff members that are part of the Operations and Management committees for the Joint Venture, which recommends and approves the work plans for studies such as the annual spring surveys of the main winter road construction camps.

Since 2003, the ENR, in partnership with the Yellowknives Dene First Nation (YDFN), has surveyed non-commercial users of the Tibbitt-to-Contwoyto Winter Road, using a check station established at Ross Lake. This has allowed ENR to monitor activities by non-commercial road users, and may help to determine what impacts the road users have on wildlife and the surrounding environment (Ziemann 2007, internet site). The Bathurst Caribou Management Plan and the Barren Ground Caribou Management Strategy have identified documenting harvest numbers through winter road monitoring as a tool to determine how winter roads impact caribou herds (Ziemann 2007, internet site).

The check station uses a one-page survey questionnaire to record information on the people using the Tibbitt-to-Contwoyto Winter Road (number, community, purpose of trip, type of hunter, number of days hunting, species hunted) as well as information on species harvested or observed. More detailed caribou harvest information is collected, including harvest numbers, sex, health, condition, and pregnancy rates, as well as numbers of caribou sighted along the winter road. The survey results are entered into a database (Ziemann 2007, internet site).

The West Kitikmeot Slave Study (WKSS) and the Joint Venture have contributed funding for the project. The ENR meets with the Joint Venture to discuss survey results and address any concerns. The Joint Venture shares road information with ENR, and ENR liaises on wildlife issues with Nuna Logistics, the company responsible for winter road building and maintenance (Ziemann 2007, internet site).

Ziemann (2007 internet site) summarized yearly data from the monitoring program, including activities that road users were engaged in, use of the Tibbitt-to-Contwoyto Winter Road by community, harvested wildlife by species, and harvested caribou by hunter type. These data were presented in Section 11.8.2.5.

Information collected from harvesters through the Ross Lake check station showed that 31% of female caribou harvested along the Tibbitt-to-Contwoyto Winter Road were pregnant. This percentage is thought to be low compared to

pregnancy rates of 75% to 80% recorded for community hunts throughout the 2006 season (Ziemann 2007, internet site). The low percentage reported from the winter road survey could be a result of lack of experience among the check station monitors as some information regarding caribou sex and pregnancy was not recorded. Pregnancy rates for previous seasons were not available (Ziemann 2007, internet site).

Survey results from ENR show that the number of persons, number of vehicles, and numbers of wildlife harvested have declined each year from 2004 to 2006 (Section 11.8.2.5). Reasons for this include shorter operating season, and fewer numbers of caribou along the road resulting in lower harvest numbers. The ENR planned to continue use of the check station at Ross Lake (Ziemann 2007, internet site).

11.8.3 Access and Transportation for the Project

This section describes:

- the access and transportation plans for the Project;
- the projected changes in both winter road and air traffic due to the Project;
- the potential for accidents and malfunctions on the Tibbitt-to-Contwoyto Winter Road and the Winter Access Road; and
- the implications of exceptional winter road seasons on projected winter road and air traffic.

Environmental design features built into the access and transportation plan are summarized in Section 11.8.3.1.3, while other mitigation or adaptive management strategies to limit potential effects are described in other sections of this subject of note, where relevant.

11.8.3.1 Access and Transportation Plan

This section provides details on the access and transportation scenarios for the Project. Access to the Project site will be by Winter Access Road for bulk supplies and by aircraft for personnel, fresh food, and equipment and supplies required throughout the year that cannot be delivered over the Winter Access Road. Air cargo will be minimal during the winter road season, but could be substantial outside of this period.

11.8.3.1.1 Winter Road Access and Transportation

The trucking route will follow the Tibbitt-to-Contwoyto Winter Road north from the end of the Ingraham Trail (km 0), east of Yellowknife. At km 271 of the Tibbitt-to-Contwoyto Winter Road, a 120 km long Winter Access Road will be constructed each year to connect the Tibbitt-to-Contwoyto Winter Road to the Project site.

The main access to the site from the Winter Access Road will be at a point on the north shoreline of Kennady Lake. The access road will continue on land from this point to the east of Lake A1 and south towards the plant site. During construction, up to 100 trucks can arrive for offloading in a 24-hour period. To prevent truck congestion, a truck staging area will be located along the stretch of the Winter Access Road just south of Lake A1 (Figure 11.8-1); from here, trucks will be dispatched to the appropriate unloading area on-site.

During operations, a large portion of the winter road deliveries will be diesel fuel. As a safety measure and to avoid contact between freight and operations vehicles, the fuel unloading facilities will be located away from operations at the Winter Access Road entrance to the site.

11.8.3.1.2 Air Access and Transportation

Construction

During construction, Yellowknife-based personnel will be transported between Yellowknife and the site via scheduled flights on various types of propeller aircraft with 37 to 42 person capacity. Jet aircraft may also be used; however, details related to their use are not yet determined. Otherwise, personnel will travel between Yellowknife and Edmonton via commercial airlines and between Yellowknife and the Project site via scheduled flights on smaller aircraft.

Cargo will normally be transported via DHC-5 Buffalo. Hercules aircraft will be used as required for transport of critical items too large or heavy for the DHC-5 Buffalo. Smaller aircraft such as Dash 7, Dash 8, Twin Otter, Beech, and King Air will be used during the first year of construction when the permanent airstrip is not yet available, and for charter or special visitor flights as required.

Development of a permanent airstrip will be a priority in the first year of construction. The 1,620 m long and 45 m wide airstrip will be designed to accommodate Hercules and Boeing 737 aircrafts, as well as smaller planes, and will be located about 1 km southeast of the plant site on the opposite side of Kennady Lake. The airstrip will be accessed by a causeway formed by Dyke A. Until the permanent airstrip is established, aircraft will land on an ice airstrip

located on Kennady Lake. The ice airstrip will be capable of handling all aircraft potentially servicing the site.

Operations

During operations, all personnel will be transported between Yellowknife and the site via scheduled flights on various types of propeller aircrafts with 37 to 42 person capacity. Cargo will normally be transported in the same way as during the construction period. Smaller aircraft such as Twin Otter, Beech, and King Air will be used for non-scheduled trips as required. Jet aircraft may also be used.

11.8.3.1.3 Planned Use of Glycol for De-icing

The permanent airstrip will include mobile de-icing equipment. This could include a glycol tank and spray unit. It is expected that environmentally benign de-icing fluids will be primarily used for the project; however, glycol has been included as a possibility for use. To prevent accumulation and/or runoff of de-icing fluid, which may include glycol, at the airstrip, aircraft will be sprayed in a specific area on the strip that will be equipped with swales to collect excess de-icing fluid. Puddles of de-icing fluid in the swales will be removed by vacuum truck upon aircraft departure. The liquid will be deposited into waste de-icing fluid drums (empty de-icing fluid barrels), which will be stored in the containment area for off-site shipment to recycling facilities if required depending on the actual fluid used.

Based on the experience at Snap Lake, the Project is not expected to use any significant quantity of glycol for de-icing. No glycol has been required for de-icing in 2005/2006 and 2006/2007 at Snap Lake.

11.8.3.1.4 Environmental Design Features

Environmental design features include Project designs and environmental best practices, management policies and procedures, and programs that remove the pathway or limit (mitigate) the effects to the environment, plants, animals, and people. Environmental design features are built into the Project, and were developed through an iterative process with engineering and environmental assessment teams. Environmental design features of the access and transportation plan for the Project are summarized here.

Route selection and design considerations were important for mitigating potential impacts associated with access and transportation. Alternative methods for bringing freight to the Project site were considered for the Snap Lake Mine. These included an all-weather road between Yellowknife and site, railway, pipeline (for fuel), hovercraft, year-round air transport, airship transport, aerial tramway and monorails, all-terrain vehicles, and a combination of lake barges

and all-weather road or winter road to site. The winter road option was considered to be the most viable for various reasons, including economics and permitting (De Beers 2001). Current and projected traffic levels do not justify an all-weather road specifically for the Project as it is not feasible because of schedule and economic constraints. No major technical changes to the recommended freight method have occurred since the Snap Lake alternatives study was undertaken.

Three Winter Access Road routes to the Project site from the Tibbitt-to-Contwoyto Winter Road were assessed in alternative route studies. These included:

- a central route from the Tibbitt-to-Contwoyto Winter Road through Lake-of-the Enemy to Kennady Lake;
- a southern route extending the Snap Lake Mine Winter Access Road to Kennady Lake; and
- the previously used northern route from the Tibbitt-to-Contwoyto Winter Road at MacKay Lake to Kennady Lake.

Lake-of-the-Enemy (Figure 11.8-4) is a significant cultural location for Aboriginal people. The Yellowknives Dene requested that De Beers not use the route because of its importance. Heritage sites and graves are located at Lake-of-the-Enemy. Because of these concerns, the central route alternative was discarded early in the analysis of alternatives.

The southern route included the approved Winter Access Road to the Snap Lake Mine. From there, the new route would go east to Lac Capot Blanc (Figure 11.8-4), then east to Munn Lake, and join the existing Project exploration Winter Access Road at Margaret Lake. The annual construction and maintenance costs for this route were approximately the same as the third alternative, and both of these routes would have a similar environmental impact. This route was not selected due to difficulties in laying out the actual route.

The third alternative was to continue using the existing exploration Winter Access Road from the Tibbitt-to-Contwoyto Winter Road at MacKay Lake to Kennady Lake. Ultimately, De Beers chose to continue to use the existing northern winter road from MacKay Lake to Kennady Lake. When the Project starts up, the final section of the road crossing Kennady Lake will be shortened to accommodate construction requirements (Figure 11.8-1); no other alterations in the route are proposed.

The Tibbitt-to-Contwoyto Winter Road is operated under a Licence of Occupation by the Joint Venture. Terms and conditions in the Licence specify the general route of the winter road, environmental protection measures (i.e., suspension of overland travel if rutting or gouging occurs on the portages); payment amounts, clean-up requirements upon licence expiration, and permitted dates of operation. It also requires annual submission of a comprehensive plan for the prevention and clean-up of spills of transported goods (EBA 2001a). The Winter Access Road will be constructed and operated in accordance with practices outlined in the Land Use Permit, with appropriate plans for updates and improvements. All Tibbitt-to-Contwoyto Winter Road drivers are required to undergo a safety orientation program, which includes reviewing and signing off on the Winter Road Regulations and Rules for the Road (Appendix 11.8.I). These regulations and rules are discussed in more depth in section 11.8.3.4.

A Project-specific Emergency Response and Contingency Plan has been prepared to establish a guidance document for emergency responses at the site. This plan provides:

- a clear chain of command for all emergency activities;
- accountability for the performance of the spill response;
- well defined task and operational hazards/risk; and
- reporting and record keeping requirements to track program progress.

Of particular relevance to traffic and road issues, this plan provides protocols for dealing with vehicle/wildlife incidents, equipment, or people falling through ice, and a spill response plan. The plan will be a “living” document and will be updated on a regular basis as new information comes to light or procedures, permits, and authorizations change. The Emergency Response and Contingency Plan is provided as Attachment 3.I.1 of Section 3, Appendix 3.I.

Based on past experience, the Joint Venture typically advises the Tibbitt-to-Contwoyto road users to schedule transport of goods and fuel over a 67 day period starting with light loads in early February, and graduating to full loads by the third week of February. Notices are forwarded to users of the Tibbitt-to-Contwoyto Winter Road advising them of restrictions with respect to vehicle transport weights and speed limits. This allows the users to plan their transport loads during the operational period of the winter road.

Marshalling facilities for the Project located in Edmonton, about two days drive away, will allow for flexibility in the sequencing and timing of loads. Where possible, full truckloads of materials will be stored at the vendor’s facility until the

Tibbitt-to-Contwoyto Winter Road has opened, after which they will be shipped directly to site. Full-load shipments that cannot be retained at the vendor's facility will be shipped to the marshalling facility in Edmonton. The marshalling facility will enable materials to be consolidated to make up full loads.

