# ENVIRONMNTAL SCOPING, EXISTING DATA COLLECTION AND REGULATORY REQUIREMENT IDENTIFICATION FOR A TRANSPORTATION CORRIDOR IN THE SLAVE GEOLOGICAL PROVINCE NORTHWEST AND NUNAVUT TERRITORIES

*Prepared For:*
Department of Transportation
Government of the Northwest Territories
Yellowknife, NT

*Prepared By:*
Ferguson Simek Clark
Engineers & Architects
Yellowknife, NT

&

Jacques Whitford Environment Limited
Calgary, AB

&

Lutra Associates Limited
Yellowknife, NT

&

AIMM North Heritage Consulting
Stonewall, MB

**FSC PROJECT NO. 98-1570**

**April 1999**

# Table of Contents

**APPENDICES**

# 1 EXECUTIVE SUMMARY

## 1.1 Background

The Department of Transportation (DOT) of the Government of the Northwest Territories (GNWT) is preparing a highway strategy to plan for the development of a transportation corridor through the Slave Geological Province (SGP) for the purpose of mineral development and transshipment. Significant mineral resources have been identified in the SGP; however, little development has occurred. Improved infrastructure would enhance the economics of these deposits by lowering access and production costs in the SGP (DOT 1998). The corridor under consideration encompasses the North Slave communities of Rae-Edzo and Yellowknife, the existing Lupin Winter Road alignment, current and proposed mining development properties, and the location of known and favourable mineral resources in the SGP (Fig 1.1).

Existing transportation infrastructure in the SGP is limited. NWT Highways # 3 and # 4 provide all – weather road access to the communities of Yellowknife, Rae-Edzo, and Dettah. A public winter road is built annually from Rae-Edzo to the communities of Wha Ti and Rae Lakes. Until recently, Royal Oak Mines annually constructed a winter road north of Rae-Edzo to their Colomac Gold Mine. The GNWT took advantage of this winter road to resupply Wekweti with fuel and construction materials by transporting materials from the winter road to the community by cat train. With the suspension of operations at Colomac in 1997, the winter road to this site is no longer constructed. The Lupin Winter Road, built and operated by Echo Bay Mines, is built annually from the terminus of Highway # 4 at Tibbit Lake to the Lupin Mine on Contwoyto Lake, has come to serve as an essential re-supply route for the operating mines and numerous exploration sites within the SGP. Each of the private operators in the SGP is required to construct their own access to the Lupin Winter Road. The winter road is approximately 500 kilometres long and provides access for a maximum of three months each year.

The idea of improving the transportation infrastructure in the SGP has been pursued, albeit intermittently, since the 1950s, when a report by Commissioner R. G. Robertson suggested building an extensive road network in the SGP to enhance development of mineral reserves. In the late 1970s, the Department of Indian Affairs and Northern Development (DIAND) undertook an analysis of future transportation infrastructure in the region, with a focus on encouraging mining development. In the early 1990s, Metall Mining examined potential transportation alternatives for accessing their base metal property at Izok Lake in the northern part of the SGP. A common theme in these studies was the inadequacy of the existing transportation system in supporting the development of base metal and other mineral deposits in the SGP, and the consequent need for an all-weather road.

To provide a long- term plan for the development of transportation in the Northwest Territories, DOT developed the Northwest Territories Transportation Strategy (DOT 1990). The strategy was updated in 1994. One of the strategic objectives of the Transportation Strategy, titled "Building New Transportation Corridors for Economic Development," involves the development of new roads and ports to provide low cost, reliable access that will encourage and sustain resource and other economic developments. Several new road initiatives were identified in the 1990 strategy; however, the Strategy Update (DOT 1995) and the New Roads Initiative (DOT 1998) refines the focus to: a road from Yellowknife to a port on the Arctic Coast, the extension of the Mackenzie Valley Highway from Wrigley to Inuvik and the construction of an all-weather between Inuvik and Tuktoyaktuk.

## 1.2 The Proposed Slave Geological Province Transportation Corridor

In March 1998, the GNWT announced its new roads initiative and dedicated funds for the socio-economic, environmental, and pre-engineering investigation of four new roads in the NWT, including the Slave Geological Province Transportation Corridor (SGP TC). At this early stage, the project remains conceptual with potential routing, design, and construction practices to be determined as part of the initial planning and scoping process.

Construction of a transportation route in the corridor would provide all-weather access to the SGP from the existing all-weather territorial highway transportation system in the south and the Arctic Coast in the north. As part of the proposed transportation corridor project, a port capable of handling ocean-going ships would be built at tidewater: Bathurst Inlet is the proposed site. Several corridor routes have been advanced, primarily by developers focusing on the logistics of providing access to their respective properties. A specific route has not been identified; however, several groups are reviewing potential routes and port locations in terms of cost, practicality, logistics, and potential financial contributors. If constructed from the end of the territorial highway system in the south to an Arctic Coast port, the transportation corridor could be approximately 850 kilometres in length. Figure 1.1 illustrates the general routing of transportation corridors presently being investigated.

The corridor would be expected initially, to consist of an all-weather road; however, future linear developments, such as communication or power transmission facilities, could also be located within the corridor. As it would be constructed primarily to serve industrial needs, the road would be built to industrial standard, incorporating design considerations related to terrain conditions and operational requirements. Preliminary costs to construct the road are estimated at $550 million, whereas port construction costs are estimated at approximately $50 million (DOT 1995). While the GNWT supports the development of a transportation corridor in the SGP, it has not made any commitment to develop the project.

## 1.3 Environmental Scoping of the Transportation Corridor

Ferguson Simek Clark, in association with Jacques Whitford Environment Limited, Lutra Associates Limited, and Aimm North Heritage Consulting, were retained by the DOT to conduct an environmental scoping study of the proposed SGP TC. In addition to the environmental scoping study, the DOT is also undertaking the following studies:

- Need/Feasibility analysis;
- Multi level Mapping, Route Analysis and Preliminary Cost Estimates; and
- Economic Impact, Benefit Cost and Taxation Revenue Analysis.

This Environmental Scoping Study was undertaken for the DOT in advance of any commitment by the GNWT or any other proponent to proceed with the SGP TC. This scoping study, in combination with the other studies identified above, is intended to assist the DOT in developing a strategy for transportation infrastructure in the SGP. Additionally, the scoping study will assist future proponents and regulators in preparing for the environmental assessment of the potential project.

Central to the scoping project was the identification of biophysical, social, economic, and cultural issues and concerns of project stakeholders regarding the potential development of the SGP TC. Issue identification necessitated the dissemination of project information to project stakeholders through a variety of fora. Issues identified would serve to focus a future environmental assessment, should the project proceed to development. Determination of the type of environmental assessment to which the potential SGP TC may be subject was also an objective of the study.

## 1.4 Stakeholders' Concerns

Project stakeholders include residents and users of the SGP and its resources, industry, government, regulators, Aboriginal organizations, and non-government organizations. Existing documentation was reviewed and consultations with stakeholders were undertaken to identify Valued Ecosystem Components (VECs), Valued Social Components (VSCs), and issues and concerns related to the potential effects of the SGP TC on the VECs and VSCs. The VECs, VSCs, and issues are documented in the report and are summarized below:

- Need for and purpose of project;
- Need for increased public consultation and discussion about the project;
- Desire by Aboriginal organizations for involvement and control in project;
- Cumulative environmental and social effects of the project:
- Effects of the project on the Bathurst Caribou Herd;
- Effects of providing all-weather access to SGP;
- Effects of access on harvesting and the sustainability of resources;
- Effects of the project on fish and wildlife and habitat, especially eskers;
- Effects of climate change on the project and the project on climate change;
- Effects on marine environment and resources, caribou and people of shipping in the Arctic and, Bathurst Inlet specifically;
- Effects of project on existing tourism operations in the SGP;

- Need for training, jobs, and business opportunities; and
- Potential social costs of the project, including drug and alcohol abuse, health and well being, and family stability.

The VECs, VSCs, and associated issues identified are intended to provide a focus for an environmental assessment of the SGP TC should it proceed.

## 1.5 Regulatory and Environmental Review Requirements

An important consideration in the planning for the development of a transportation corridor includes an examination of the regulatory and environmental assessment requirements that must be satisfied to achieve project approval. There has been considerable change and evolution of the regulatory framework for environmental assessment, land use planning, and resource management in Canada's North in recent years, due to:

- New and revised federal legislation (*e.g.*, the *Canadian Environmental Assessment Act* (*CEAA*) and regulations, the *Mackenzie Valley Resource Management Act* (*MVRMA*) and regulations);
- The creation of Nunavut; and
- The finalization of Aboriginal land claims agreements (*e.g.*, Nunavut Land Claims Agreement (NLCA), Inuvialuit Final Agreement, Gwich'in Comprehensive Land Claim Agreement, Sahtu Dene and Metis Comprehensive Land Claim Agreement).

The permits, licences, and authorizations potentially required for development and operation of the SGP TC have been identified. As presently conceived, the proposed SGP TC transects both Nunavut and the Northwest Territories, and would be subject to environmental assessment processes established in each jurisdiction. Additionally, the *Canadian Environmental Assessment Act* (*CEAA*) may also apply, depending on the project scope. The Nunavut, Mackenzie Valley, and *CEAA* environmental review processes are described and discussed in terms of how they may apply to the proposed SGP TC.

The review of regulatory and environmental review processes concludes that the SGP TC may generate significant public concern, and may have potentially significant adverse local and/or transboundary environmental effects. Therefore, it is likely that the SGP TC would be subject to review pursuant to *CEAA* and the *MVRMA* and the *Nunavut Land Claim Settlement Act* (*NLCSA)*. It also is likely that the SGP TC would be subject to review by a (joint) panel.

## 1.6 Data Gaps

The scoping project involved the identification of information sources related to an environmental assessment of the SGP TC. Available documents were reviewed and noted as appropriate in sections of the report. Deficiencies related to specific VECs and VSCs are noted in the report. In general, the collection of site specific data will be required once a route or routes have been identified. All data sources are identified in this report, and in an additional volume which references data sources to topic areas.