A Winter Access Road truck parking or staging area will be provided at the end of the Winter Access Road, to prevent truck congestion and reduce the likelihood of accidents at the site (Figure 11.8-1). During operations, a large portion of the Winter Access Road deliveries will be diesel fuel. As a safety measure and to avoid contact between freight and operations vehicles, the fuel unloading facilities will be located away from operations at the Winter Access Road entrance to the site.

11.8.3.2 Projected Changes to Winter Road Traffic

This section describes changes to traffic volume and pattern that are anticipated for the Project. The Project will result in increased traffic on the Tibbitt-to-Contwoyto Winter Road and Ingraham Trail as well as the Winter Access Road. Winter road traffic bound for the Project will access the Tibbitt-to-Contwoyto Winter Road via the Ingraham Trail (Highway 4). Table 11.8-13 provides a forecast of average and maximum winter road traffic volumes for the Project, for each phase of development. In Table 11.8-13, closure refers to the interim closure of the site (e.g., decommissioning of facilities and contouring); there will be approximately six more years of closure to allow for re-filling of Kennady Lake. These forecasts indicate the Project-specific contribution to traffic volume, and apply to the Winter Access Road as well as to the Tibbitt-to-Contwoyto Winter Road. A typical winter road season has been assumed. The effect of an exceptional winter road season on both air and winter road traffic is discussed in Section 11.8.3.5.

Table 11.8-13 Project-related Winter Road Traffic Forecast by Phase

Project Phase	Number of Years	Loads per Year	
		Average	Maximum
Construction	2	1,500	2,000
Operations	11	1,000	1,200
Closure[(a)]	2	110	200

Sources: JDS feasibility study.

(a) Closure refers to time required to remove site infrastructure, also referred to as "interim closure". Only infrastructure required for lake refilling will remain at the Project site beyond two years. Final site demobilization will occur via a winter ice strip once Kennady Lake has been refilled.

Load frequency for the construction phase was based on the experience at similar projects (Ekati and Snap Lake). The operations phase forecast is based on the 2006 Conceptual Study freight estimate (Gregor 2008, pers. comm.). The closure forecast assumes 25% of the construction forecast.

Projections of traffic volumes on the Tibbitt-to-Contwoyto Winter Road must also take into account forecasted traffic volumes for other projects in the region. Winter road traffic to the Project will share the first 271 km of the Tibbitt-to-Contwoyto Winter Road with other users.

A total of 7,100 loads are projected for users of the Tibbitt-to-Contwoyto Winter Road for 2011. This projection was based on information provided by the Joint Venture Management Committee, which issues weekly general summary updates by e-mail once the Tibbitt-to-Contwoyto Winter Road opens, stating loads carried to date and a projection of total load counts for the season. Typically, load estimates are obtained from the main users during the summer period, and then revised during the fall season as the users obtain and provide additional details to the Joint Venture. To date, the Joint Venture has not actively pursued detailed load projections beyond one operational season.

For 2007, the Tibbitt-to-Contwoyto Winter Road accommodated a record 11,656 loads (GNWT 2007b). The increased truck tonnage and volume for 2007 incorporated equipment and materials that were not transported on the 2006 winter road due to early closure. The total number of loads declined over the next several years due to several factors, including the shutting down of the Jericho Diamond Mine. Snap Lake has essentially completed its construction phase. It is anticipated that the load factors for other users of the Tibbitt-to-Contwoyto Winter Road will not exceed the 7,100 range per year over the next 10 years given that the existing mines will continue to operate at present levels of production without any large infrastructure developments.

Duration of winter road operation may be constrained by a change in natural weather patterns. In addition, labour supply challenges, late deliveries, congestion delays, and work stoppages could cause transportation windows to be missed. Some of these constraints can be mitigated with additional seasonal planning. For example, Nuna Logistics started work earlier on the winter road for the 2007 season and reduced the down time over the Christmas period. Additional air freight services could be implemented and procurement activity schedules could be altered.

Taking into consideration the projected truck loads for other Tibbitt-to-Contwoyto Winter Road users (7,100) as well as the projected average truck loads for each

phase of the Project (as per Table 11.8-13), the total projected truck loads during development phases would be between 8,600 and 9100 (construction), 8,100 and 8,300 (operations) and 7,210 (closure), respectively (Table 11.8-14). During construction, the Project would, therefore, contribute a 17% to 22% increase in truck loads on the Tibbitt-to-Contwoyto Winter Road (Table 11.8-14). During operations and closure it would result in 12% to 14% and 2% to 3% increases, respectively.

Table 11.8-14 Impact of Project Loads on Total Tibbitt-to-Contwoyto Winter Road Loads

Project Phase	Number of Years	Project Loads per Year (Average)[a]	Other User Loads per Year[b]	Total Winter Road Loads per year[c]	Percentage Change Due to Project (%)
Construction	2	1,500 to 2,000	7,100	8,600 to 9100	17 to 22
Operation	11	1,000 to 1,200	7,100	8,100 to 8300	12 to 14
Closure[d]	2	110 to 200	7,100	7,210 to 7,300	2 to 3

[a] Forecast winter road traffic for the Project.
[b] Forecast winter road traffic for other operating mines and mineral exploration on the Tibbitt-to-Contwoyto Winter Road in 2011.
[c] Forecast winter road traffic from Project, as well as other operating mines and mineral exploration on the Tibbitt-to-Contwoyto Winter Road.
[d] Closure refers to time required to remove site infrastructure, also referred to as "interim closure". Only infrastructure required for lake refilling will remain at the Project site beyond two years. Final site demobilization will occur via a winter ice strip once Kennady Lake has been refilled.

% = percent

In terms of overall capacity to handle the influx of additional traffic forecast for the Project, it would appear that the parallel transportation requirements for all users can be met without compromising the requirements for each user. The peak predicted traffic volume of 8,600 loads during the Project construction phase is well within the road's capacity as demonstrated by the total load number of 11,656 trucks in 2007 (GNWT 2007b).

11.8.3.3 Projected Changes to Air Traffic

Table 11.8-15 provides a forecast of air traffic volumes for the construction, operations, and closure phases of the Project, by type of aircraft. These forecasts assume a normal winter road season. The effect of an exceptional winter road season on flights and road traffic is discussed in Section 11.8.3.5.

Table 11.8-15 Air Traffic Forecast by Project Phase and Type of Aircraft

Project Phase	Number of Years	Number of Flights per Year			
		Jet	Large Propeller[(a)]	Small Propeller	Helicopter
Construction	2	n/a	500	200	50-75
Operations	11	n/a	150	100	50-75
Closure[(b)]	2	n/a	20	40	50-75

(a) Large propeller defined as more than 32 seats.

(b) Closure refers to time required to remove remaining site infrastructure. Only infrastructure required for lake refilling will remain at the Project site beyond two years. Final site demobilization will occur via a winter ice strip once Kennady Lake has been refilled.

n/a = not available

The construction phase forecast is based on experience from the Snap Lake Mine, while the operations forecast is based on the estimates for the Project. The closure forecast is based on reduced camp size. The specific use of jet aircraft is uncertain at this time.

No large seasonal variation in air traffic to the Project is anticipated, with the exception of the winter road season, when most freight will be brought in by surface vehicle and flights will be almost exclusively passenger flights. This only impacts the large propeller category, which includes Hercules and Buffalo aircraft.

During construction, the frequency of large propeller flights is estimated at 25 flights per month during February and March (50 flights during the winter road season), and 45 flights per month for the remaining months (450 flights outside the winter road season). During the operation phase of the Project, it is estimated that there will be five large propeller flights per month in February and March (10 flights during the winter road season), and 10 flights per month for the remaining months (100 flights outside the winter road season). During the closure phase, there will be no significant winter road season variation, as most flights will include both passengers and freight.

11.8.3.4 Potential for Winter Road Accidents

The potential exists for accidents on the Tibbitt-to-Contwoyto Winter Road or the Winter Access Road to result in chemical spills; however, the overall risks to the environment are predicted to be negligible to low. The Joint Venture's winter road regulations, emphasis on safety and training, and proven mitigation measures have meant that accident rates have not increased in proportion to traffic volume. Should an accident occur that results in a chemical spill, procedures are in place to contain and clean up the spill such that any potential

impacts are minimized. The paragraphs that follow describe the risk assessment results for accidents and malfunctions, as well as relevant mitigation.

The potential for accidents and malfunctions due to petroleum and ammonium nitrate spills were assessed for the Tibbitt-to-Contwoyto Winter Road and for the Winter Access Road using a standard risk assessment approach. Results are reported in Section 3, Appendix 3.I, Accidents and Malfunctions, and summarized here.

All spills from 1983 to the end of March 2001, except one, had been cleaned up by the end of 2001 (EBA 2001b). There have been no substantial spills of petroleum products into any waters along the winter road corridor where fish or other aquatic resources have been affected. Also spill records indicated that the number of spill incidents per year had not increased as a result of higher levels of commercial vehicle traffic since the mid 1990s. A review of the ENR hazardous materials spill database from 2002 to 2010, identified only two additional spills (150 L and 80 L of diesel) on the Tibbitt-to-Contwoyto Winter Road since 2001 (ENR 2010d, internet site).

Two large spills of diesel occurred in the first two years of Tibbitt-to-Contwoyto Winter Road operation (1983 and 1984) when vehicles overturned. Since that time, one large spill (15,000 L) occurred in 2000 when a vehicle overturned. This low occurrence of large spills is expected to continue, but it will remain within the "possible" range of the frequency index. In most cases, a large spill would be contained on the ice surface and cleaned up. The consequences of a potential large spill that could not be contained on the ice surface and cleaned up are moderate to the environment. Therefore, the risk from large spills is low to the environment.

No reportable spills occurred on the Winter Access Road when it was open from 1999 to 2002 and 2006. While the record is short, it indicates that a large spill on this road is possible, or occurring at a frequency of at least one chance in 100 years, but less than once in ten years. The consequence of a large spill to the environment that is contained on the ice surface and cleaned up is low; however, if the spilled material cannot be contained, the consequence is moderate. The risk from large spills is low.

Small spills on the Tibbitt-to-Contwoyto Winter Road and the Winter Access Road are highly likely, estimated to occur at least once a year. Given that spills on the winter roads occur under frozen conditions (e.g., above the ice on an ice-covered lake) and are cleaned up, the consequences and risk of a small spill are negligible to the environment.

Two small spills involving ammonium nitrate occurred on the Tibbitt-to-Contwoyto Winter Road in 2001 (EBA 2001b) and one small spill also occurred in 2007 (Joint Venture 2008a, internet site). One large (12,000 L) spill of ammonium nitrate occurred in 2000 (EBA 2001b). All spills were cleaned up to the satisfaction of the inspectors. Ammonium nitrate has never been spilled on the Winter Access Road, although ammonium nitrate use will increase during construction and operations. The number of vehicles carrying ammonium nitrate will be less than the number of vehicles on the Tibbitt-to-Contwoyto Winter Road.

The frequency of a spill, small or large, is estimated to be possible. For small spills, the consequences to the environment are low. The risk to the environment is therefore negligible. For a large spill, the consequences could be moderate to the environment if the spill cannot be adequately contained and recovered. Ammonium nitrate is a fertilizer and a spill could increase aquatic or terrestrial productivity near the spill. Because the consequences could be moderate, the risk to the environment from large spills is low.

Accidents occur rarely and they have been relatively minor when they have occurred, due to the slow speed of travel regulated on the road, proper security, and good training. All transport carriers adhere to the winter road approved contingency plans that are actively monitored and enforced by SecureCheck on behalf of the Joint Venture. Regulations for traffic safety and environmental compliance are based on many years of winter road operational experience, and are reviewed or amended yearly as required by the Joint Venture advisory group.

Before driving the winter road, all drivers must undergo a safety orientation program. This includes reviewing the road regulations and rules, and signing off on them. The Regulations and Rules include:

- provisions for spill reporting;
- speed limits;
- load limits and dimensions;
- right-of-way procedures on portages and lakes;
- convoy and vehicle spacing;
- drugs, alcohol, and firearms;
- wildlife encounters; and
- penalties.