## LIST OF ACROYNYMS

| | |
|---|---|
| *CEAA* | *Canadian Environmental Assessment Act* |
| CEAA | Canadian Environmental Assessment Agency |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CSR | Comprehensive Study Report |
| DIAND | Department of Indian Affairs and Northern Development |
| DOT | Department of Transportation |
| DFO | Department of Fisheries and Oceans |
| EIS | Environmental Impact Statement |
| GNWT | Government of the Northwest Territories |
| HTO | Hunters' and Trappers' Organization |
| KIA | Kitikmeot Inuit Association |
| KC | Kitikmeot Corporation |
| MVEIRB | Mackenzie Valley Environmental Impact Review Board |
| MVL&WB | Mackenzie Valley Land and Water Board |
| *MVRMA* | *Mackenzie Valley Resource Management Act* |
| NEB | National Energy Board |
| NGO | Non-Government Organization |
| NIRB | Nunavut Impact Review Board |
| NLCA | Nunavut Land Claim Agreement |
| NPC | Nunavut Planning Commission |
| NTI | Nunavut Tungavik Incorporated |
| NSMA | North Slave Metis Association |
| NWT | Northwest Territories |
| RA | Responsible Authority |
| ROW | Right-of-Way |
| SGP | Slave Geological Province |
| SGP TC | Slave Geological Province Transportation Corridor |
| TK | Traditional Knowledge |
| VEC | Valued Ecosystem Component |
| VSC | Valued Social Component |
| WKSS | West Kitikmeot Slave Study |
| WSC | Water Survey of Canada |
| YKDFN | Yellowknives Dene First Nation |

# 2 INTRODUCTION

## 2.1 General

The Department of Transportation (DOT) of the Government of the Northwest Territories (GNWT) is preparing a highway strategy to plan for the development of a transportation corridor through the Slave Geological Province (SGP) for the purpose of mineral development and transshipment (DOT 1998).

Ferguson Simek Clark, in association with Jacques Whitford Environment Limited, Lutra Associates Limited, and Aimm North Heritage Consulting, were retained by the DOT to conduct an environmental scoping study of the proposed Slave Geological Province Transportation Corridor (SGP TC). In addition to the environmental scoping study, the DOT is also undertaking the following studies:

- Need/Feasibility analysis;
- Multi level Mapping, Route Analysis and Preliminary Cost Estimates; and
- Economic Impact, Benefit Cost and Taxation Revenue Analysis.

The DOT has established a Project Stakeholder Committee to oversee and advise the Minister of Transportation on these studies and the development of the highway strategy.

This report documents the results of the environmental scoping study.

## 2.2 Background

The DOT of the GNWT has the mandate to "provide for the safe, accessible and reliable movement of people and goods to serve the social, economic and political needs and aspirations of the people of the Northwest Territories" (DOT 1990). To provide a long- term plan for the development of transportation in the Northwest Territories, DOT developed the Northwest Territories Transportation Strategy (DOT 1990). The strategy was updated in 1994 to reflect accomplishments since the 1990 Strategy and to recognize new priorities (DOT 1995). Both the initial strategy and its subsequent update state that the high cost of living in many communities is a result of high transportation costs, and the lack or inadequacy of transportation is a major factor frustrating the development of the NWT's abundant natural resources (DOT 1990,1995).

One of the strategic objectives of the Transportation Strategy, titled "Building New Transportation Corridors for Economic Development," involves the development of new roads and ports to provide low cost, reliable access that will encourage and sustain resource and other economic developments. Several new road initiatives were identified in the 1990 strategy; however, the Strategy Update (DOT 1995) and the New Roads Initiative (DOT 1998) refines the focus to: a road from Yellowknife to a port on the Arctic Coast, the extension of the Mackenzie Valley Highway from Wrigley to Inuvik and the construction of an all-weather between Inuvik and Tuktoyaktuk.

The idea of improving the transportation infrastructure in the Slave Geological Province (SGP) has been pursued, albeit intermittently, since the 1950s, when a report by Commissioner R. G. Robertson suggested building an extensive road network in the SGP to enhance development of mineral reserves (Robertson 1955). In the late 1970s, the Department of Indian Affairs and Northern Development (DIAND) undertook an analysis of future transportation infrastructure in the region, with a focus on encouraging mining development (Dubose 1979). In the early 1990s, Metall Mining examined potential transportation alternatives for accessing their base metal property at Izok Lake in the northern part of the SGP (Klohn-Crippen 1993). A common theme in these studies was the inadequacy of the existing transportation system in supporting the development of base metal and other mineral deposits in the SGP and the consequent need for an all-weather road.

In March 1998, the GNWT announced its new roads initiative and dedicated funds for the socio-economic, environmental, and pre-engineering investigation of four new roads in the NWT, including the SGP TC. At the time of the announcement, the Minister of Transportation stated "transportation infrastructure is critical to the future of both Nunavut and the Western Territory. These four roads will have the greatest impact and economic benefit in the short term" (GNWT 1998). While the GNWT is funding the studies on new roads, it has not committed to the development of any of the projects. "The information gained upon completion of this stage (the studies) will be instrumental in attracting partners in the construction phase" (GNWT 1998).

## 2.3 The Proposed Slave Geological Province Transportation Corridor

The GNWT wishes to facilitate exploration and mining activity in the Northwest Territories (DOT 1998). Significant mineral resources have been identified in the SGP; however, little development has occurred. Improved infrastructure would enhance the economics of these deposits by lowering access and production costs in the SGP (DOT 1998). To facilitate mineral development and transshipment, the DOT is preparing a plan for the development of a transportation corridor through the SGP (DOT 1998). The corridor under consideration encompasses the North Slave communities of Rae-Edzo and Yellowknife, the existing Lupin Winter Road alignment, existing and proposed mining development locations, and the location of known and favourable mineral resources in the SGP (Fig 2.1).

At this early stage, the SGP TC proposal is strictly conceptual in nature. Details on its routing, design standards, and construction timing would be worked out in future planning and scoping exercises carried out by a future proponent.

The proposed SGP TC would provide all-weather road access to the SGP from the existing territorial highway system in the south to the Arctic Coast in the north. As part of this proposal, a port capable of handling ocean-going ships would be built at tidewater, possibly in Bathurst Inlet. Depending on the final alignment, this north-south transportation route would be approximately 850 kilometres in length. Preliminary costs to construct the road are estimated by DOT at $550 million, and port construction costs are estimated at approximately $50 million. The project concept is discussed in greater detail in Chapter 3.

Concurrently with the DOT initiative, Nuna Logistics, in partnership with the Kitikmeot Corporation (KC), has proposed to build a port at Bathurst Inlet and an all-weather road linking the port to Contwoyto Lake, the Lupin Mine with the base metal deposit at Izok Lake (Nuna Logisitics 1998). Figure 2.2 illustrates the route proposed by the Nuna/KC joint venture. This scoping study addresses the Nuna/KC proposal as a possible component of the proposed SGP TC.

The GNWT supports the concept of a transportation corridor within the SGP, but has made no commitment to construct any project. DOT is sponsoring this preliminary environmental scoping study and other studies to provide basic information to assist in reaching a decision about whether and how to proceed with the corridor proposal. However, GNWT is not the proponent, and given the potential costs, the GNWT has stated that it cannot take on responsibility for constructing this transportation route without other public and private partners.

## 2.4 The Slave Geological Province – Development Context

The proposed transportation corridor will cross the SGP, one of seven geologically distinct regions within the Canadian Shield. The SGP consists of two major Ecozones, the Taiga Shield and Southern Arctic, and covers an area of approximately 190,000 $km^2$ stretching from the northern shores of Great Slave Lake to the Arctic coast. This vast region encompasses a range of terrain, water bodies, vegetation communities, and supports significant and diverse wildlife resources, notably the 350,000 strong Bathurst Caribou Herd. Other prominent wildlife within the SGP include moose, muskox, black and grizzly bears, and numerous species of small mammals. Birds and waterfowl are plentiful throughout the region. The many small and large waterbodies found in the SGP are home to a number of fish species which are harvested for subsistence and recreation.

Communities located within or adjacent to the SGP include: Yellowknife, Rae-Edzo, Wha Ti, Rae Lakes, Wekweti, Dettah, Lutsel K'e, Kugluktuk, Cambridge Bay, Umingmaktok and Bathurst Inlet. With the exception of the regional centre, Yellowknife, these communities continue to rely on "mixed" economies, which blend wage employment, resource harvesting, and government transfer payments. The region's renewable resource base supports domestic and commercial harvesting by Aboriginal people and an active resident and sport harvesting sector.

Tourism in the SGP, both consumptive and non-consumptive, adds over $ 50 million to the GDP of the NWT (V. del Valle, pers.comm 1999). It is the third largest export in the NWT behind petroleum and mining sectors. Auto touring is the largest source of NWT visitors generating 13,000 trips annually (V. del Valle, pers.comm. 1999). Figure 2.3 illustrates the location of tourist facilities within the SGP.

The significant mineral resources of the SGP have resulted in a long history of exploration and development in the region. A number of mines have been developed in the region. While many have closed, there are still several producing gold mines located within the SGP, and Canada's first diamond mine, Ekati, recently began production at Lac de Gras in the centre of the region. The proposed Diavik diamond mine is now in the federal environmental review process, with production expected to begin in 2002. A number of other gold, diamond, and base metal deposits have been identified in the region, and advanced exploration is occurring at several known deposits. Figure 2.4 exhibits known potential and producing mineral deposits within the SGP.

With the creation of the new territory of Nunavut on April 1, 1999, the SGP will span two political jurisdictions. Figure 2.5 illustrates the boundary between Nunavut and the Northwest Territories. Responsibilities, including the planning and development of transportation infrastructure, currently held by the GNWT will transfer to the government of Nunavut for the new territory. Nunavut Tungavik Incorporated, the Regional Inuit Organizations, and the co-management boards, such as the Nunavut Impact Review Board, will continue to exercise their authorities in the new territory. Land ownership in Nunavut primarily rests with the Crown; however, through their land claim settlement in 1993, Nunavut Tungavik Incorporated and the Regional Inuit Organizations received title to some lands in Nunavut, including lands within the SGP (Figure 2.6). Surface title has been granted in some areas, whereas surface and subsurface (including mineral rights) title has been granted in other locations.