Operators are required to check in and are then dispatched north in groups of three or four depending on road conditions.

The Joint Venture maintains a fully integrated emergency response plan for any emergency, including spills of hazardous materials. An emergency response would be coordinated by the Joint Venture and could include the road maintenance crews, the Yellowknife fire department, and the emergency response teams from the nearest mine sites. The clean-up of hazardous materials spilled on winter roads would proceed in a manner similar to that used for spills at a mine site (Section 3, Appendix 3.I, Attachment 3.I.1, Emergency Response and Contingency Plan).

11.8.3.5 Exceptional Winter Road Season

The Terms of Reference for the Subject of Note: Traffic and Roads Issues requested that consideration of traffic and road impacts consider two types of seasons:

- 'normal' winter road seasons, such as the 2006/07 season; and
- exceptional seasons, such as the 2005/06 season that resulted in a significant increase in air traffic.

Previous winter road traffic predictions (Section 11.8.3.2) assumed an average season. This section considers the implications of exceptional (warmer than normal) winter road seasons.

The unseasonably warmer weather experienced in 2006 resulted in a shorter winter road season compared to subsequent years (50 versus 70 days, respectively). Further, the warmer temperatures produced thinner ice, which limited load sizes. All mines were forced to fly in freight. For example, Diavik flew in 15 million L of diesel fuel, among other supplies (Joint Venture 2007).

It is difficult to predict the impact from an exceptional winter road season similar to that experienced in 2006 on the number of flights and winter road loads. The impact is dependent not only on the development phase and specific activities of the Project, but on many externalities to the Project. Any meaningful analysis must consider the combined winter road traffic from all of the mines, and their future planned activities, and predict changes in climate conditions at a relatively small scale (i.e., the region of the winter road). This type of information was not available.

Based on the Snap Lake Mine experience in 2006, it is estimated that an exceptional winter road season could mean 600 fewer winter road loads than a normal winter road season. Air traffic could increase by as many as 500 Hercules flights and 500 Buffalo flights. It would also mean that mines would be

replenishing supplies in the following winter road season, increasing the number of loads in the next year.

11.8.4 Pathway Analysis

11.8.4.1 Methods

Pathway analysis identifies and assesses the issues and linkages between the Project components or activities (e.g., traffic and roads), and the correspondent potential residual effects on the persistence of aquatic and terrestrial ecosystems, and the continued opportunity for traditional and non-traditional use. Pathway analysis is a three-step process for identifying and validating linkages between Project activities and environmental effects. Potential pathways through which traffic and roads could influence aquatic and terrestrial ecosystems were identified from a number of sources including:

- potential pathways identified in the Terms of Reference (Gahcho Kué Panel 2007) and the Report of Environmental Assessment (MVEIRB 2006);
- a review of the Project Description and scoping of potential effects by the environmental assessment and Project engineering teams for the Project; and
- consideration of potential effects identified for the other diamond mines in the NWT and Nunavut.

The first part of the analysis is to produce a list of all potential effects pathways resulting from Project-related traffic and roads. Each pathway is initially considered to have a linkage to potential effects on aquatic and terrestrial ecosystems. This step is followed by the development of environmental design features and mitigation that can be incorporated into the Project to remove the pathway or limit (mitigate) the effects to aquatic and terrestrial ecosystems from traffic and roads. Environmental design features include Project designs and environmental best practices, and management policies and procedures. Environmental design features (e.g., regulations for traffic safety and environmental compliance) are based on many years of winter road operational experience, and are reviewed or amended as required by the Joint Venture advisory group. Design features developed for the Tibbitt-to-Contwoyto Winter Road will be applied to the Winter Access Road to avoid or mitigate effects.

Knowledge of the ecological system and environmental design features and mitigation is then applied to each of the pathways to determine the expected amount of Project-related changes to the environment and the associated

residual effects (i.e., after mitigation) on the persistence of aquatic and terrestrial ecosystems, and the continued opportunity for traditional and non-traditional use. For an effect to occur, there has to be a source (e.g., traffic, roads) and a correspondent effect on VCs in the aquatic and terrestrial ecosystems.

Pathway analysis is a screening step that is used to determine the existence and magnitude of linkages from the initial list of potential effects pathways for Project-related traffic and roads. This screening step is largely a qualitative assessment, and is intended to focus the effects analysis on pathways that require a more comprehensive assessment of effects. Pathways are determined to be primary, secondary (minor), or as having no linkage using scientific and traditional knowledge, logic, and experience with similar developments and environmental design features. Each potential pathway is assessed and described as follows:

- no linkage – pathway is removed by environmental design features and mitigation so that the Project results in no detectable environmental change and, therefore, no residual effects to a VC relative to baseline or guideline values;
- secondary - pathway could result in a measurable and minor environmental change, but would have a negligible residual effect on a VC relative to baseline or guideline values; or
- primary - pathway is likely to result in a measurable environmental change that could contribute to residual effects on a VC relative to baseline or guideline values.

Primary pathways require further effects analysis and impact classification to determine the environmental significance from the Project-related traffic and roads, in combination with other Project-related activities, on the persistence of aquatic and terrestrial ecosystems, and the continued opportunity for traditional and non-traditional use. Pathways resulting from traffic and roads with no linkage to aquatic and terrestrial ecosystems or pathways that are considered minor (secondary) are not analyzed further or classified because environmental design features and mitigation will remove the pathway (no linkage) or residual effects can be determined to be negligible through a simple qualitative evaluation of the pathway. Pathways resulting from traffic and roads that are determined to have no linkage to effects, or those that are considered secondary are not predicted to result in environmentally significant effects on the persistence of VCs in the aquatic and terrestrial ecosystems, and the continued opportunity for traditional and non-traditional use. Primary pathways are assessed in more detail in other key lines of inquiry and subjects of note that consider all pathways by which the Project may affect the VCs (e.g., Key Line of Inquiry: Caribou).

However, the assessment of pathways related specifically to traffic and roads are summarized here for completeness.

Project-related pathways from traffic and roads and the potential effects on the aquatic environment are discussed in Section 11.8.4.2, whereas potential pathways and associated effects for the terrestrial environment are discussed in Section 11.8.4.3.

11.8.4.2 Aquatic Environment Results

Potential pathways through which effects to the aquatic environment from the construction and operation of the Tibbitt-to-Contwoyto Winter Road and Winter Access Road (including increased traffic volume) could occur from the following pathways:

- increased risk of chemical spills (including de-icing fluid at the airstrip) could negatively affect water quality, and possibly be detrimental to fish and fish habitat;
- changes to hydrology processes, such as water levels and flow, could lead to effects on water quality, fish and fish habitat;
- increases in traffic volume could increase the potential for erosion and sedimentation around portages, leading to effects on water quality, fish, and fish habitat;
- changes to fish and fish habitat from water withdrawal during winter road construction;
- increased fishing pressure due to increased access and human presence; and
- changes to fish behaviour or survival as a result of traffic-generated noise.

Because the environmental design features are specific to each pathway, they will be included in the pathway validation and discussed with each pathway.

11.8.4.2.1 Pathways with No Linkage

A pathway may have no linkage if the activity does not occur or the activity does not occur when the VC is present (e.g., species not active or present in the winter), or if the pathway is removed by environmental design features and mitigation so that the Project results in no detectable (measurable) environmental change and no residual effects to the aquatic ecosystem. The following pathways are anticipated to have no linkage to the persistence of VCs in the aquatic ecosystem, and will not be carried through the effects assessment.

Increased risk of chemical spills could negatively affect water quality, and possibly be detrimental to fish health

Chemical spills along the transportation corridors, particularly those of petroleum and ammonium nitrate, can adversely affect surface water quality and fish habitat, and can cause fish mortality. As described in Section 11.8.3.4, there is a low risk of major spills on the Tibbitt-to-Contwoyto Winter Road and the Winter Access Road, even when the additional traffic predicted for the Project is considered. The environmental design features (i.e., mitigation) and adaptive management plans in place for the Tibbitt-to-Contwoyto Winter Road, which will also be used for the Winter Access Road, include:

- approved spill contingency plans that are actively monitored and enforced;
- traffic safety measures;
- environmental compliance measures;
- employee education; and,
- security.

These plans and measures will be reviewed and amended yearly as required.

A risk analysis of spills on the Tibbitt-to-Contwoyto Winter Road and the Winter Access Road was done as part of Accidents and Malfunctions (Appendix 3.II). The risk was determined to be negligible to low when both the severity of the consequence and the frequency of occurrence (probability) were considered.

To prevent accumulation and/or runoff of de-icing fluids at the airstrip from aircraft de-icing operations, aircraft will be sprayed in a specific area that will be equipped with swales to collect excess fluids if necessary. Puddles of de-icing fluids in the swales will be removed by vacuum truck and deposited into waste de-icing fluid drums for shipment to recycling facilities, as appropriate.

Given the implementation of the environmental design features and adaptive management plans, and based on the risk analysis, there is expected to be no detectable change to water quality, fish habitat, and fish survival relative to baseline conditions. Therefore, this pathway was determined to have no linkage to effects on the persistence of VCs in the aquatic ecosystem and to continued opportunity for traditional and non-traditional use.

Changes to hydrological processes, such as water levels and flow, could lead to effects on water quality, fish and fish habitat

The Tibbitt-to-Contwoyto Winter Road and the Winter Access Road are to be constructed and operated only in winter. The roads will be closed in late winter of each year, before any appreciable snowmelt begins. The annual closure will include removal of all obstructions to watercourses so that the passage of spring runoff is not affected or delayed. Therefore, there is no expected linkage between the two winter roads and changes to hydrology that would lead to the persistence of VCs in the aquatic ecosystem. Because the winter roads are predicted to result in no detectable (measurable) change to hydrological processes, there will be no residual effects to continued opportunity for traditional and non-traditional use.

Changes to fish and fish habitat from water withdrawal during winter road construction

No effects to fish or fish habitat from water withdrawal during annual construction and maintenance of the Winter Access Road to the site are anticipated. The Winter Access Road will be constructed in accordance with Fisheries and Oceans Canada (DFO's) Protocol for Winter Water Withdrawal in the NWT (1995a) and DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (1995b). With this recommended mitigation in place, there is no expected linkage between water withdrawal and the persistence of VCs in the aquatic ecosystem. The Project is also predicted to result in no detectable (measurable) environmental change to continued opportunity for traditional and non-traditional use.

Increased fishing pressure due to increased access and human presence

The Winter Access Road will be available for only about ten weeks from January to April, on average, and is accessible only after considerable travel on the Tibbitt-to-Contwoyto Winter Road, which has restricted speed limits. Although the Winter Access Road would provide access to several large lakes including Reid Lake, Munn Lake, Margaret Lake, and Murdock Lake and numerous smaller unnamed lakes along the route to Kennady Lake in winter, increased fishing pressure on these lakes is unlikely because:

- the duration of the Winter Access Road is typically no more than 10 weeks long and occurs when day-time air temperatures are typically -30 degrees Celsius (°C) or lower;
- abundant opportunities exist to ice fish or hunt closer to Yellowknife; and
- De Beers will extend its no-fishing policy to all employees, contractors, and sub-contractors while using the Winter Access Road.

Dogrib, Yellowknives Dene, and Łutselk'e Dene have not identified any lake along the Winter Access Road route as an important traditional fishing area (Annex M, Traditional Knowledge and Traditional Land Use Baseline). Therefore, it is unlikely that any of these First Nations would increase their fishing activities along the Winter Access Road. The Project will also increase traffic along the Tibbitt-to-Contwoyto Winter Road, but this increase in traffic will not provide fishing opportunities.

Therefore, this pathway was determined to have no linkage to effects on the persistence of VCs in the aquatic ecosystem and human use.

11.8.4.2.2 Secondary Pathways

In some cases, both a source and a pathway exist, but the change caused by the Project is anticipated to result in a minor environmental change, and would have a negligible residual effect on VCs in the aquatic environment relative to baseline or guideline values (e.g., a slight increase in a water quality parameter above Canadian Council of Ministers of the Environment [CCME] guidelines, but would not affect fish health). The following pathways were determined to be secondary pathways, and will not be carried through the effects assessment.