Current territorial jurisdiction within the area of the SGP located in the NWT will continue after creation of Nunavut. Two Aboriginal political organizations are currently negotiating land claim settlements which include parts of the SGP. The Dogrib Treaty 11 Council, representing the Dogrib Nation in the communities of Rae-Edzo, Wha Ti, Rae Lakes, and Wekweti, expect to reach a settlement with the federal government during 1999. Through the settlement, the Dogrib Nation will receive, among other rights and benefits, title to lands and formal involvement in resource management in the SGP. The Akaitcho Territory Tribal Council, representing signatories to Treaty # 8, located in the NWT communities of Dettah, Lutsel K'e, Fort Resolution, and Fort Smith, are also involved in land claim negotiations involving their traditional territory which includes part of the SGP.

Negotiations between Treaty 8 and the federal government are not advanced to the extent of the Treaty 11 negotiations; therefore, uncertainty remains in terms of the type of settlement being negotiated and the date at which a settlement could be expected to be concluded. The North Slave Metis Alliance, representing Metis peoples in Yellowknife and Rae-Edzo, is also expected to pursue a land rights settlement with the federal government. At present, ownership of lands within the NWT portion of the SGP remains primarily with the Crown; however, future land claim settlements are expected to provide Aboriginal groups with surface and sub-surface title to some of the lands.

## 2.5 The SGP TC Environmental Scoping Study

### *2.5.1 Purpose*

This Environmental Scoping Study was undertaken for the DOT in advance of any commitment by the GNWT or any other proponent to proceed with the SGP TC. This scoping study, in combination with the other studies identified above, is intended to assist the DOT in developing a strategy for transportation infrastructure in the SGP. Additionally, the scoping study will assist future proponents and regulators in preparing for the environmental assessment of the potential project.

Central to the scoping project was the identification of biophysical, social, economic, and cultural issues and concerns of project stakeholders regarding the potential development of the SGP TC. Issue identification necessitated the dissemination of project information to project stakeholders through a variety of fora. Issues identified would serve to focus a future environmental assessment, should the project proceed to development.

The SGP TC, as currently proposed, spans two territories with evolving regulatory and environmental assessment regimes. Determination of the type of environmental assessment to which the potential SGP TC may be subject was also an objective of the study. Knowledge of probable environmental assessment requirements would assist future proponents in designing studies and allocating resources.

Undertaking the scoping studies involved a review of many literature sources about the SGP and the northern environment, all of which have been documented for future use by a future proponent.

### *2.5.2 Methodology*

Meeting the Project Terms of Reference (DOT 1998) required a variety of activities be undertaken by the Project Team. Initial activities involved the development of a conceptual project description which would be used to assess potential project/environment interactions and serve as a basis for public consultation. Specific activities, related to the project objectives are highlighted below:

- Issues Scoping:
  - Development and distribution of public information package (Appendix A);
  - Preparation of environmental overview of SGP region;
  - Information booth at NWT 1998 Geoscience Forum in Yellowknife;
  - Public consultations in most communities in or surrounding the SGP;
  - Interviews with industry officials, government and regulatory agencies, Aboriginal organizations and NGOs;
  - Sub-contracting of community organizations to collect Traditional Knowledge information.
  - Review of available information regarding past, current, and proposed developments in the SGP; and
  - Analysis of issues.

- Identify Existing Data and Data Sources through:
  - Database and library searches;
  - Consultations with project stakeholders;
  - Review and analysis of available data; and
  - Documentation of available data and data sources.

- Documentation of Potential Environmental Review Process:
  - Review of enabling legislation, agreements, and process documents;
  - Interviews with environmental review agency personnel; and
  - Review of similar experiences.

- Identification of Data Gaps and Future Study Needs:
  - Review of available materials;
  - Interviews with project stakeholders;
  - Analysis of issues raised during consultation;

### *2.5.3 Report Outline*

This report documents the results of the Environmental Scoping Study. Following this introductory chapter, the main features of a potential SGP TC are described under the heading Conceptual Project Description. The environmental review process to which the SGP TC would likely be subject is documented in Chapter 4. The consultation process and issues raised during consultation, including the traditional knowledge component, are described in Chapter 5 of the report.

Chapter 6 describes existing environmental and socio-economic conditions in the SGP, identifies potential project/environment interactions, discusses issues raised during consultation, reviews available data, and identifies future study requirements for an environmental assessment. Study conclusions are reported in Chapter 7 of the report. Accompanying the main document is a second volume which documents existing data and data sources related to the project.

## 2.6 Bibliography


***Personal Communications***

Del Valle, V. Coordinator Facilities and Assets. Parks and Tourism Division, Department of Resources Wildlife and Economic Development, GNWT. Yellowknife, NWT. 1999.

***Existing Information***

Dubose, L. 1979. Northeast Mackenzie District Transportation Study – Phase I. Prepared by Economic Analysis Division, Department of Indian Affairs and Northern Development.

(DOT) Department of Transportation. 1990. Northwest Territories Transportation Strategy. Government of the Northwest Territories.

(DOT) Department of Transportation. 1995 Northwest Territories Transportation Strategy Update. Government of the Northwest Territories.

(DOT) Department of Transportation. 1998. Request For Proposals, Environmental Scoping, Existing Data Collection and Regulatory Requirement Identification for a Transportation Corridor in the Slave Geological Province.

Government of the Northwest Territories (GNWT). 1998. New Roads Initiative. Press Release, March 23, 1998. Government of the Northwest Territories.

Klohn-Crippen Consultants Ltd. 1993. Environmental Evaluation of the Izok Project. Submitted to the Regional Environmental Review Committee, DIAND. Metall Mining Corporation.

Robertson, R. G. 1955. The Northwest Territories, Its Economic Perspective, A Brief Presented to the Royal Commission on Canada's Economic Prospects. Government of the Northwest Territories.

# 3 CONCEPTUAL PROJECT DESCRIPTION

## 3.1 Purpose

While the proposed SGP TC is presently at a conceptual level only, it is essential that some detail to the concept be provided to allow environmental scoping and consultation activities to be effective. Accordingly, a conceptual project description has been developed based on the broad components of what might be included in an SGP TC and experiences from other road and port development projects. The following conceptual project description was developed to provide a focus for the identification of concerns and issues by the public and to assist with the determination of regulatory and environmental assessment requirements should the project proceed. It must be acknowledged that the following represents one potential development scenario which may or may not be implemented in the possible future development of a SGP TC.

## 3.2 Project Overview

At this early stage, the project remains conceptual with potential routing, design and construction practices to be determined as part of the initial planning and scoping process. This chapter describes a possible scenario for development of the corridor. Figure 3.1 illustrates the existing transportation infrastructure within the Slave Geological Province.

Construction of a transportation route in the corridor would provide all-weather access to the SGP from the existing all-weather territorial highway transportation system in the south and the Arctic coast in the north. As part of the proposed transportation corridor project, a port capable of handling ocean-going ships would be built at tidewater, probably in Bathurst Inlet. Several corridor routes have been advanced, primarily by developers focusing on the logistics of providing access to their respective properties. A specific route has not been identified; however, several groups are reviewing potential routes and port locations in terms of cost, practicality, logistics and potential financial contributors. If constructed from the end of the territorial highway system in the south to an Arctic coast port, the transportation corridor could be approximately 850 kilometres in length. Figure 2.1 illustrates the general routing of transportation corridors presently being investigated.

The corridor would be expected initially to consist of an all-weather road; however, future linear developments such as communication or power transmission facilities may also be located within the corridor. As it would be constructed primarily to serve industrial needs, the road would be built to industrial standard, incorporating design considerations related to terrain conditions and operational requirements. Preliminary costs to construct the road are estimated at $550 million, whereas port construction costs are estimated at approximately $50 million (DOT 1995).

In addition to this scoping project for the SGP TC, the GNWT is presently undertaking routing analysis and need/feasibility studies. It is intended that these studies could lay the foundation for the detailed planning and design phase, should the project go forward, which would include a formal environmental assessment of the project.

Others are also investigating the economic feasibility of a transportation corridor. A joint initiative from Nuna Logistics and the Kitikmeot Corporation proposes the development of a port at Bathurst Inlet and construction of an all-weather road from the port to the east side of Contwoyto Lake, barge or winter road service across the lake, and construction of an all-weather road from the Lupin Mine site to the potential Izok Lake base metal property. The potential development and routing of this initiative are being addressed in this scoping project and the other related studies. While the DOT supports the concept of a transportation corridor within the Slave Geological Province, and has sponsored the initial studies, the GNWT has not made a commitment to construct the transportation corridor. Given fiscal restraint and costs associated with such a project, decisions on construction could only be made after the need/feasibility of the project is proven and funding sources are identified and secured. This conceptual project description has been written as if the GNWT is involved to some extent in the development of the proposed project; however, it is not intended to indicate GNWT commitment. It is likely that, should the corridor project proceed, it will be developed by some form of partnership involving private industry, other organizations and government.

### 3.3 Project Purpose and Rationale

DOT, under its mandate to "provide for the safe, accessible and reliable movement of people and goods to serve the social, economic and political needs and aspirations of the people of the Northwest Territories," identified three strategic objectives in its most recent Transportation Strategy Update, released in 1995. One of these objectives, "Building New Transportation Corridors for Economic Development," promotes the building of new highways, winter roads, and ports to improve prospects for non-renewable and renewable resource development and for tourism.

The GNWT supports the sustainable development of northern resources and recognizes that the mining industry has the potential to contribute significantly to the economy of the NWT. The GNWT believes that known gold, base metal, and diamond deposits have the potential to triple the value of mineral exports and to increase the value of the territorial gross domestic product by more than 50% (DOT 1995).

Under this broad objective, DOT has identified the need to investigate the feasibility of an all-weather transportation corridor within the SGP as a priority. The high cost of transportation has been recognized as a significant factor limiting the development of mineral resources within the SGP. The need for transportation infrastructure to support mineral development in the SGP was identified as far back as the 1950s (Robertson 1955). In 1979, the federal Department of Indian Affairs and Northern Development (DIAND) undertook a study to determine transportation infrastructure required to facilitate the development of base metal deposits within the SGP (Dubose 1979). Since that time, industry and government have examined the potential for, and benefits of, an all-weather road to the SGP. An all-weather transportation corridor within the SGP would reduce transportation and storage costs, thereby encouraging greater exploration and development, possibly making marginal deposits economic. Increased exploration and development would provide economic benefits to the NWT and Canada. While primarily intended to facilitate increased resource development in the SGP, the transportation corridor may reduce the costs of goods and services in communities as they may take advantage of new transportation infrastructure and distribution patterns.