Increases in traffic volume could increase the potential for erosion and sedimentation around portages, leading to effects on water quality, fish, and fish habitat.

Best management practices (Cott and Moore 2003) as well as NWT (Stanley and Sentar 1993) and federal (DFO 1995a, 1995b, 2008, internet site) guidelines are followed during construction of the Tibbitt-to-Contwoyto Winter Road. The same company responsible for constructing the Tibbitt-to-Contwoyto Winter Road, Nuna Logistics, will construct the Winter Access Road to the Project site.

Evidence of existing effects to aquatic habitat along the lake shoreline and at stream crossings along the 33 portages of the Winter Access Road route used during exploration was limited to three sites where the riparian vegetation (e.g., willows and sedges) had been compacted (portages 2, 19, and 31) and one site (portage 5) where previous construction activities have affected the active stream channel. No other existing or potential sediment effects or evidence of damage to riparian or inundated vegetation was observed along the existing Winter Access Road route.

Based on this evidence and the precautions currently taken on the Tibbitt-to-Contwoyto Winter Road, the change in the vegetation and shoreline along the winter road route is expected to be minor (i.e., small changes of limited extent occurring infrequently). The residual effect of these changes to the persistence of riparian vegetation and the aquatic ecosystem is expected to be negligible,

and effects to the continued opportunity for traditional and non-traditional use is predicted to be negligible.

Changes to fish behaviour or survival as a result of traffic-generated noise

Truck traffic on winter roads or by aircraft landing on the ice airstrip can cause increased noise levels on lakes. Mann et al. (2009) found that under-ice noise levels from a variety of anthropogenic sources, including trucks and graders, were greater in Kennady Lake than ambient noise levels at a control site. However, noise levels from all sources were within the range of natural background noise (44 decibels [dB] to more than 105 dB in the 200 to 300 hertz (Hz) band). Hearing sensitivity varies among fish species (Popper and Carlson 1998; Mann et al. 2007). Fish species with specialized hearing adaptations, such as lake chub (*Couesius plumbeus*) and suckers (*Catostomidae*), are the only species present in the Project area that are able to detect noises within the range associated with Project activities (Mann et al. 2007, 2009). Therefore, effects on the hearing or behaviour of any other fish species are likely to be negligible.

Underwater noise created by graders and trucks is unlikely to damage hearing or alter the behaviour of fish present in lakes crossed by the Winter Access Road. Noise from trucks and graders is too low to damage the hearing of lake chub (Mann et al. 2009). Hearing loss in lake chub was only temporary (less than 24 hours) after exposure to air gun blasts (Popper et al. 2007), which were much louder than any noise possibly produced by truck traffic on the winter roads. Masking of background noise may occur on fish with sensitive hearing (Mann et al. 2009); however, any masking effect on natural sounds typically heard by lake chub would be likely be too small to increase the susceptibility of lake chub to increased predation or to decrease their detection of prey. Fish will also have the ability to move away from the noise and these movements would be expected to be within their normal range of daily or day-to-day range. As such, changes to fish behavior or survival as a result of traffic-generated noise is expected to have negligible residual effects on fish, and therefore, is also expected to have no effect on continued opportunity for traditional and non-traditional use of fish species.

11.8.4.2.3 Primary Pathways

No pathways were identified as having a primary linkage to the persistence of the aquatic ecosystems and the continued opportunity for traditional and non-tradition use.

11.8.4.3 Terrestrial Environment Results

11.8.4.3.1 Pathways with No Linkage

The Subject of Note: Traffic and Road Issues overlaps with the Key Line of Inquiry: Caribou and other subjects of note. The following discussion on effects from traffic and roads on vegetation and wildlife is based on residual impacts that were identified and analysed in the Key Line of Inquiry: Caribou (Section 7), Subject of Note: Vegetation (Section 11.7), Subject of Note: Carnivore Mortality (Section 11.10), and Subject of Note: Other Ungulates (Section 11.11). Pathways identified as primary or secondary are summarized below. Pathways identified as having no linkage can be found in the originating sections. Since there are no residual effects, they have not been summarized here.

11.8.4.3.2 Secondary Pathways

There may be some potential for impacts to ptarmigan, snowy owl, common raven, and gyrfalcon from the Winter Access Road, but the effects are expected to be negligible. Grizzly bears are typically in hibernation from October through late April to early May, and should not be influenced by winter road activities (Section 11.8.2.4.2). No residual impacts to grizzly bears and birds were identified as a result of traffic and roads; therefore birds and grizzly bears are not discussed further in this section. Effects to vegetation are limited to effects on overland portages and effects at the shoreline as vehicles move onto a portage.

Effects to Vegetation

Section 11.7 (Subject of Note: Vegetation) considered whether changes to vegetation communities could occur as a result of construction and operation of the Winter Access Road and a cumulative increase in traffic on the Tibbitt-to-Contwoyto Winter Road. Construction and operation of the Winter Access Road will follow best practices (e.g., use of snow or ice pads of sufficient thickness to limit damage to overland portages between lakes; discontinued use of the Winter Access Road when ground surface becomes too soft). These are measures that are implemented in the design, construction, and operation of the Tibbitt-to-Contwoyto Winter Road that have proven to be successful in limiting the effects to vegetation (EBA 2002). As a result of these mitigation measures, only minor compression of vegetation comprising the portages is anticipated. Some degradation to vegetation along the boundary between lakes and shorelines may occur. Minor vegetation degradation may also occur from spills or accidents along the road. The mitigation and management of spills on the Winter Access Road is provided in the Emergency Response and Contingency Plan (Section 3, Appendix 3.I, Attachment 3.I.1). The Tibbitt-to-Contwoyto Winter Road Joint Venture's regulations, emphasis on safety and training, and proven mitigation measures have been effective in limiting accidents and spills. Safety measures

(e.g. strict adherence to speed limits and regulations) implemented during the construction and operations phases of the Winter Access Road are expected to limit this potential effect. As a result, the pathway of changes to vegetation quality due to the winter roads is secondary (i.e., the change on vegetation could be measureable, but minor). The residual effect of the Winter Access Road and the increase in traffic on the Tibbitt-to-Contwoyto Winter Road on vegetation relative to baseline conditions will be negligible.

Effects to Survival and Reproduction

The predominant factors that contribute to road-related wildlife deaths are traffic volume and vehicle speed (EBA 2001a). These factors directly affect the success of an animal reaching the opposite side of the road. An increase in either factor reduces the probability of an animal crossing safely (Underhill and Angold 2000).

The implementation of the Winter Road Policy, Rules and Procedures, and the Wildlife Effects Mitigation and Management Plan (Appendix 7.I) is anticipated to limit caribou, other ungulate and carnivore mortality from vehicle collisions along the Winter Access Road. Based on the success of mitigation and management practices used at operating mines in the NWT, the environmental design features implemented for the Project are anticipated to reduce caribou, other ungulate and carnivore mortality from vehicle and aircraft collisions. Therefore injury or mortality to individual animals is expected to be a secondary pathway. Caribou, other ungulate, and carnivore mortality from vehicle and aircraft collisions is expected to have a negligible residual effect on the persistence of caribou, other ungulate and carnivore populations. It is expected to have a negligible effect on the continued opportunity for traditional and non-traditional use of caribou, other ungulate and carnivores.

Increased access from the Winter Access Road may increase the number of individuals harvested by residents and Aboriginals. However, the number of vehicles travelling for hunting on the Tibbitt-to-Contwoyto Winter Road showed a decline from 573 vehicles in 2004 to 284 vehicles in 2006 (Ziemann 2007, internet site). In December 2009 interim emergency actions were put in place to help conserve the Bathurst caribou herd (ENR 2009, internet site). Beginning January 1, 2010, barren ground caribou commercial/meat tag, resident and non-resident harvesting was closed in the North Slave and South Slave regions and all hunting was closed in a new no-hunting conservation zone established north of Yellowknife where the Bathurst herd winters (ENR 2010b, internet site). The new zone includes the Tibbitt-to-Contwoyto Winter Road, the Winter Access Road, as well as all diamond mines in the NWT, including the Project.

The increase in access to the region associated with the winter roads is limited to an 8 to 12 week period each year, and should result in minor changes to the annual harvest rate of ungulates and carnivores relative to baseline conditions. The number of animals harvested by residents and non-residents is regulated, and the Winter Access Road will not influence accessibility to ungulates and carnivores for non-residents. Policies implemented by De Beers will prevent people at the Project site from using the Winter Access Road for hunting ungulates and carnivores (while they are at site). As such, increased access to the region for harvesting is considered a secondary pathway. Increased access for harvesting along the winter roads is expected to have a negligible residual effect on the persistence of caribou, carnivore and other ungulate populations, and a negligible residual effect on the continued opportunity for traditional and non-traditional use of caribou, carnivore and other ungulates.

Effects to Habitat Quality

Road footprint may cause changes to the amount of different quality habitats (e.g., degradation to vegetation), and alter carnivore movement and behaviour However, construction and operation of the Winter Access Road connecting the Project with the Tibbitt-to-Contwoyto Winter Road will follow best practices and is considered a secondary pathway for caribou, muskoxen, and carnivore populations (see Tables 7.4.1, 11.11-2, and 11.10-5). These best practices are implemented in the design, construction, and operation of the Tibbitt-to-Contwoyto Winter Road and have proven to be successful in limiting the effects to vegetation (EBA 2001a) (Section 11.7). As such, only minor compression of vegetation comprising the portages is anticipated. Overall, the Winter Access Road is anticipated to have a minor influence on habitat quality relative to baseline conditions and the residual effects to the persistence of caribou, musk oxen and carnivore populations are predicted to be negligible. Direct effects from winter roads on the behaviour and movement of moose were not assessed. This is because moose that have the RSA overlap a portion of their home range typically move to the forest during the winter season, and are not likely to be using the habitats along the Winter Access Road when it is in operation.

11.8.4.3.3 Primary Pathways

Effects to Habitat Quantity and Fragmentation

The cumulative direct effects to habitat loss and fragmentation from the Project footprint, Winter Access Road, and other previous and existing developments (including the Tibbitt-to-Contwoyto Winter Road) in the study areas were analyzed through changes in the area, composition, and spatial configuration of habitat types on the landscape (i.e., landscape metrics). The effect of the winter road on habitat quantity and fragmentation was considered a primary pathway,

meaning the pathway is likely to result in a measurable environmental change that could contribute to residual effects on a VC.

The effects to habitat quantity and fragmentation were analyzed in the Key Line of Inquiry: Caribou, the Subject of Note: Carnivores, and the Subject of Note: Other Ungulates. After the residual effects are determined and summarized, the residual impact is classified (i.e., rated with respect to magnitude, duration, geographic extent, and other criteria). The residual impact of traffic and roads is then combined with all other key pathways to determine the environmental significance to the overall impact of the Project on the population. Section 11.8.5 summarizes the results of the effects analysis and the impact classification from the original sources. Significance is not determined on one Project activity (e.g., traffic), but rather, on the VC (e.g., caribou). Significance cannot be determined in this subject of note, because it only addresses a few of the pathways that would affect the caribou population, for example.

Effects to Behaviour and Movement

Road footprint may alter carnivore movement and behavior. The infrastructure planned for the Project requires an increase in vehicles on the Tibbitt-to-Contwoyto Winter Road and the Winter Access Road. Sensory effects (e.g., noise, presence, lights, smells) from vehicle traffic on the Winter Access Road and an increase in such sensory effects on the Tibbitt-to-Contwoyto Winter Road may decrease habitat quality and affect behaviour and movement of wildlife, leading to changes to population size and distribution. Thus, effects on behaviour and movement are considered a primary pathway. The approach described above is presented in Section 11.8.6 for effects on behaviour and movement.