At the same time, Nuna Logistics and the Kitikmeot Corporation has advanced a proposal to build a port at Bathurst Inlet and an all-weather road connecting the port to Contwoyto Lake and Izok mine. Preliminary feasibility work has been carried out on this initiative but no commitments to proceed with this project have been made. The studies undertaken by DOT will include the Nuna Logistics/Kitikmeot Corporation proposal as potential components of a SGP transportation corridor.

### 3.4 Project Study Area

The SGP is one of seven geological provinces composing the Canadian Shield. It covers an area of approximately 190,000 $km^2$ stretching from the northern shores of Great Slave Lake to the Arctic coast. The SGP contains rocks estimated to be almost 4 billion years old, among the oldest surface rocks known to man. It is an area with extensive mineral and renewable resources.

The SGP is located within the traditional territory of Inuit, Dene, and Metis residents of the NWT. Several communities are located in the region. These communities range from the commercial and government center of Yellowknife with a population of 17,275, to a number of communities with less than 100 residents who remain largely dependent on traditional resource harvesting. Communities located within and around the SGP include Rae-Edzo, Wha Ti, Rae Lakes, Wekweti, Lutsel K'e, Bathurst Inlet, Umingmaktok, Cambridge Bay, Kugluktuk, Dettah, and Yellowknife.

The SGP encompasses two major ecozones: the Taiga Shield and Southern Arctic. The northern limit of trees provides a border between these two ecozones. The area is home to significant wildlife resources, including the 350,000 strong Bathurst Caribou Herd. Bears, wolves, moose, a variety of small mammals, a variety of bird species, and significant fishery resources are found throughout the SGP. The abundant wildlife supports traditional harvesting by Aboriginal residents and an active non-resident and sport-harvesting sector. Tourism, both consumptive and non-consumptive, continues to be an important economic activity within the SGP.

However, the most significant economic activity within the SGP is mineral exploration and development. Mineral exploration expenditures in the NWT have ranged between $150 - $200 million annually over the years 1994-1997, the majority of which has been spent in the SGP (Armstrong 1998). Several producing gold mines are located within the region and Canada's first diamond mine, Ekati, recently began production at Lac De Gras in the central area of the SGP. The formal environmental review process has commenced for the proposed Diavik Diamond Mine, located near Ekati, with production expected to commence in 2002. Feasibility and environmental studies have also been undertaken at the proposed Izok Lake base metal project, east of the Lupin Gold Mine. A number of other promising gold, diamond, and base metal deposits have also been identified within the region. Advanced exploration is occurring at a number of known deposits within the SGP; however, production has not yet commenced.

There are four hydroelectric power-generating plants within the SGP. These plants, located on the Snare River system, currently produce a maximum output of 30 megawatts of electricity to supply the communities of Rae-Edzo and Yellowknife. Additional potential hydroelectric generating sites have been identified within the SGP, some of which could provide power to new developments.

Land ownership within the region rests largely with the federal Crown. The Inuit of Nunavut, however, received surface and subsurface title to some lands within the region through their comprehensive Aboriginal rights settlement with the federal government in 1993. The Dogrib Treaty 11 Council, representing the Dogrib people in the southwestern area of the SGP, is currently negotiating a comprehensive land claim with the federal government which will include ownership of lands and resource management responsibilities. It is expected that through the claim settlement, the Dogribs will acquire title to some surface and some subsurface lands within the SGP. Two other groups, the North Slave Metis Alliance and the Akaitcho Territory Tribal Council, are in discussions with the federal government with respect to land and resource settlements in their traditional territories which include parts of the SGP.

In summary, the SGP supports a number of different economic activities. It is, however, the vast mineral resources of the region which the GNWT believes present the greatest potential for the economic development of the area and the Northwest Territories as a whole. The lack of all-season road access into the region results in high development and operational costs, constraining mineral development to date, and will likely continue to be a factor limiting development in the future.

### *3.4.1 Existing Transportation Infrastructure in the SGP*

The public transportation infrastructure in the NWT consists of approximately 2,200 kilometres of all-weather roads, 1,300 kilometres of winter roads, community airports, and limited marine infrastructure. Of this total, there are approximately 200 kilometres of public all-weather roads and 250 kilometres of public winter roads in the SGP.

A significant part of the transportation infrastructure serving the SGP is the Lupin Winter Road, between the terminus of Highway # 4, east of Yellowknife at Tibbett Lake, and the Lupin Mine on the shores of Contwoyto Lake. The Lupin Winter Road is built annually by Echo Bay Mines, the owner of the Lupin Mine, to resupply their mine, but has come to serve as an essential resupply route for the Ekati Diamond Mine and numerous exploration sites within the SGP. Each of the private operators in the SGP is required to construct their own access to the Lupin Winter Road. The Lupin Winter Road is approximately 500 kilometres long and provides access for up to three months each year.

NWT Highway # 3 links Yellowknife and Rae-Edzo to the south and the rest of Canada. NWT Highway # 4 provides access from Yellowknife to Dettah and recreational properties to the east of Yellowknife (Figure 3.1).

A public winter road is built annually from Highway # 3 at Rae-Edzo north to Wha Ti and Rae Lakes. This winter road provides up to three months road access to these two communities. When the road is not in service, these communities must rely exclusively on air service. Until recently, Royal Oak Mines annually constructed a winter road north of Rae-Edzo to their Colomac Gold Mine. The GNWT took advantage of this winter road to resupply Wekweti with fuel and construction materials by transporting materials from the winter road to the community by Cat train. With the suspension of operations at Colomac in 1997, the winter road to this site is no longer constructed.

The communities of Lutsel K'e on Great Slave Lake, and Kugluktuk, Cambridge Bay, Umingmaktok, and Bathurst Inlet on the Arctic coast receive barge service during the open water season. Scheduled air service is provided year round to all of these communities, except Bathurst Inlet and Umingmaktok.

With the exception of Rae-Edzo, Bathurst Inlet and Umingmaktok, where small private airstrips are present, the GNWT provides and maintains airports in the communities in or surrounding the SGP. Air service to remote sites within the SGP is primarily limited to the open water season or when ice cover is of sufficient strength to accommodate aircraft. Some of the larger developments, such as the Lupin and Ekati Mines, have constructed all-weather airstrips, but most exploration sites rely on seasonal air access.

### 3.5 Conceptual Project Schedule

The transportation corridor project is early in the planning stages, where potential routes are being examined, the need/feasibility of the project is being determined, financing opportunities and other factors are still being evaluated. A commitment to proceed with the corridor project has not been made by any party.

These initial studies and related initiatives undertaken by groups such as Nuna Logistics/Kitikmeot Corporation will help form the basis for a decision on whether or not to pursue construction of a road and associated port. Such a major decision relies on a number of factors in addition to construction costs, including financing alternatives, commodity prices, markets, and environmental concerns, among others. It is likely that, after the completion of the initial studies, a period of several years will be required for interested parties to make a decision on whether or not to proceed with the proposed project. Reports completed by the GNWT will be made available to the Government of Nunavut who will be responsible for planning for public transportation in Nunavut.

Assuming a decision to proceed with the project is made, it is expected that the project would require a similar schedule as outlined below. It is assumed that Year 1 represents the first year after a decision to proceed with the project is made.

This schedule is provided for information purposes only and would change significantly depending on project scope (*i.e.,* proceed with northern or southern section only), route alignments, financing, environmental review requirements, and other factors.

**Table 3.5.1 Generalized Project Schedule**

| Activity | Year(s) |
|---|---|
| Planning/Consultation | 1 |
| Detailed Design | 2-3 |
| Environmental Assessment/Permitting | 1-4 |
| Construction | 5-15* |
| Monitoring | 5-15+ |

*This schedule could change significantly depending on a number of factors including length of road to be constructed, financing constraints, length of environmental review, and other issues. If the entire proposed road of 850 km in length were constructed over a 5 year period, approximately 170 km would have to be constructed each year. If construction were spread out over a 15 year period, only approximately 57 km would need to be constructed each year.

## 3.6 Alternatives

Should the project proceed to development, the environmental assessment will include an assessment of alternatives to the project and alternative methods of carrying out the project. A brief discussion of potential alternatives follows.

### *3.6.1 Alternatives to the Project*

Currently identified alternatives for improving access to, and transportation within the SGP include:

- Status Quo;
- Additional Winter Roads;
- A Northern Port;
- Increased Air Transportation; and
- An All-Weather Transportation Corridor.

Previous studies (Klohn-Crippen 1993) have investigated the feasibility of alternatives such as hovercrafts, airships, pipelines, and rail construction. The following represent the alternatives presently under consideration.

#### 3.6.1.1 Status Quo

The *Status Quo* option would include the current transportation infrastructure in the SGP only. Access into the SGP would be primarily by the Rae Lake and Lupin Winter Roads and by air. Existing practices of mobilizing bulk supplies to exploration sites and producing mines during the short winter road season would continue. Air support would be available year round to sites with all-weather airstrips and on a seasonal basis to those sites without airstrips.

Producers of gold and diamonds, whose commodities have a much greater value per unit of weight than base metal producers, are able to justify flying the product out of remote sites; however, they must still finance substantial storage facilities and purchase a year's operating supplies for delivery on the winter road system. The *Status Quo* requires operators to make significant investment in storage infrastructure and finance most annual operating supplies over a short period. The more significant developments such as the operating mines have constructed all- weather airstrips which permit air access on a year round basis. However, the costs of air service justifies only the transport of workers and fresh goods to the sites and precious products from the site. For diamond mines and most gold mines an all-weather road is not required and the status quo is sufficient. However, should a significant number of new mines be developed in the SGP, it is likely that the capacity of the existing winter roads would be exceeded.

Base metal properties which must ship out large volumes of ore concentrates must have access to a port, and preferably an all-weather road (Arthur Anderson LLP et al 1999). It is unlikely that any base metal deposits in the SGP will be developed without all-weather road access. The *Status Quo* is not sufficient to enable the mineral resources of the SGP to be fully explored and developed to provide the economic benefits believed to be achievable.