11.8.5 Effects to Wildlife Habitat Quantity and Fragmentation

During the winter period, previous and existing developments (which include the Winter Access Road used during exploration) have physically altered habitats on the landscape relative to reference conditions (Section 11.10.4.2.2 and 11.11.4.1.2). The percent change was dependent on the scale of the study area, which varied between species. However, regardless of the spatial scale the marginal increase in landscape disturbance was less than 1% relative to the non-winter period. Most of the change is associated with the temporary disturbance of frozen lakes from winter roads.

The incremental disturbance to any habitat from the Project, including the Winter Access Road, is expected to be less than 1% of the study areas, which is below the 40% threshold value identified for habitat loss associated with declines in bird

and mammal species (Andrén 1994, 1999; Fahrig 1997; With 1997; Mönkkönen and Reunanen 1999). For caribou, the cumulative decrease to the total area of habitats (excluding burns) for the future scenario was estimated to be less than 1.7% per seasonal range of Ahiak and Bathurst caribou. Of all non-disturbance (human or fire-related) habitat types and seasonal home ranges, rock-associated habitat in the winter range of the Bathurst and Ahiak herd will be influenced the greatest.

The presence of the winter roads may represent a barrier to animals, and lead to fragmentation of the population within the RSA. For example, roads may contribute to fragmentation of populations through both increased mortality and modifications of behaviour that makes animals less likely to cross roads (Trombulak and Frissell 1999). However, the road is only open for 8 to 12 weeks per year. In some cases, roads appear to be “leaky barriers” (some animals do manage to cross successfully) but they may nevertheless restrict the landscape-scale dynamics of species (Treweek 1999). The presence of the winter roads is seasonal, and potential effects to caribou, other ungulates, wolves, and wolverine, associated with habitat fragmentation, are temporary. Direct impacts from the Winter Access Road are expected to be reversible within 5 years after initial closure (medium-term).

For caribou, the incremental impact of habitat fragmentation from the Winter Access Road is expected to be negligible to low in magnitude (Table 7.7-2), and regional in extent. The geographic extent of cumulative impacts is considered to be beyond regional because, at the scale of the population, the cumulative local and regional impacts from the Project and other developments extend beyond the regional scale. Individuals within the population travel large distances during their daily and seasonal movements and can be affected by the Project, and several additional projects. Frequency of the impact is periodic, and limited to the seasonal use of the Winter Access Road. The indirect impact on habitat quality, movement, and behaviour of caribou will be reversible in the medium-term (i.e., before end of closure [EIS Section 7]) (Table 7.7-2).

For muskoxen and moose, habitat fragmentation from the Winter Access Road will be low in cumulative magnitude, and regional in extent. Frequency of the impact is periodic, and limited to the seasonal use of winter roads. The indirect impact on habitat quality, movement, and behaviour of other ungulates will be reversible in the long-term (Table 11.11-16). For wolverines, the incremental impact is predicted to be of low magnitude and regional in geographic extent and the cumulative impact is predicted to be moderate in magnitude and beyond regional in extent (Table 11.10-37). The impact is periodic (i.e., limited to the seasonal use of winter roads) and predicted to be reversible in the medium-term (Table 11.10-37). The residual impact classification is similar for wolves, except

that the magnitudes of incremental and cumulative effects are negligible to low and low, respectively (Table 11.10-38).

11.8.6 Effects to Wildlife Behaviour and Movement

Various studies have documented that muskoxen are alerted by the noise from snowmobiles at distances over 1 km (McLaren 1981; McLaren and Green 1985). Dau and Cameron (1986) and Cameron et al. (1992) reported that caribou were displaced up to 2 km from a road with moderate to heavy traffic around calving time.

During the two-year construction period, up to 25 trucks are anticipated to be on the Winter Access Road in a 24-hour period (1,500 to 2,000 trucks per year per 12 week period). Traffic is anticipated to decrease to 14 trucks and 3 trucks per 24-hour period on the Winter Access Road during operations and initial closure (two year period), respectively. Disturbances from the winter roads will occur up to eight times per hour during construction, reducing to two times per hour during operations. Noises from the Winter Access Road will diminish to background noise levels within 1.75 km, based on traffic volume during the construction period, and in 500 m during normal operations (see Section 11.11.6.2). The results show that while noise will be generated by the Winter Access Road, the expected levels are within relevant criteria established for remote areas. This change to habitat suitability for caribou, other ungulates and carnivores is periodic, as the winter roads are in operation for an average of 8 to 12 weeks each year.

Based on the current literature, the spatial extent of changes to the behaviour of caribou from activity along winter roads is predicted to be within 5 km of a road, and the magnitude is predicted to approach or exceed the limits of baseline values. This is a conservative prediction for caribou, given that on-site behavioural observations made over the last decade have noted that resting and feeding behaviour was common for caribou near airstrips or roads (Gunn et al. 1998; BHPB 2007). For caribou and other ungulates, the magnitude of incremental impacts from sensory disturbance from combined indirect effects, including vehicles on the Winter Access Road is predicted to be negligible to low (Table 7.7-2 and 11.11-18). Frequency of the impact is periodic for the winter road, and limited to the seasonal use of the Winter Access Road. The geographic extent of sensory effects from combined indirect effects, including vehicles on the Winter Access Road is regional for other ungulates (Table 11.11-18), and beyond regional for caribou (Table 7.7-2). The indirect impact on habitat quality, movement, and behaviour of caribou and other ungulates will be reversible in the medium-term (before end of closure). Use of

the Winter Access Road is predicted to stop in Year 12 , and effects should be reversed before the end of closure Year 20.

The magnitude of cumulative impacts from traffic on wolverine and wolf behaviour and movement is predicted to approach or exceed the limits of baseline values. The incremental magnitude of sensory impacts from winter roads to wolverine and wolves was classified as negligible to low, while the cumulative magnitude is low to moderate (Tables 11.10-37 and 11.10-38). As wolverines and wolves may be exposed to sensory disturbance throughout their home range and population, the impact is beyond regional. The indirect impact from winter roads on habitat quality, movement, and behaviour of wolverines and wolves is expected to be reversible in the long-term (Tables 11.10-38 and 11.10-39).

11.8.7 Related Effects to People

Effects to the aquatic and terrestrial environments, in particular to fish and wildlife species, may affect people who harvest these natural resources. Effects were analyzed and assessed in various biophysical key lines of inquiry and subjects of note, and summarized here. In addition, people may be affected if traffic and road issues result in impacts to tourism or the wilderness character of the region. The latter effects were assessed in the Subject of Note: Impacts on Tourism Potential and Wilderness Character (Section 12.7.3) and are also summarized here.

11.8.7.1 Harvesting Opportunities

Fish and wildlife harvesting opportunities are related to access as well as availability of the resources. As discussed in Section 11.8.4.1, improved access due to the construction of the Winter Access Road will only slightly increase the opportunity for fisheries resource use, lasting only for the duration of the Project construction and operations periods. Once the Winter Access Road is no longer constructed, any impacts will be reversible. As the Winter Access Road is only operated seasonally, its impact is periodic.

Increased access from the Winter Access Road will have a positive impact on traditional and non-traditional harvesting opportunities for caribou and other wildlife. Although the recent decline in resident hunters may provide more opportunities for aboriginal hunters the overall number of hunting vehicles travelling on the Tibbitt-to-Contwoyto Winter Road has declined in recent years (i.e., 50% decline from 2004 to 2006). Therefore, it is expected that the magnitude of positive impacts to traditional users from increased access for

harvesting is negligible, and should be reversible in the medium-term. The positive impact to traditional users from increased access is not significant.

Because the Project is remote, the magnitude of positive impacts to non-traditional users from increased access for harvesting is negligible. In addition, the number of hunting vehicles travelling on the Tibbitt-to-Contwoyto Winter Road showed a 50% decline from 2004 to 2006. There are no outfitters in the RSA. (Section 11.8.1.3) The positive impact to non-traditional users of increased access for harvesting is not significant.

11.8.7.2 Tourism and Wilderness Character

Potential effects relating to traffic and road issues that may affect people include loss of tourism or wilderness character. As described in Section 11.8.2.5, the Tibbitt-to-Contwoyto Winter Road offers winter access for a variety of semi-remote tourism and recreational activities. Access along this winter road is limited due to the lack of services, low speed limits, and seasonality of the winter road. Section 12.7.3 examines changes to access for winter road tourism and recreation activities as a valid pathway through which the Project could affect wilderness character.

The year 2006 was the warmest winter in 70 years and caused problems for the Tibbitt-to-Contwoyto Winter Road, such that the road never reached full load-bearing capacity. If the trend towards warmer winters continues, potential access to the winter road for tourism activities may be reduced. Reduced availability may be a result of the road's physical conditions that require reduced speed limits, or potential management solutions that restrict the number of vehicles that can access the road in a given time period. As described in Section 11.8.2.5.2, tourist use of the Tibbitt-to-Contwoyto Winter Road has declined by about 50% from 2004 to 2006.

It is difficult to predict what impact another unseasonably warm winter would have on winter road traffic and the resulting impact on winter road tourism. There are numerous variables, such as predicting what the winter road operator's response will be to shortened seasons, or increased traffic loads. An analysis would also require knowledge of threshold levels of access for various magnitudes of impact on winter road tourism. This information was not available for this analysis.

Due to declining winter road tourism, and the uncertainty of predicting access restrictions, the effects of the winter road on tourism are considered to be negative in direction, low in magnitude, regional in extent, medium-term in

duration, periodic in frequency, and reversible (see Section 12.7.3). The effect on tourism is not expected to be significant.

11.8.8 Uncertainty

Sources of uncertainty associated with predicted impacts from traffic and roads on the environment, and related effects to people include:

- adequacy of baseline data for understanding current conditions and future changes unrelated to the Project;
- climate change and the long-term implications for construction and operation of winter roads;
- exploration and potential new developments in the Slave Geological Province and resulting cumulative effects from air transport and winter road traffic;
- ability to estimate load projections for air and truck transportation;
- understanding of Project-related impacts on the ecosystem;
- model inputs; and
- knowledge of the effectiveness of mitigation.

Where possible, a strong attempt was made to reduce uncertainty in the EIS to increase the level of confidence in impact predictions. The following paragraphs outline how uncertainty was minimized.

Existing data on winter road traffic accidents and frequency of chemical spills for the Tibbitt-to-Contwoyto Winter Road and Winter Access Road were available from the GNWT as well as the Joint Venture responsible for the winter roads. Thus, the effectiveness of the existing mitigation could be demonstrated using these data with current known safety policies, procedures, and other mitigation, providing a greater level of confidence in the resulting predictions for the Project. Similarly, uncertainty in the predictions was reduced through use of relevant data such as commercial traffic statistics for the Tibbitt-to-Contwoyto Winter Road kept by the GNWT and the Joint Venture and monitoring data for non-commercial users of the Tibbitt-to-Contwoyto Winter Road collected by the GNWT.

Including mechanistic linkages between cause and effect in model variables limits predictive error. For example, the effects analysis for caribou included key behavioural processes in human-modified landscapes that may affect not only caribou distributions, but caribou vital rates and population sizes. Sources of uncertainty surrounding predictions of the effects from the Project on caribou and

other ungulates habitat were minimized by employing multiple habitat mapping methods (Burgman et al. 2005).

Using data from wildlife effects monitoring programs at existing diamond mines and the literature as inputs for models rather than strictly hypothetical or theoretical values also helped to reduce the uncertainty of predictions. In addition, implementing a conservative approach when information is limited means that impacts are typically overestimated. For example, the assessment included both fragmentation analyses and the use of habitat suitability models, which together reduce bias and imprecision in predictions.

11.8.9 Monitoring and Follow-up

Upon approval of the Project, monitoring programs will verify predictions and allow for adaptive management responses, as in the case of monitoring portages for signs of erosion. In addition, De Beers will monitor the length of hauling seasons for the winter road. If the hauling season is shortened, De Beers will develop options for logistical planning, such as larger storage for fuel and increased trucking over a shorter period.

The Project's Emergency Response and Contingency Plan (Section 3, Appendix 3.I, Attachment 3.I.1) states that wildlife have the right-of-way. It outlines procedures to be followed if a collision occurs between a vehicle and wildlife. These procedures allow tracking of wildlife injuries or mortality due to the Project.