#### 3.6.1.2 Additional Winter Roads

Increased transportation access into the SGP could be achieved through the construction of additional winter roads to provide an extension of the Lupin Winter Road to properties further north or east of the Lupin Mine. The existing public winter road to Wha Ti and Rae Lakes could be extended to provide access to properties on the western part of the SGP. Additionally, winter roads to specific properties or groups of properties could be built to provide improved access. These road extensions would have to be built at the cost of individual operators and would increase exploration and development costs.

However, while increased winter road access to sites not presently served by winter roads will be an improvement to the current situation, the problems associated with seasonal access remain and the impediment to increased development continues to exist. These include the cost of storage infrastructure, carrying costs of an annual supply of fuel and materials over a 2-3 month period, and the uncertainty of the length of the road season. Metall Mining investigated the development of a winter road from the Izok Lake base metal deposit to the Arctic Coast but determined an all-weather road and port was required to make the project feasible (Klohn–Crippen 1993). The lack of all-weather transportation infrastructure was a significant factor in the suspension of development plans for the site. The expansion of the existing winter road network is not considered practical in meeting the GNWT's objective of fostering increased mineral development in the SGP.

#### 3.6.1.3 A Northern Port and Associated Winter Road

Existing winter roads provide access to the SGP from the all-weather road system at Yellowknife and Rae-Edzo. With the current infrastructure, transportation of goods to the SGP must proceed from southern Canada over the existing rail and road network. Improved access to materials and markets

could be provided through the development of a port on the Arctic coast and development of winter roads south into the SGP.

This alternative is similar to the *Status Quo*, but differs in the fact that access to SGP would be from the north on the Arctic coast rather than from the south as is currently the case. A winter road would connect mineral properties to the port. This alternative would provide access to goods on the international market and marine markets for products produced. However, due to the seasonal nature of shipping and winter roads, this option would require developers to build significant storage infrastructure at the port site, in addition to storage facilities at their development site. Metall Mining proposed the development of a port on a site on the Coronation Gulf, approximately 19 km east of Kugluktuk. This port would allow Metall to ship base metal concentrates to foreign locations and bring supplies in from around the world.

Marine access to a port would be available for 3-4 months during the late summer and fall; however, materials would need to be stockpiled at the port for up to 4 or 5 months until they can be transshipped via winter roads. Metall's analysis concluded that an all-weather road was required between the Izok Lake site and the port to make the project economically feasible (Arthur Anderson LLP et al 1999), therefore, this alternative does not achieve the GNWT's objective of increased mineral development in the SGP.

#### 3.6.1.4 Increased Air Transportation

Increased reliance on air access to the SGP is not considered practical. The cost of shipping large volumes of equipment and materials to sites within the SGP is prohibitive and would eliminate all but the most lucrative deposits from being developed. Shipment of bulk concentrates by air to a smelter in southern Canada or abroad would be prohibitively expensive. The existing winter road system was developed in response to the high cost of transporting equipment and materials by air to remote locations within the SGP.

There will always be a role for aircraft to move people and precious goods, but it is not cost effective to construct and operate a mine or ship bulk concentrates to market using aircraft. This alternative is even more costly than using winter roads and is not considered practical in achieving the objective of increased mineral development in the SGP.

#### 3.6.1.5 All-Weather Transportation Corridor

An all-weather transportation corridor into the SGP has been proposed to reduce the high costs of transportation in the SGP and stimulate increased mineral development, resulting in greater economic development and socio-economic benefits for the NWT. The transportation corridor under consideration would consist of an all-weather road connecting the SGP with the NWT all-weather highway system in the south and a port on the Arctic Coast to the north.

The current infrastructure within the SGP consists primarily of the Lupin Winter Road between the terminus of Highway # 4 (Ingraham Trail) and the Lupin Mine on Contwoyto Lake. Access roads off

this main road are built to individual properties. While this road provides surface access to much of the SGP, the access is available for a maximum of three months per year. This requires the mineral industry to tie up large amounts of capital in purchasing a year's worth of supplies at one time and constructing significant storage facilities to store the year's supplies. This situation eliminates the potential for a steady cashflow and increases capital start-up costs significantly.

The seasonal nature of transportation infrastructure has been identified as a significant impediment to development of the area's resources. While diamond and precious metal properties have been and continue to be developed with the existing transportation infrastructure; base metal properties, with their need to ship large volumes of ore concentrates to smelters, would likely not be developed without an all-weather road and access to tidewater.

### *3.6.2 Alternate Means of Carrying out the Project*

The transportation corridor is expected to consist of an all-weather road within a corridor that may contain other linear developments in the future. The current construction estimate of $550 million is based on a two-lane, 10m wide gravel surface with an embankment averaging 1-1.5 metres in thickness and 3:1 side slopes. Standard road construction practices must be followed to ensure a stable and durable road is constructed. Within these general parameters, several alternative approaches to design, construction, and operation can be considered.

The road would be designed primarily to carry heavy truck traffic. Light vehicle traffic may be expected; however, the majority of traffic on the road is expected to consist of heavy industrial loads. Road width could consist of a single lane with turnouts on a regular basis to allow for passing of vehicles. This approach would require less granular material than a two-lane road; however, depending on traffic levels, this approach may affect transit times and safety of users. Road surfacing options are practically limited to a gravel surface. Road geometrics can vary to accommodate the level and type of traffic expected to use the road. Embankment slope, construction materials, and surfacing type will be based on the type of traffic using the road and the cost of construction. The initial cost and ongoing maintenance cost of a paved surface is likely not justified for this largely industrial road.

Routing studies are identifying the most practical routes from several perspectives – mainly the way in which the routes can link existing and potential development properties and ease of construction (access to granular resources, minimize river crossings, avoid significant topography). Alternative route segments may be considered to avoid environmentally or culturally sensitive areas or to access renewable resources, existing communities, or tourism opportunities. Parties involved in the financing of the project will ensure the routing of the road meets their own specific needs but can consider alternative route segments to access or avoid certain resource or cultural values.

While road construction must follow standard permafrost construction practices, it may be scheduled to allow for the most appropriate sections to be built first. For practical purposes, it is expected that construction would begin from either the Arctic coast or the all-weather highway system. This would ease the mobilization of equipment and ensure access is available to the highway system or port site immediately. Internal road segments could be constructed on an as-needed priority basis.

## 3.7 Construction

### *3.7.1 Construction Cost Estimates*

Preliminary estimates to construct the road, exclusive of the port, are estimated at $550 million. Port construction costs are estimated at $50 million (DOT 1995).

### *3.7.2 Assumptions Made in Developing This Conceptual Project Description*

In describing project-related activities, the following assumptions about the work have been made.

1) The total time frame for the entire project from initiation of first fieldwork to completion of last roadwork is fifteen years. This is based on up to four years of initial data collection, survey work, design, and regulatory approvals, and up to ten construction years, each involving the development of approximately 70-80 kilometres of road per year. This schedule could change significantly depending on the proponents, routing, financing, and other factors.

2) The standard road bed design will be a fill with an anticipated gravel road surface approximately 10 m across, an average embankment thickness of 1-1.5 m, side slopes at 3:1, an upslope interceptor ditch where needed, and appropriate cross drainage.

3) The right-of-way (ROW) will be 60 m in width.

4) Primary route selection criteria for engineering and construction purposes will include: selection of the most direct route; minimize roadway excavation; proximity to borrow sources; follow glacier-smooth surfaces with a micro relief of less than one metre; minimize river crossings; locate crossings at narrowest points where suitable foundation conditions exist; and, minimize crossing of seasonally wet or organic terrain.

5) All construction activities will be supported by temporary camps located conveniently to the work. These camps would be capable of accommodating up to 200 people.

6) The design process is receptive and responsive to new information.

### *3.7.3 Construction Schedule*

It is expected that construction scheduling would largely be dictated by the physical and climatic conditions of the particular route segment. It is expected that construction would proceed during the summer/fall and winter. It would be possible to plan construction of road sections or specific installations such as bridges at times of the year that would avoid seasonal wildlife movements or tourism activities. Depending on available resources and priorities, several sections or spreads of the road could be constructed at one time. Practical construction scheduling would be developed during the design and environmental review stage.

### *3.7.4 Route Selection and Final Design*

The process of selecting a route and preparing a final road design for construction has several distinct phases. Initially, feasibility work is carried out to establish a general idea of what is required to meet the stated goal of the project. Concurrently with this environmental scoping study, routing and need/feasibility studies are ongoing. The reader is referred to the reports of those studies (Geowest 1999) for more detailed information. The following summary description of route selection and road design process is provided to support the identification of potential project – environment interactions.

The alignment of the proposed road would be determined through a comprehensive route selection process, which would include examination of feasible route alternatives. Initial corridor identification has been undertaken through a review of air photos, topographic map and aerial reconnaissance. The initial investigation resulted in the identification of three to five potential routes on 1:250,000 and 1:50,000 NTS map sheets. Route refinements are expected to include a 1:60,000 aerial photo analysis for each potential route followed by aerial reconnaissance.

Following the identification of a preferred route and route alternates, preliminary ground surveys would be undertaken to establish ground controls (*e.g.*, centreline surveying); these surveys will assist crews in carrying out field studies by clearly marking the proposed route and alternates. Information to be collected at this stage in the process includes: geotechnical data along the ROW (*e.g.*, depth to bedrock, sediment composition and texture); route topography and grade requirements; location of borrow sources; location and nature of watercourse crossings; slope stability; presence and depth of organic soil; and presence and nature of permafrost. Where the route passes through forested land, minimal clearing may be required to establish line-of-sight for surveying.

Additionally, discipline-specific environmental studies would be carried out to compile necessary data regarding relevant environmental components (*e.g.*, flora, fauna, habitat, heritage resources) as determined through the initial issues scoping exercise (documented in Chapters 5 and 6 of this report). Field programs will require logistical support, including establishment of field camps with associated water requirements, fuel storage, and machinery activity. Geotechnical programs involving drilling will take place in the winter when ground access is possible, while environmental programs will be timed seasonally to address specific data requirements.

With information from the above studies in hand, a multi-disciplinary design team will select the final preferred route and document the rationale for its selection. A final construction program plan will be generated that will detail the schedule, construction segments, and all support-related issues including camps, select material sources, watercourse crossing designs, and so on. An environmental protection plan, contingency plans, and environmental compliance and effects monitoring programs would be prepared.

The last phase of project design involves the development of the operations and maintenance plan. This plan is generally developed in the year preceding the commissioning of the road, and may be phased in as the construction proceeds.

### *3.7.5 Logistics*

During the data collection phase (*e.g.*, route selection, environmental studies, preliminary geotechnical surveys) of the project, field crew sizes requiring logistical support would vary in size from as few as two people to as many as 40. Generally, transportation methods would be determined by the season of study. During the winter months, ground access would be possible, while summer activities would rely on aircraft and watercraft for access. Aircraft use would be restricted by weather conditions, and in the winter, by daylight hours.

Most large field crews would operate from mobile skid camps, hauled by tracked vehicle, which would provide office space, accommodation, and kitchen and sanitary facilities. Camp operation requirements would include water supply, sanitation, sewage disposal, waste handling, and communications. Small field crews may establish temporary fly camps using tents and other portable facilities.

The construction phase would require similar logistical support, but on a larger, more intensive scale. Construction camps are discussed in greater detail in section 3.7.12. Given the current assumptions about construction schedule noted earlier, eight major construction camps with a capacity of approximately 200 workers, including support staff, would be required. These camps would be adjacent to or within the ROW, and may include development of a support airstrip.

There may be a requirement for smaller camps at specific locations such as major watercourse crossings, if these cannot adequately be serviced from a main camp.

Field camps would be selected and established in consideration of potential for long term use to meet requirements during the operation phase (*e.g.*, maintenance depots, emergency facilities). The details of the logistics program would be determined in consideration of appropriate use and availability of support services, particularly aircraft, watercraft, and tracked vehicles.

If a decision is made to construct the entire project, it is possible to begin construction from either the north or south or both. Equipment and supplies could be moved north from the existing all-weather highway system or shipped to the port site and used to begin construction in a southerly direction. Construction may occur from both the north and south to reduce the construction period.

### *3.7.6 Watercourse Crossings*

During the route selection and road design process, close attention would be given to all watercourse crossings and drainage considerations. Route selection would attempt to minimize the number of river crossings and position the necessary crossings at the narrowest points of the river where foundation conditions are suitable. As a general rule, the ROW would cross all watercourses at right angles, using as low a fill height as acceptable for design. Relevant data would be compiled for each identified watercourse, including, as appropriate, geotechnical characteristics, hydrological characteristics, water quality, and aquatic habitat values. This information would be used to develop the specific crossing design for each watercourse crossing. Design factors, including type of installation, size, anticipated peak flows, timing of sensitive life cycle periods for aquatic resources, special fish passage design, inlet and outflow features, installation timing, and technique, would be identified on design drawings.

There are two basic design options available for the road: culverts or bridges. The majority of watercourse crossings would use culverts sized and installed to accommodate normal and storm flows. Where fishery values warrant the maintenance of fish passage, culvert designs will meet standards established by Fisheries and Oceans Canada for culvert slope and in-culvert water velocity. Special design consideration would be given to streams exhibiting *aufeis* characteristics, and inlets and outlets would be given special attention for control of scour and erosion. Design fill heights over watercourse crossings would be kept low to minimize culvert length and instream physical disturbance. During construction, machine traffic within the wetted perimeter of any watercourse would be controlled, and bank vegetation would be maintained both upstream and downstream of the installation.

Larger watercourse crossings may require bridge installations. To the extent practical, disturbance of the streambed and banks would be minimized. Freeboard heights would be established to accommodate the 1:100 year flood event as a minimum. Some particularly large watercourse crossings could be crossed with a single lane bridge. Major watercourse crossings may require a small separate camp to address logistical demands; such camps are anticipated to accommodate approximately 30 workers.

Streamflow may be diverted temporarily to enable construction of watercourse crossings to proceed "in the dry." Diversion techniques would depend on flow, and may include diversion channels, pumping, or cofferdams and sandbags.

### *3.7.7 Right-of-Way Preparation*

The ROW is that part of the project that lies within the alignment and is occupied by highway features including the road embankment and clearing, culverts, bridges, intersections with other roads, and adjacent drainage and erosion control. The ROW nominally will be 60 m in width, except where additional space is necessary for construction (*e.g.*, larger watercourse crossings, deep cuts or fills), maintenance, or safety.

Work on the ROW would follow a standard sequence of activities, likely to include: surveying and flagging of work boundaries; clearing and salvaging of trees (within forested areas); stripping and grubbing of surface vegetation (except where precluded by permafrost considerations); spoil disposal and backfill; excavation and embankment construction; compaction, if required; installation of drainage and erosion control; and (if required) sub-base and base course installation. The timing of these activities will depend on a number of factors including the construction method, terrain conditions, and the proponent's schedule.

Surveying and flagging of work boundaries would be done in advance of any ROW construction to restrict all construction activities to the ROW. Establishment of horizontal and vertical control with monumentation would precede actual ROW flagging, which will generally consist of staked stations 25 m apart, delineating centre-line location and grade. In areas of fill, off-set grade stakes would be installed to direct and control stripping and grubbing, fill, and final grade. In excavation areas, the calculated edge of cut would be staked to control the width of excavation. Survey control would continue to be used throughout construction to ensure that material and machinery use is optimized and the work proceeds in an orderly fashion.

During the initial survey work below the treeline, salvageable timber would be flagged, machine or hand cut, limbed, decked, and stockpiled for use in construction as cribbing material. All other cleared vegetation would be windrowed and stockpiled for other uses, such as subgrade material, wood chips, or rollback on cut mineral slopes. Generally, this work would be done prior to the main construction activities.

Where stripping and grubbing is acceptable, all other surface organic detritus and debris would be rolled back from under the anticipated width of fill and removed to a disposal site, such as a borrow pit, or along the edge of the embankment where it can be used for reclamation. Spoil or unsuitable materials encountered on the ROW would also be handled in this manner.

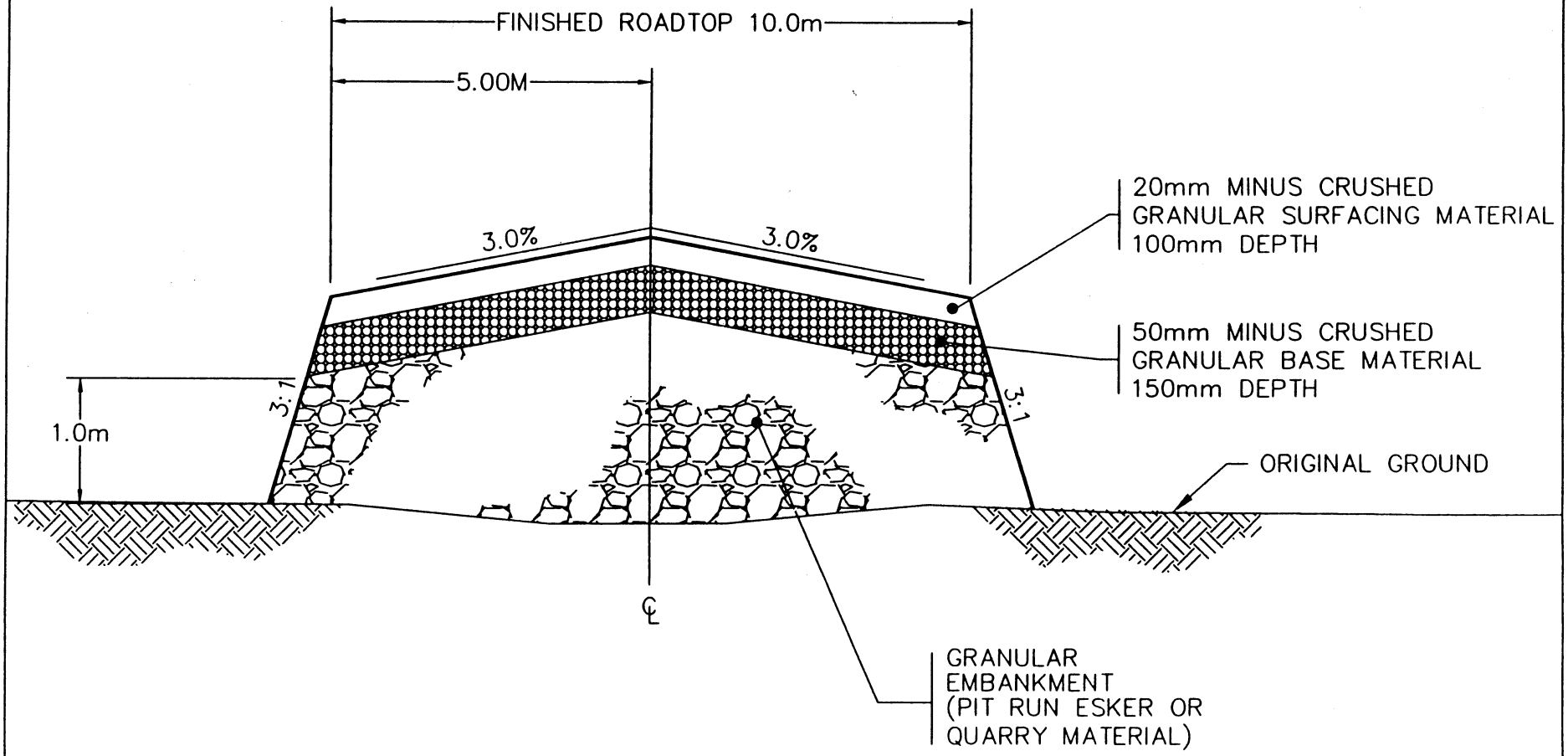
Because the ROW will be located to minimize grade, excavation requirements are expected to be minimized. Typically, the road would consist of an embankment constructed of borrow materials imported from off the ROW. Where cut slopes are required, every effort would be made to maximize use of the cut materials in embankment on either side of the cut to minimize haul requirements.

### *3.7.8 Embankment Construction*

The embankment would be constructed by end-dumping fill from the end of the built subgrade. Either tandem axle dump trucks or scrapers would be used to bring the fill material to the ROW from borrow pits, and, where appropriate, back-haul unsuitable or excess spoil material to the borrow pits. Figure 3.2 illustrates a typical road embankment cross-section. Special construction methods may need to be applied in areas of sensitive terrain and over rock outcroppings. Fill material would be distributed and compacted by bulldozer tractors, graders, and compactors within the surveyed roadbed. Fill material would be regularly inspected for compliance with design specifications. As the road bed development progresses, standard culvert installations would proceed concurrently, and in some instances precede the fill operation. Major watercourse crossings would be installed separately and temporary bypasses may be required at some locations.