As a user of the Tibbitt-to-Contwoyto Winter Road and partner in the Joint Venture, De Beers and its employees will adhere to all regulations established by the Joint Venture, including reporting any concerns relating to the environment, and participating in compliance inspections and ongoing monitoring of the winter road conditions.

A Wildlife Effects Monitoring Program (WEMP) will be implemented to test environmental impact predictions and reduce the level of uncertainty related to each prediction. The principal goal of the WEMP is to provide information required for the Project's Environmental Management System to adaptively manage the Project to protect wildlife and wildlife habitat. The design of the WEMP will be based on the ability to measure anticipated environmental effects. The principal areas of concern are impacts to wildlife habitat, changes to wildlife behaviour and distribution (which influences local abundance), and wildlife incidences linked to Project activities and facilities. Monitoring will continue

through the construction and operation of the Project. Specific objectives of the WEMP would be:

- to verify the accuracy of impact predictions made in the EIS, and identify unanticipated effects;
- to implement a wildlife mitigation and management plan designed to reduce the risks and disturbance to wildlife and wildlife habitats;
- to determine the effectiveness of the wildlife mitigation and management plan;
- to consider and incorporate, where possible, TK into the WEMP;
- to design studies and data collection protocols that are consistent with other monitoring programs in the Arctic (e.g., Snap Lake Mine, Diavik Diamond Mine, and Ekati Diamond Mine), and can be used to understand and manage cumulative effects, and participate in regional and/or collaborative programs;
- to develop and review the WEMP in collaboration with the Department of the Environment and Natural Resources, Canadian Wildlife Service (Environment Canada), and the communities; and
- to provide an annual report that will satisfy all interested and concerned stakeholders, and will provide the opportunity for feedback from communities, governments, and the public.

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11.8.11 Acronyms and Glossary

11.8.11.1 Acronyms

CCME	Canadian Council of Ministers of the Environment
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DDT	dichlorodiphenyltrichloroethane
DFO	Fisheries and Oceans Canada
DKFN	Deninu Kué First Nation
EBA	EBA Engineering Consultants Ltd.
EIS	environmental impact statement
ENR	Department of Environment and Natural Resources of the Government of the Northwest Territories
GNWT	Government of the Northwest Territories
HB	High Boreal
HS	High Subarctic
Joint Venture	Tibbitt-to-Contwoyto Winter Road Joint Venture
LS	Low Subarctic
LSA	Local Study Area
NWT	Northwest Territories
Project	Gahcho Kué Project
RSA	Regional Study Area
SARA	*Species at Risk Act*
SD	standard deviation
SGP	Slave Geological Province
TASH	tall shrub riparian
TK	traditional knowledge
TLU	traditional land use

VC	valued component
WEMP	Wildlife Effects Monitoring Program
WKSS	West Kitikmeot Slave Study
YDFN	Yellowknives Dene First Nation

11.8.11.2 Units of Measure

%	percent
°C	degrees Celsius
dB	decibels
ha	hectare
Hz	Hertz
km	kilometre
km^2	square kilometre
L	litre
m	metre
m^2	square meter
mg/kg	milligram per kilogram

11.8.11.3 Glossary

Annual home range	The area traversed by animals in its normal activities of food gathering, mating and caring for young. Occasional sallies outside the area, perhaps exploratory in natures, should not be considered part of the home range. An alternative, statistical explanation is the smallest sub-region which accounts for a specified proportion of its total utilization over the course of the year.
Bogs	Sphagnum or forest peat materials formed in an ombrotrophic environment usually due to the slightly elevated nature of the bog, which tends to disassociate it from the nutrient-rich groundwater or surrounding mineral soils. Characterized by a level, raised or sloping peat surface with hollows and hummocks. Mineral-poor, acidic and peat-forming wetlands that receives water only from precipitation.
Boreal Forest	The northern hemisphere, circumpolar, tundra forest type consisting primarily of black spruce and white spruce with balsam fir, birch and aspen.
Brunisol	A soil order consisting of immature soils, but of sufficient development to exclude it from the Regosolic order, but without sufficient development to include it in any other order. These soils develop under various climates and vegetation, and are frequently characterized by a reddish colour.
Carnivore	An animal that preys on other animals; especially any mammal of the Order Carnivora including wolves, bears and wolverine.
Coniferous	This term is used to describe a tree that bears cones. Evergreens comprise the majority of this type of tree. They are called evergreens because they do not shed their leaves all at once in the fall.
Cratering	When caribou dig down through snow and ice to access lichen.

Cryosol	An order of soils in the Canadian taxonomic system. Cryosolic soils are mineral or organic soils that have perennially frozen material within 1 m of the surface in some part of the soil body, or pedon. The mean annual soil temperature is less than 0°C (32°F). Their maximum development occurs in organic and poorly drained, fine textured materials. The active layer of these soils is frequently saturated with water, especially near the frozen layers, and colors associated with gleying are therefore common in mineral soils, even those that occur on well drained portions of the landscape. They may or may not be markedly affected by cryoturbation. The order has three great groups: Turbic Cryosol, Static Cryosol, and Organo Cryosol (q.v.).
Cuestas	An asymmetric ridge characterized by a short, steep escarpment on one side, and a long, gentle slope on the other. The steep side exposes the edge of erosion-resistant rock layers that form the cuestas. They are usually formed by erosion in plains areas underlain by gently dipping sedimentary rock layers.
Deciduous	Deciduous means temporary or tending to fall off (deriving from the Latin word decidere, to fall off) and is typically used in reference to trees or shrubs that lose their leaves seasonally.
Diameter at Breast Height	A standard method of expressing the diameter of the trunk or bole of a standing tree.
Drumlins	A long, narrow or oval, smoothly rounded hill of unstratified glacial drift.
Ecoregion	Ecological regions that have broad similarities with respect to soil, terrain and dominant vegetation.
Ecozone	An area of the earth's surface that is representative of a broad-scale ecological unit characterized by particular abiotic (non-living) and biotic (living) factors, e.g., taiga forest, tundra.
Ericaceous	Plants that belong to the Heath family.
Eskers	Linear structures of loose sand and gravel, formed by glacial rivers. They provide critical habitat for carnivores and ungulates in the Arctic.
Fens	Sedge peat materials derived primarily from sedges with inclusions of partially decayed stems of shrubs formed in a eutrophic environment due to the close association of the material with mineral rich waters. Minerotrophic peat-forming wetlands that receive surface moisture from precipitation and groundwater. Fens are less acidic than bogs, deriving most of their water from groundwater rich in calcium and magnesium.
Glaciofluvial	Material moved by glaciers and subsequently deposited by streams flowing from the melting ice.
Graminoids	Grass like plant (grasses, sedges, and rushes).
Habitat	The physical space within which an organism lives, and the abiotic and biotic entities (e.g., resources) it uses and selects in that space.
Headwater	The source or upper part of a stream or river; where a river begins.
Health tundra	A closed mat plant community that grows on moderate to well drained soils, covering most of the upland areas. Plants generally belong to the heath family, the Ericaceae. The vegetation layer forms a mat of low shrubs dominated by dwarf birch and Labrador tea.
Home range	The area traversed by an animal during its activities during a specific period of time.
Hummock	A very complex sequence of slopes extending from somewhat rounded depressions or kettles of various sizes to irregular to conical knolls or knobs. There is a lack of concordance between knolls and depressions. Slopes are generally 9% to 70%.

Hydrology	The science of waters of the earth, their occurrence, distribution, and circulation; their physical and chemical properties; and their reaction with the environment, including living beings.
Joint Venture	The Tibbitt-to-Contwoyto Winter Road is managed by the Tibbitt-to-Contwoyto Winter Road Joint Venture. Current members of the Joint Venture are De Beers Canada Inc., BHP Billiton Diamonds Inc. and Diavik Diamond Mines Inc.
Kames	Steep-sided mounds of stratified material deposited against an ice-front.
Keystone species	A species that plays a larger or more critical role in supporting the integrity of its ecological community or in maintaining ecosystem function than would be predicted based on its abundance.
Lowlands	An area of land that is low in elevation in relation to the surrounding country.
Natal den	A lair, typically underground, used for the birthing and initial rearing of young; often occur in esker complexes.
Natal home range	Geographic area in which an organism is born.
Not at Risk	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Microtine species	Of the rodent subfamily Microtinae-for example, lemmings.
Morainal	Of or pertaining to moraine, which is a mound, ridge, or other distinct accumulation of unsorted, unstratified drift, predominantly till, deposited chiefly by direct action of glacier ice in a variety of topographic landforms that are independent of control by the surface on which the drift lies. It is now commonly used as a geomorphologic name for a landform composed mainly of till that has been deposited by a glacier.
Organic Cryosols	An organic soil having a surface layer containing more than 17% organic carbon by weight, with permafrost within 1 m below the surface. In the Canadian System of Soil Classification, Organic Cryosol is more than 40 cm thick, or more than 10 cm thick over a lithic contact, or more than 10 cm thick over an ice layer that is at least 30 cm thick. Organic Cryosols have mean annual ground temperatures below 0°C.
Permafrost	Permanently frozen ground (subsoil). Permafrost areas are divided into more northern areas in which permafrost is continuous, and those more southern areas in which patches of permafrost alternate with unfrozen ground.
Population	Classically, a collection of interbreeding individuals.
Range	The geographic limits within which an organism occurs.
Riparian	Refers to terrain, vegetation or simply a position next to or associated with a stream, floodplain or standing waterbody.
Risk	The risk is a measure of the likelihood and severity of harm.
Sedge	Any plant of the genus Carex, perennial herbs, often growing in dense tufts in marshy places. They have triangular jointless stems, a spiked inflorescence and long grass-like leaves which are usually rough on the margins and midrib. There are several hundred species.
Sedimentation	The process by which suspended particles in waste water settle to the bottom

Sensitive	1. Sites or organisms which are particularly vulnerable to harmful effects. 2. A general status rank for a species with one or more of the following indicators: a small population size or restricted distribution, a declining population trend and/or moderate threats to its population of habitats. 3. In statistics, parameter sensitivity refers to a series of tests in which different parameter values are set to see how a change in the parameter causes a change in the dynamic behaviour of the system in question (e.g., how much does a change in adult female survival affect population growth of a caribou herd).
Species of Special Concern	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Sport fish	Any fish providing sport for the angler
Staging area	Staging areas provided seasonally suitable habitat requisites such as early open water and associated foraging areas.
Standard deviation (SD)	A measure of the spread or dispersion of a set of data. It is calculated by taking the square root of the variance.
Standard error (SE)	A measure of the sampling variability or precision of an estimate. The SE of an estimate is expressed in the same units as the estimate itself. It is calculated as the standard deviation divided by the square root of the number of observations.
Static Cryosols	A mineral soil showing little or no evidence of cryoturbation, with permafrost within 1 m below the surface (Canadian System of Soil Classification). Static cryosols occur most commonly in coarse-textured materials, and patterned ground features may or may not be present. They have mean annual ground temperatures below 0°C.
Study area	An arbitrary spatial extent chosen by the investigator within which to conduct a study.
Successional (late successional stage)	A particular phase of the forest succession continuum with its own characteristic of age, structure and composition of species. Stages may include the following: pioneer, young seral, maturing seral, old seral, young edaphic, mature edaphic, young climatic, mature climatic and disclimax.
Swale	An elongated depression in the land surface that is at least seasonally wet, is usually heavily vegetated, and is normally without flowing water.
Taiga	Sub-Arctic, coniferous forest that is considered to be a transition between the boreal forest and the tundra (barrenlands).
Territory	The spatial extent defended by an animal or group of animals. Typically a subset of, but may include all of, the overall home range.
Treeline	An area of transition between the tundra and boreal forest to the south.
Tundra	A vast, mostly flat, treeless Arctic region of Europe, Asia, and North America in which the subsoil is permanently frozen. The dominant vegetation is low-growing stunted shrubs, mosses, lichens.
Turbic Cryosols	A mineral soil showing marked evidence of cryoturbation, as indicated by broken horizons and displaced material. Turbic cryosols generally occur on patterned ground. They have mean annual ground temperatures below 0°C, with permafrost within 2 m below the surface.
Tussock	A clump or tuft.
Ungulate	A hoofed, grazing mammal (e.g., caribou, muskox, deer, moose).
Uplands	Ground elevated above the lowlands along rivers or between hills; highland or elevated land; high and hilly country.
Valued Component	Represent physical, biological, cultural, and economic properties of the social-ecological system that are considered to be important by society.