With the development of the subgrade, drainage and erosion control measures would be installed. First, an upslope interceptor ditch would be installed parallel to the embankment to collect all upslope surface drainage and direct flow to cross drainage structures (culverts). Within the interceptor ditch, ditch bottom erosion would be controlled by velocity breaks such as timber, rock, or sandbag dikes, and ditch slope rates will be controlled to lessen erosion potential.

Organic soils salvaged from the ROW may be used as a source of vegetative material and growth medium to hasten the re-establishment of surface vegetation along the edge of the embankment. The inlets and outlets of all culverts would be riprapped to control erosion in areas intended to collect and transfer large volumes of water across the ROW. Disturbed surfaces would be reclaimed and stabilized either with vegetative material and/or physical structures.




## FIG. 3.2 - TYPICAL EMBANKMENT CONSTRUCTION

**SCALE: NTS**

Following completion of construction, a final course of select gravel would be distributed over the travel surface of the roadway to protect the subgrade from excessive rutting and erosion and to give an appropriate level of traction to traffic.

Wherever possible, frost susceptible materials would be avoided. Where this is not practical, such materials should be used in minimum depths in the embankment and practices to encourage the drying of the materials should be implemented.

### *3.7.9 Borrow Materials*

Borrow requirements and sources would be determined during and after route selection, following more detailed surveying of route topography. Borrow materials would be obtained from identified glacial deposits (*e.g.*, eskers, kames, drumlins) and rock quarries within or as close to the ROW as possible. The development of glacial deposits for borrow materials typically involves machine harvesting using bulldozers, scrapers, and dump trucks. In some instances, screening operations can be established to separate aggregate, sand, select fill, clay, and small riprap. Larger boulders can be crushed to select grades and sizes for specific uses or used as-is for large riprap. Such deposits are usually worked mechanically with no blasting requirements.

The development of rock borrow would involve blasting and surface mining techniques. If required, rock faces would be developed to allow for relatively large-scale harvesting. Such borrow sources usually supply very competent material for embankment construction, but at a fairly high unit cost. Their main purpose would be to supply select aggregate and riprap.

Borrow pits and access roads may be reclaimed at the completion of construction, if the borrow pit will not be used during the operation phase. Stockpiled vegetation and surficial organic materials removed during pit development would be used during reclamation. Borrow pits may continue to be used during operation for borrow or stockpiling.

### *3.7.10 Construction Vehicle Operation and Access*

During the route selection and design phase, vehicles to be used would likely include 4X4 trucks, high boy tractor trailers, mechanic's trucks, fuel trucks, graders, bulldozers, tracked drill rigs, nodwells, water trucks, and skid-mounted trailers.

Vehicle traffic would be restricted to those areas in which field surveys are undertaken, and would follow existing winter roads to the extent practical. During the construction phase, each of the construction sections could be expected to have the following vehicles in use:

**Table 3.7.1 Typical Vehicle Inventory for a Single Construction Spread**

| Vehicle Type | Number |
|---|---|
| 4X4 trucks | 10 – 15 |
| Service trucks | 5 |
| Fuel trucks | 2 |
| Low boy machine haulers | 2 |
| High boy supply trailers | 2 |
| Graders | 3 |
| Backhoes (+245) | 2 |
| Bulldozers (D-8) | 3 |
| Scrapers | 4 |
| Dump trucks | 5 |
| Water truck | 1 |
| Sheep's foot compactor | 1 |
| Case backhoe | 1 |

Additional miscellaneous specialty vehicles may be in use, if required. In-camp mechanics would maintain vehicles and equipment, including fueling, fluid changes, servicing, and most mechanical repairs. Vehicles assigned to camps isolated from the end of existing all-season access would be moved in on winter roads and removed at work completion either by winter road or new permanent access. Most vehicles will use diesel fuel, which would be stored in proper storage facilities in the camps and dispensed to individual vehicles by a mobile fueling truck.

During parts of the construction season when ambient temperatures are low, vehicles would likely be left running to keep them serviceable for the next work shift. This would increase the volume of emissions and period of noise from the vehicles over operating them only during work hours.

### *3.7.11 Laydown Areas*

Materials required for construction would be stockpiled in laydown areas, often located near or adjacent to construction camps. Materials to be stockpiled may include culverts, construction materials, such as cement, fuel, select borrow material, armour stone, or rip-rap, sandbags, machinery, piping, spare parts, and supplies. Laydown areas typically are located near major logistic support sites, often at the start, middle, and end of construction sections. Often these sites are converted to maintenance depots for the operational phase of the road. Because they are specifically chosen for materials handling, these sites are usually flat, well drained, and not susceptible to surface erosion. Laydown areas would be constructed of select granular material and will have a small maintenance building or trailer on site.

### *3.7.12 Construction Camps*

Each construction section will require a camp to support the ROW construction activity. Each camp typically would be located in the middle of any given construction section to minimize travel times for

work crews, and would have sufficient service capability to maintain a camp population of up to 200 people, including all contractor, proponent, regulatory, and camp operations staff assigned to the construction section. Each camp would encompass a large enough flat area (*ca.* 10 hectares) to include: accommodation, kitchen, and sanitary facilities; office space; maintenance buildings; parking for about 40 vehicles; fuel storage depot; water treatment and pressure system; sewage treatment system; gray water/wastewater disposal lagoon; power building and transformer facility; interconnecting walkways; and telecommunications. An additional 4 hectares may be required if the site is to include a laydown area.

Specific location criteria will include proximity to borrow materials and water supply available 12 months of the year with a peak demand of approximately 40,000 litres/day.

Sanitation requirements are set by the GNWT Department of Health and Social Services and will involve a set number of toilets, sinks, and showers calculated on the total anticipated camp population. The sewage disposal system may involve primary separation of solids from effluent, with solids being trucked to a suitable disposal facility, and all gray water and wastewater being placed in a local lagoon. At the end of camp operation, the lagoon would be sanitized, drained, and backfilled.

The camp would be operated by a licensed catering contractor who would supply all in-camp services, including food and non-alcoholic beverages, room maintenance with regular room cleaning and bed changes, recreational facilities, including games room, television, and videos, and general yard maintenance. The catering contractor also would be primarily responsible for maintenance of the water supply, sewage handling, food waste disposal, and sanitation.

All project personnel would be required, as a condition of employment, to attend orientation programs which would address, among other things, safety, community concerns, environmental issues, and project commitments.

It is likely that some of the construction camps would be used for maintenance shops, granular stockpiles, or other activities during road operations. However, upon completion of construction most camps would be dismantled, and all salvageable materials removed. The site would be graded back to original contours, and revegetated, preferably with native species. All earth works would be removed, the sewage lagoon will be sanitized, drained, and backfilled, the fuel tank farm would be dismantled, and the water supply system removed.

### *3.7.13 The Port*

A port would be constructed on the Arctic Coast, possibly within Bathurst Inlet as this location can be reached by ocean-going ships and is the closest port site to the majority of currently identified potential producing mineral properties.

Loading, unloading, and storage facilities would be required at the port site for fuels, materials and bulk concentrates. A wharf facility capable of handling a single 50,000 tonne OBO ship would be required. Ancillary support infrastructure including a camp, maintenance facility, and airstrip would also be located at the port.

Ships would offload supplies and take on concentrates during a period between August and October of each year. The shipping schedule and amount of traffic would depend on the extent of activity within the SGP and the types of ships being used, but is expected initially to be restricted to the late summer and fall period. It is not expected that more than one ship would be at the port at any one time.

### *3.7.14 Clean Up, Reclamation, and Rehabilitation After Construction*

With the exception of facilities to be used during the operation phase, all construction-related facilities would be dismantled and removed. All buildings, trailers, sheds, shelters, tankage, piping, service lines, powerlines, transformer stations, generators, pumps, walkways, and materials would be removed. Where site development involved construction of gravel pads and lagoons or dikes, these would be graded to match original contours and the surface prepared for application of natural soil amendments, where appropriate. Existing drainage and erosion control would be retained and enhanced if necessary, and all surface drainage collectors would include sediment control at the outlet. Borrow pits would be partially reclaimed where materials are exhausted, but may be left in a useable state where borrow is still available. Stockpiles of salvaged organic soil and/or spoil would be distributed along the toe of the embankment where appropriate as an aid in natural revegetation. Where spoil has been hauled to disposal sites, it would be graded to match original contours and stabilized.

The use of vegetative processes to stabilize reclaimed areas in the project area is not considered to be a medium term solution to stabilization. Some agronomic species would be used to generate quick cover but at best are expected to last only one growing season and then to act as a nursery crop. Emphasis would be on re-introduction of locally occurring species; however, these may take at least several years to reestablish. For these reasons, surface stabilization would be achieved by contouring, avoidance of surface flow concentration, and use of erosion resistant materials. Habitat enhancement would not be a goal of the reclamation program.

### *3.7.15 Hazardous Materials Management*

Highway construction does not involve the use of many hazardous chemicals. Hazardous materials likely to be in use include fuels, lubricants, and oils required for construction machinery operation, explosives for quarrying and right-of-way preparation, solvents, cleaners, bleaches, concentrates, and purifiers required for camp operation, and paints, lacquers, solvents, and thinners required for signage.
Fuel depots may be established at each camp facility and laydown area. Fuel depots will comprise an above-ground tank farm, including a lined and bermed containment dike capable of holding at least 125% of the volume of the largest tank inside the dike, and piping with flow control valves both at the tank outlet and at the fueling station. All handlers of fuel transfer would be trained in emergency response and clean-up procedures. An appropriate supply of tools and sorbent materials would be maintained at all fuel depots and spill contingency plans would be in place.

Fuel would be transferred from the depot to the work site in well-maintained and serviced fuel tank trucks. All transfer hoses would be examined daily and repaired at any sign of cracking or leakage. Transfer valves would be back-pressure checked regularly and all fueling nozzles would be equipped

with automatic cut-off handles. All fuel truck operators would be trained in fuel handling procedures. Fueling of construction machinery would be strictly controlled near any waterbody.