Watershed	A region draining into a river, river system, or other body of water.
Wetlands	An area of land where the water table is at or above the mineral soil for the entire year.
Zone of Influence	The surrounding area of a development site in which animal occurrence is reduced, possibly due to avoidance of sensory disturbances or low-quality habitats.

APPENDIX 11.8.I
WINTER ROAD REGULATIONS AND RULES FOR THE ROAD

Winter Road Regulations and Rules of the Road

TABLE OF CONTENT

A. Purpose and Scope

The Winter Road Rules and Regulations (WRR) have been established by the Tibbitt to Contwoyto Winter Road Joint Management Committee (JMC) to ensure traffic safety and environmental protection. The WRR apply to all persons operating on the winter road directly or indirectly under the authority of the JMC. The winter road is private and users are reminded that continued access is dependent upon compliance with these rules and regulations. Any information that is provided annually at the "December Truckers

Meeting" must be incorporated into the individual trucking company orientations to its employees for the upcoming season.

B. Definitions

1) Lad1:
For the purposes of the WRR, Lad1 refers to radio frequency 154.1 and is the primary means of communication on the winter road.
2) Road Number:
Sequential number and corresponding placard assigned to each haul truck driver by Nuna Logistics Yellowknife Dispatch.
3) Convoy:
Group of two or more trucks dispatched to travel together on the winter road.
4) One Loaded Truck Only Lake:
Lake designated by signage as being restricted to "one loaded truck only" at a time.
5) Hotshot:
Vehicle designation authorized to facilitate expeditious travel by permitting delivery trucks not exceeding five (5) ton tandem rating to: travel alone on the winter road and/or; exceed posted speed limits by 10 kph and/or; pass other vehicles in a safe manner.
6) Winter Road:Refers to the Tibbitt to Contwoyto Winter Road Joint Venture.
7) RMP:Nuna Logistics Road Maintenance Personnel.
8) Dispatch Points:
Designated Dispatch Points include Yellowknife (all haulers); Lockhart Lake (all haulers); Diavik (Diavik haulers only); Ekati (Ekati haulers only), Misery (Misery haulers only); Lac de Gras and Lupin (Lupin haulers only); Snap Lake (DeBeers haulers only), Tahera (Tahera haulers only) the Meadows (haulers as needed).
9) Rest Areas:
Designated Rest Areas include Yellowknife (all haulers); Lockhart Lake (all haulers); Diavik (Diavik haulers only); Ekati (Ekati haulers only), Misery (Misery haulers only); Lac de Gras and Lupin (Lupin haulers only); the Meadows (haulers as needed).
10) Emergency Rest Area:
Besides the areas listed above, Portage #49 is designated as an emergency rest area in the case of a severe snow storm or blizzard.
11) End Users:
Companies authorized by the JMC to access the winter road for the purpose of transporting goods and materials.
12) Empty Only Traffic Lanes:
Winter road traffic lanes restricted by signage to empty trucks only.
13) One-Way Traffic Lanes:
Winter road traffic lanes restricted by signage to one-way traffic only.

C. Regulations

1) General

a) The JMC reserves the right to amend the WRR at any time.
b) The JMC or delegate may suspend travel on the winter road at any time and without prior notice.

c) Speed limits, convoy size, truck spacing, load restrictions and pilot car requirements will be determined by the JMC or delegate.
d) Hotshot designations will be authorized by JMC or delegate.
e) End users access to the winter road for the purpose of transporting goods and materials must be pre-authorized in writing by the JMC. End users requesting access to the winter road must sign a "Winter Road Use Agreement".
f) The JMC or delegate will respond to all spills in accordance with the Tibbitt to Contwoyto Winter Road Emergency Response/Spill Contingency Plan including notification of the NWT Spill Report Line at (867) 920-8130.
g) There will be no changing of oil along the road which includes road camps. Changing of oil must be conducted at appropriate company facilities in Yellowknife.
h) The JMC will not be responsible for third party or other service requests outside the scope of the winter road operations.
i) All winter road users are encouraged to report concerns or inappropriate activity involving wildlife including but not limited to the following: abandoned carcasses, injured wildlife, incidents of wildlife harassment, etc. Sightings/incidents should be reported to Environment and Natural Resources (ENR) by telephone at 867-873-7181 or via LAD1 radio to (ENR) reporting/inspections stations along the winter road. Reports should include as much detail as possible, i.e.: description of event, date, time, location, vehicle descriptions, registration numbers, etc.
j) A driver can drive or be on-duty 105 hours in a 7 day period provided that they operate out of the same seasonal terminal for the duration of the 7 days. A driver must take 8 consecutive hours of off-duty before the first change in duty status of any day. There is no daily limit that a driver must be on-duty or driving in any period of time.
k) Drivers MUST BE WELL RESTED prior to heading northbound from Yellowknife or southbound from designated dispatches.

2) Enforcement
a) Acting on behalf of the JMC, SECURECheck (assisted by Nuna Logistics Road Maintenance personnel (RMP) will be responsible for controlling traffic flow on the winter road including the enforcement of the WRR, the issuance of infraction tickets/driver suspensions, conducting traffic related investigations and responding to emergency situations.
b) Trucking companies may apply to the JMC for the release of information related to traffic accidents and other security related investigations.
c) Infraction tickets may be served on drivers personally or through the driver's company representative. In those cases where a ticket is to be served through the driver's company representative, drivers will be verbally notified of the infraction(s) at the time of the occurrence or as soon thereafter as is practical and company representatives will ensure the driver is provided a copy of the infraction ticket as soon as possible.
d) SECURECheck or the JMC will promptly notify companies of driver suspensions in writing. Upon notification of a suspension, companies are responsible for contacting the driver and enforcing the suspension. SECURECheck will advise Nuna Logistics Yellowknife Dispatch of all suspensions.
e) Unless otherwise specified in the WRR, suspensions will normally take effect upon completion of the current winter road trip. If deemed necessary in the interest of public safety, security personnel may suspend a driver forthwith.
f) Drivers are prohibited from operating any motor vehicle on the winter road during any period of suspension imposed under the WRR.

g) Suspensions issued as a result of infractions committed after March 21st of a winter road season may, at the discretion of the JMC, be carried over to the next winter road season.
h) Penalties for different infractions may be cumulative. For example if a driver receives a written warning for failing to yield right-of-way and then another written warning for truck spacing, the second infraction may be sufficient for a suspension.
i) Notwithstanding the penalties provided for elsewhere in the WRR, upon written application by SECURECheck, the JMC may impose additional restrictions as deemed appropriate, upon any driver who has demonstrated a serious disregard for the WRR while using the winter road. Such restrictions may include probationary periods and suspension from operating on the winter road for future seasons.
j) Companies may formally appeal any suspension issued under the authority of the WRR. Appeals must be made to the JMC in writing within seven (7) days of the suspension effective date. The JMC will formally respond to written appeals within 24 hours, during which period the suspensions will remain in effect. Appeals must be sent by facsimile to, Charlie DeLuca (fax 867-880-4603 BHPB) and Erik Madsen (fax 867-669-9058 DDMI).

3) Road Maintenance
a) RMP are responsible for winter road construction and maintenance.
b) To the extent possible major road maintenance initiatives will be scheduled to minimize interference with road traffic.
c) RMP are responsible for the provision of adequate traffic control for all work areas.
d) Nuna Logistics is responsible for dispatching, monitoring and ensuring the safety of all vehicles they operate on the winter road.
e) Nuna Logistics is responsible to ensure that all road maintenance personnel (RMP) and other motor vehicle operators they employ are familiar with the WRR.
f) Nuna Logistics is responsible to ensure that the WRR and current speed/load restrictions for all road maintenance equipment are posted in a clear, concise and consistent manner at all winter road camps for the information of all RMP and other motor vehicle operators they employ.

4) Signage
a) RMP are responsible for all winter road signage.
b) Traffic signs will be posted along the winter road to clearly show current speed limits, restricted travel lanes, road maintenance areas, road hazards and other information as required.
c) Nuna Logistics is responsible to ensure that the WRR and all current amendments/updates, including changes in speed, spacing and load restrictions, are posted in a clear, concise and consistent manner at all winter road dispatch points for the information of all road users.
d) All traffic signs are to be of a size and construction so as to be clearly visible to all road users in daylight and darkness

5) Dispatching
a) Nuna Logistics is responsible for controlling the dispatching of traffic for the winter road, in consultation with trucking company dispatch personnel.
b) Nuna Logistics Yellowknife Dispatch, assisted by Dispatch personnel at the winter road camps/mine sites and security personnel, will coordinate dispatching.
c) Nuna Logistics Yellowknife Dispatch will, upon presentation of a signed copy of the WRR, assign drivers of authorized companies a road number.

d) Nuna Logistics is responsible for dispatching, monitoring and ensuring the safety of all vehicles they operate on the winter road.
e) Trucks leaving Yellowknife for the winter road will report to Nuna Logistics Yellowknife Dispatch thirty (30) minutes prior to scheduled departure time unless directed otherwise.
f) Trucks will be dispatched from designated dispatch points in convoys at regular intervals as dictated by road and traffic conditions. Trucks will not be dispatched alone for travel on the winter road. (Exception: i)Trucks with hotshot designation may travel alone and ii) Single "loaded" southbound transport trucks south of Ekati may travel alone, only if they have contacted their next planned dispatch location to check weather, confirmed their truck number, provided departure time and have been given approval by that dispatch to proceed.
g) All loaded trucks are required to report to Yellowknife Nuna Logistics dispatch on return from southbound trips. However, if there is congested traffic at the Yellowknife Dispatch area when returning southbound, then the driver can call in via radio that they have returned.
h) Lockhart Dispatch – Trucks may depart in pairs northbound when ready but must maintain spacing. Southbound trucks may radio in as they pass by Lockhart.
i) Drivers must report to all winter road dispatch locations along their route in person and or via radio.
j) All drivers must comply with direction given by dispatch personnel.
k) Providing incorrect departure or arrival time at any dispatch point including but not limited to Yellowknife, Lockhart, Lac de Gras, Diavik, Ekati, Misery, Lupin, Snap Lake or Tahera is prohibited.
l) Drivers must accurately report oversize and/or heavy loads.
m) The maximum Gross Vehicle Weight (G.V.W.) for normal full loads Super "B" loads, is 63,000 kg /140,000 lbs. during deemed full load periods, unless otherwise designated by authorized Winter Road Dispatch offices. (Northbound: Nuna Logistics' Yellowknife Dispatch office. Southbound: Diavik, Ekati, Lupin, and Snap Lake, Tahera Dispatch offices)
(1) Early season loads will be designated as a percentage of unit GVW configuration, as posted by Nuna Logistics Yellowknife Dispatch.
(2) GVW for normal full loads, during full load periods, may be revised depending on ice condition.
n) Access to the Tibbitt to Contwoyto Winter Road for loads 14 feet or wider and/or tractor trailer standard configurations up to and including Super "Bs" in excess of 63,000 kg or 140,000 lbs. is restricted as follows.
(1) Trucking companies must apply in writing to Nuna Logistics Yellowknife Dispatch for authority to move any such load on the winter road.
(2) Applications must be received by Nuna Logistics Yellowknife Dispatch a minimum of 24 hours prior to requested dispatch date.
(3) Approvals from Nuna Logistics Yellowknife Dispatch will include a dispatch time/date, pilot car requirements and other direction as deemed appropriate.
o) Trucks may be required to scale prior to being dispatched.
p) Dispatch points will authorize hotshot travel only when such trips can be made safely, taking into consideration weight restrictions, road/weather conditions and traffic volumes. Dispatching points authorizing hotshot travel are responsible for confirming the driver's safe and timely arrival at the next dispatch point.
q) In the event of heavy congested traffic or weather related concerns, the Meadow's dispatch will be used to dispatch southbound trucks to Yellowknife. The Meadow's dispatch will always act as a "radio check-in" dispatch for northbound trucks.

6) Trucking Companies

a) Trucking companies are to provide a Winter Road Orientation Program for all winter road drivers. The program must include:

1) A thorough review of the Winter Road Rules and Regulations.
2) Review of the Road Risk Awareness Powerpoint Presentation
3) Provision of a valid 24-hour contact telephone number for emergency response assistance
4) General overview of winter road travel and trip preparation.
5) Identification of common problems/solutions
6) Instruction on the use of tire chains and troubleshooting malfunctioning trailer braking systems, i.e.: clearing frozen air lines.
7) Instruction on dealing with dangerous/emergency situations
8) Familiarization with NWT/NU legislation regarding the reporting of spills, logbooks, the illegal use of radar detection devices, reporting of accidents, load restrictions and pilot car requirements.
9) Review the responsibilities and liabilities of trucking companies in the case of an incident including any ongoing environmental clean-up.

b) Trucking companies are to ensure all haul trucks are equipped with a sleeper, unless otherwise authorized by the JMC or delegate.

c) All 3rd party users must have signed a "Road Use Agreement" provided by the Joint Tenants of the Licence of Occupation before utilizing the Tibbitt to Contwoyto Road.

D. Rules of the Road

The JMC reserves the right to amend these rules at any time as required by the seasonal variances of weather and ice conditions

1) Speed Restrictions

a) Speed restrictions will be clearly posted through signage along the winter road and bulletins at all winter road dispatch points.

b) All posted speed restrictions will designate maximum loaded speeds. (Exception: Speeds posted on "Empty Only Traffic Lanes" will designate maximum empty speeds for haul trucks, including hotshots.)

c) Empty trucks may travel at 10kph above loaded speed restrictions unless otherwise designated.

d) All trucks must slow to 10kph when travelling on/off lakes.

e) When loaded northbound and loaded southbound trucks meet on a lake, both must slow to 10kph while passing.

f) Loaded southbound trucks must yield to empty southbound trucks by slowing to 10kph and allowing them to pass in a safe manner. Empty southbound trucks must slow to 15kph and communicate their intentions via LAD1 prior to passing loaded southbound trucks.

g) Trucks must slow to 10 kph while passing trucks stopped on lakes.

h) Hotshots may travel at 10kph over posted speed restrictions except on empty only lanes or as otherwise directed.

i) The maximum speed limit for pick-up trucks (one ton rating or less) is 80 kph.

j) Radar and distance/time enforced will be used to determine truck speeds

Unless otherwise posted, the following speed limits will be strictly enforced:

South of Lockhart Lake	North of Lockhart Lake
Loaded 25 km/hr	Loaded 30 km/hr
Empty 35 km/hr	Empty 40 km/hr

k) Empty haul truck status remains in effect until the maximum payload exceeds 7,500 lbs, thereafter, categorized as a loaded truck. Backhauls must have weights certified by dispatching minesite and are subject to scaling upon arrival in Yellowknife.
l) In the interest of safety it is recommended and suggested that when possible Northbound "Bob Tailing" tractors travel with hot shots or travel with a loaded convoy. This is not mandatory.

2) Southbound Loaded Truck Designation
a) Southbound loaded trucks must travel with emergency flashers and/or rotator lights on.

3) Truck and Convoy Spacing
a) Convoy and truck spacing restrictions will be clearly posted through bulletins at all winter road dispatch locations.
b) Trucks are prohibited from travelling alone on the winter road. (Exception: i) Trucks with hotshot designation may travel alone and ii) Single "loaded" southbound transport trucks south of Ekati may travel alone, only if they have contacted their next planned dispatch location to check weather, confirmed their truck number, provided departure time and have been given approval by that dispatch to proceed.
c) Trucks will be dispatched in convoy at regular intervals from dispatch locations. Drivers are responsible for ensuring interval spacing between convoys is maintained throughout the trip.
d) Drivers are to maintain ½ kilometre spacing between trucks within convoys when travelling the winter road unless otherwise designated.

4) Right-of-Way
a) Road maintenance vehicles have the right-of-way over all winter road traffic.
b) Northbound loaded trucks have the right-of-way over all other haul trucks.
c) Trucks exiting "Empty Only" lanes will yield the right-of-way to all other traffic.
d) Travel across a designated " One Loaded Truck Only Lake" is restricted to one loaded truck at a time. When loaded trucks meet at a "One Loaded Truck Only Lake", the southbound loaded truck(s) must stop on the nearest portage and yield the right-of-way to the northbound loaded truck(s).
e) Loaded southbound trucks must yield to empty southbound trucks by slowing to 10kph and allowing them to pass in a safe manner. Empty southbound trucks must slow to 15kph and communicate their intentions via LAD1 prior to passing loaded southbound trucks
f) Safe driving practices and common sense will dictate the right-of-way in other instances.

5) Portage Traffic
a) Convoy leaders must broadcast the portage number they are entering, their location, direction of travel, number of trucks in the convoy and identify any heavy/oversize loads via LAD1 radio prior to entering all portages.
a) All drivers must advise opposing traffic of their progress through portages via LAD1 as required to ensure safe traffic flow.

6) Dangerous Driving or Unsafe Practices
a) Operating a vehicle in a dangerous or unsafe manner is prohibited and includes but is

not restricted to the following:
(1) Operating a haul truck in excess of 15 kph above the designated speed limit.
(2) Operating a loaded truck on a designated "Empty Only" lane.
(3) Operating a truck on the winter road during any period that travel has been suspended.
(4) Loaded trucks overtaking and passing other trucks.
(5) Operating a truck in the wrong direction on a "One-Way Traffic Lane".

7) Interference with Security/Road Maintenance Personnel (Dispatch Information)
a) All vehicles will stop when requested to do so by a Security Officer or other representative of the JMC.
b) Vehicles stopped by a Security Officer or other representative of the JMC will remain stopped until advised otherwise.
c) Excessive verbal abuse to a Security Officer or other JMC Representative is prohibited.
d) Knowingly misleading a Security Officer, JMC Representative or providing false dispatch information is prohibited.

8) Drugs, Alcohol and Firearms
a) The possession of drugs, alcohol or firearms on the winter road and at all winter road camps is strictly prohibited.
b) Security personnel who have reason to believe a driver is in possession of alcohol, drugs or firearms may, with the individual's consent, conduct a search of their person and any vehicle under their control.
c) Refusing to consent to a search in accordance with this section constitutes an offence under this section.

9) Littering and Refuse Disposal
a) Drivers must carry garbage bags in their trucks at all times for the purpose of storing their refuse for proper disposal at winter road camps.
b) Littering on or near the winter road is prohibited.

10) Road Numbers
a) All drivers operating haul trucks on the winter road must be in possession of a valid road number.
b) Road number placards must be displayed on the driver's side windshield or driver's side window, so as to be clearly visible from the outside of the vehicle when operating on the winter road.

11) Safety Restrictions and Equipment
a) Haul trucks are restricted to one driver. (Exception: As authorized by the JMC or delegate, a trainer may accompany a trainee for instructional purposes provided they do not collectively exceed the allowable operating hours for a single driver.)
1) Truck sleepers are not to be occupied while traveling on the winter road.
2) While operating a vehicle on the winter road, all drivers must be in possession of survival equipment suitable for arctic climates including but not restricted to a parka, wind pants, winter footwear, headwear and mitts.
3) All haul trucks operating on the winter road must be equipped with tire chains, flashlight, reflective traffic triangles, tool kit, dolly pads and container

of methyl hydrate.

12) Hours of Work/Log Books
a) Drivers must rest a minimum of 8 hours in any 24-hour period.
1) Drivers must maintain an up to date logbook.
2) Drivers must surrender logbooks to security personnel for examination upon request.

13) Rest Stops at Non-Designated Rest Areas
a) Unscheduled rest stops enroute present safety concerns and should not normally be necessary. Drivers who do find themselves unable to safely continue a trip due to fatigue will:
1) as soon as possible, stop on a portage ensuring their truck is parked well off the travelled portion of the roadway so as not to present a hazard to other traffic
2) take reasonable steps to ensure that security personnel are notified of their situation
3) remain stopped until sufficiently rested so as to be able to continue the trip safely
4) resume travel by communicating their intentions to other road users in the area and;
(a) if alone, carefully joining in with the next convoy passing their location, ensuring proper truck spacing is maintained
(b) if with another truck(s), await a break in convoy traffic and carefully rejoin the traffic flow as a convoy, ensuring proper convoy/truck spacing is maintained.
b) Any Driver who consistently or routinely makes rest stops in undesignated areas will be suspended or banned from the winter road at the discretion of the JMC.

14) Communications
a) All vehicles including maintenance equipment must be equipped with a LAD1 radio.
b) Drivers will monitor LAD1 at all times while operating on the winter road.
c) Drivers will restrict the use of LAD1 to operational or emergency related communications.

15) Spills, Accidents and Dangerous/Emergency Situations
a) All persons operating on the winter road shall report any spill, property damage/injury accident or other dangerous/emergency situation to security or dispatch personnel as soon as possible.
b) Drivers involved in an accident with another vehicle must provide their road number, name and company to the other driver as soon as possible.
c) In the event of an accident, spill, or dangerous emergency situation, the incident will be fully investigated by security or dispatch personnel; and responsible parties will be held liable for any injuries, equipment damage and or environmental clean-up.

16) Radar Detection Devices
a) Possession of radar detection devices while operating on the winter road is prohibited.
b) Security personnel who have reason to believe a person is in possession of a radar detection device may, with the individual's consent, conduct a search of any vehicle under their control.

c) Refusing to consent to a search in accordance with this section constitutes an offence under this section.
d) Possession of radar detectors is illegal in the NWT/NU. Violators will be reported to the appropriate authorities.

17) Stopping on Lakes
a) Trucks stopping on lakes is prohibited. Two warning or caution signs (indicating curve) will be clearly posted before a yield sign on all the "empty only traffic lanes" prior to entering the main road again to avoid stopping.
b) Dollying off of trailers on lakes is prohibited unless:
(1) authorized by security or dispatch personnel and
(2) appropriate dolly off pads are used.
c) Should circumstances make stopping on a lake unavoidable, drivers must notify security personnel and make every effort to move their truck off the lake as soon as possible.
d) It will be the responsibility of the trucking company to remove any truck and or piece of equipment of the ice or any other road access areas as soon as possible. Should the company not have a means to conduct this they must make arrangements with Nuna Logistics or an alternate company to remove the equipment, knowing that they will be billed by Nuna or any other company used for these services.
e) Any driver stopping to offer assistance must use extreme caution in maintaining reasonable spacing between trucks.
f) Should a truck be required to remain parked on a lake for mechanical or other reason, the driver must take reasonable steps to ensure that:
1) the truck is parked so as not to present a safety hazard to other traffic and clearly marked so as not to create a hazard to other traffic.
2) security and/or dispatch personnel are notified of the situation as soon as possible.
3) arrangements are made to have the disabled truck recovered as soon as possible.

18) Stopping on Portages
a) Should a truck be required to stop on a portage for mechanical or other reason, the driver must take reasonable steps to ensure that:
1)the truck is parked, well off the travelled portion of the roadway and clearly marked so as not to present a safety hazard to other traffic.
2) security and/or dispatch personnel are notified of the situation as soon as possible.
3) arrangements are made to have any disabled truck/trailer recovered as soon as possible.
4) Section 17 (d) applies in the same manner to trucks on portages and or near or at road camps

19) Removing, Altering or Tampering with Signage or Traffic Control Devices
a) Removing, altering or otherwise tampering with winter road signage or other traffic control devices is prohibited.

20) Wildlife
a) Feeding wildlife while operating/travelling on or near the winter road is strictly prohibited.