Solvents, thinners, paint, cleaners, fertilizers, and other chemicals would be stored in secure, weather proof, clearly marked containers. Handlers of hazardous materials would have access to WHMIS information sheets, and would be trained in material handling methods. Spill contingency plans would be prepared for all hazardous materials, in compliance with the GNWT *Spill Planning and Contingency Regulations*. Any spills would be reported to the NWT Hazardous Materials Spills Line as required by the Spill Planning and Contingency Regulations. Disposal of any hazardous materials would be undertaken in compliance with applicable authorizations.

### *3.7.16 Waste Management and Disposal*

There will be three streams of waste materials generated by the project. Camp operations would generate wastewater from sanitary uses, wash water, and kitchen water. Camps would also be a major source of solid and food wastes and camp materials. The construction of the highway would generate solid wastes in the form of piping, broken equipment, dunnage, formwork, and clean-up materials.

During camp operations, wastewater would be discharged to a lagoon capable of holding 125% of the predicted production for the life of the camp. The lagoon would be diked and lined with select material. At the completion of camp activities, the lagoon would be regraded and reclaimed. The wastewater contained in the lagoon would be treated to appropriate standards prior to release to the local environment. No petroleum products or toxic materials of any variety would be discharged into the lagoon.

Food wastes generated from camp operation would be strictly controlled. All garbage would be incinerated daily, and the residue disposed into a controlled landfill on the campsite. All workers would be required to bring lunch remains back to the camp for disposal. Other wastes, including paper products, empty containers, and cans, would also be incinerated after recyclable materials are removed.

At the completion of activities, a large amount of material and detritus likely would be left that is not salvageable. This material likely will include wood, metal, and some plastic products. Typically, this material would be buried in an on-site landfill.

## 3.8 Business and Employment Opportunities

Construction of the highway and port will generate employment and business opportunities. Every $100 million of road construction creates in excess of 350 person years of employment in the Northwest Territories (DOT 1995). Table 3.8.1 illustrates the personnel categories which can be expected to be required for the construction of the highway and port.

**Table 3.8.1 Typical Personnel Categories**

| | |
|---|---|
| • civil engineers;<br>• mechanical engineers;<br>• geotechnical engineers;<br>• structural engineers;<br>• hydrological engineers;<br>• electrical engineers;<br>• draftspersons;<br>• environmental inspectors;<br>• labourers;<br>• surveyors;<br>• heavy equipment operators;<br>• drillers;<br>• blasters; | • electricians;<br>• carpenters;<br>• plumbers;<br>• mechanics;<br>• truck drivers;<br>• cooks;<br>• concrete finishers;<br>• inspectors;<br>• flag persons;<br>• safety trainers;<br>• accountants; and<br>• administration staff. |

The number of business and employment opportunities generated by construction will depend on the extent of the corridor being constructed and the construction schedule. Preference for northern employee and business participation in the project is expected.

## 3.9 Operations and Maintenance

### *3.9.1 General*

The maintenance phase on any construction section would begin upon completion of the construction contract. Each section of completed highway would have a maintenance program that details location of support facilities and maintenance materials, staffing, inspection schedule, design information, construction records, and assigned machinery.

### *3.9.2 Maintenance Activities*

All maintenance activities would proceed in compliance with established road maintenance policies and programs, such as DOT's Highway Maintenance Manual (DOT 1993). The Manual comprises standards for highway maintenance, and provides details regarding rationale, responsibility, scheduling, and methods for specific maintenance activities.

Maintenance activities typically would involve regular inspection of the roadway and associated facilities. Particular attention would be given to maintenance of all cross drainage installations and watercourse crossings to ensure that drainage is not impeded and that the roadbed is not being eroded. In addition, the traffic surface would be inspected to ensure that it is retaining its grade and granular

surface and to correct any problems in a timely manner. During the winter, snow removal would be required.

Maintenance activities that are typically undertaken on (gravel) highways in the Northwest Territories, and which may be undertaken for the project are listed in Table 3.9.1. In addition, major repair works, such as regrading, resurfacing, and bridge or culvert repair or installation, may be required over the life of the project. Specialized maintenance activities may also be carried out with respect to air and marine infrastructure.

### *3.9.3 Maintenance Depots*

Maintenance depots likely would be centrally located in maintenance sections of approximately 250 – 300 kilometres in length. These depots would serve as support centres for maintenance staff and likely would include an office, a camp with a capacity of about 10 persons, several maintenance buildings, a laydown area for materials, and a fuel depot. Additional facilities associated with maintenance depots may include an emergency airstrip and helipad, and a telecommunications installation. The location of maintenance depots would be determined by the anticipated maintenance sections, location of camps or laydown areas developed during construction, and proximity to borrow pits.

### *3.9.4 Hazardous Materials Management*

The hazardous materials management program implemented during the construction phase would be continued during the maintenance phase. Carriers of hazardous materials would be required to adhere to federal and territorial regulations respecting the storage and transportation of hazardous materials, including training of personnel, preparation of spill contingency plans, and maintenance of equipment. Any spills would be reported to the NWT Hazardous Materials Spills Line as required by the Spill Planning and Contingency Regulations

### *3.9.5 Waste Management and Disposal*

The waste management and disposal program implemented during the construction phase would be continued during the maintenance phase.

**Table 3.9.1 Typical Highway Maintenance Activities**

| |
|---|
| **Road Surfaces and Shoulders**<br>• wet and dry blading;<br>• gravel surfacing and repairs;<br>• grade repairs; and<br>• dust treatment. |
| **Drainage**<br>• culvert cleaning and inspection;<br>• culvert repair and replacement;<br>• ditch cleaning;<br>• ditch reclamation; and<br>• beaver dam removal. |
| **Bridges**<br>• bridge inspection; and<br>• bridge cleaning and maintenance; |
| **Roadside**<br>• mowing, brushing, cutting of vegetation (hand or mechanical);<br>• brush, debris, and litter removal;<br>• rest stop clean-up;<br>• survival cabin maintenance; and<br>• weigh scales/compliance. |
| **Winter**<br>• snow plowing;<br>• ice blading;<br>• chemical ice removal;<br>• sanding;<br>• snow fences;<br>• culvert steaming; and<br>• glaciation/overflow control. |
| **Traffic Services**<br>• guide rail maintenance;<br>• sign erection and maintenance; and<br>• traffic counting. |
| **Service Functions**<br>• highway patrols;<br>• equipment servicing and repair;<br>• material stockpiling;<br>• building/grounds maintenance; and<br>• camp operations. |

### *3.9.6 Traffic*

When complete, the corridor would provide all-weather, all-season access to the SGP from the existing NWT highway system. Access from the north would be year round; however, ship access to the port in Bathurst Inlet is expected to occur for a maximum of three months per year. Vehicles accessing existing mines or exploration properties (*e.g.*, personnel, equipment, and supplies in, ore and concentrates out) are expected to comprise a major component of user traffic. Additional user traffic likely would be generated by residents, service providers, suppliers, tourists, and renewable resource harvesters.

Traffic on the Lupin Winter Road which services the SGP, albeit for only a 75 day period annually, provides some indication of the potential level of traffic. Industrial truck traffic on the Lupin Winter Road totaled almost 2000 round trips in 1996, climbing to 3500 in 1997, and dropping to 2500 in 1998 (DOT 1998). The increase in traffic during 1997 is attributable to the construction of the Ekati Mine at Lac de Gras. While significant traffic to Ekati Mine continued in 1998 to support mine construction, overall volume was reduced because of the suspension of operations at the Lupin Mine. While total traffic volume is expected to increase as a result of the presence of the all-weather corridor, it would expected to be spread out over the entire year. Traffic volumes are expected to be highest in the summer months when ships will be able to access the port site and during the winter when winter roads to specific developments will be in operation. Some public traffic can be expected; however, this would likely be limited, as there are no plans to include public facilities along the road.

Maintenance traffic would be determined on an annual basis, and would depend on maintenance needs and location of maintenance depots. Inspection patrols of the highway would be carried out, and these patrols would monitor factors affecting highway structure, user safety and comfort, and environmental integrity.

### *3.9.7 Business and Employment Opportunities*

Maintenance camps are expected to be established every 250-300 km along the route. Each camp would have staff and equipment available to maintain sections of the road and respond to emergency road repair requirements. Table 3.9.2 illustrates the number of staff which could be expected to work out of each Camp.

**Table 3.9.2 Typical Maintenance Employment Requirements**

| |
|---|
| **Permanent Staff**<br>• One Maintenance Supervisor;<br>• Two Heavy Equipment Operators;<br>• One Light Equipment Operator;<br>• One Mechanic; and<br>• One Superintendent for every three camps. |
| **Seasonal Staff**<br>▪ Two Light Equipment Operators; and<br>▪ Two Labourers |

Additional staff would be required during periods when extra ordinary maintenance or major repair programs are carried out. In addition, road maintenance may present business opportunities for gravel crushing, gravel resurfacing, right-of way maintenance, equipment rental, and camp support.

## 3.10 Malfunctions and Accidents

Malfunctions and accidents which could occur in relation to the project include: loss of highway integrity or reduced safety due to frost-related hazards; fires; spills of fuel or hazardous materials; and vehicle collisions or breakdowns.

### *3.10.1 Frost-Related Hazards*

Permafrost is expected to underlie most of the proposed route. Where permafrost occurs in fine-grained sediments or sediments with high moisture content, or where massive ice occurs, surface disturbance can disrupt ground thermal conditions resulting in differential thaw subsidence, heave, or slope failure, and consequent loss of highway integrity.

Frost-related hazards would be avoided to the extent practical during route selection, and would be considered during construction planning and road design. Risk areas would be identified through detailed field investigations, and appropriate construction techniques and mitigative measures that preserve stable ground thermal conditions would be implemented. These may include, for example, removal of frost-susceptible organic or mineral sediments, use of coarse-grained fill to elevate the permafrost table into stable material, or installation of thermo-piles to maintain frozen ground conditions.

The possibility of icing (*aufeis*) at culvert installations presents some concern for maintenance of cross drainage, and also for traffic safety. Standard inspection and maintenance procedures would be carried out during risk periods.

A failure of highway integrity could cause vehicle accidents, as well as adverse environmental effects if the failure occurred in the vicinity of watercourses.

### *3.10.2 Fires*

Fires could be initiated during burning of brush and slash or debris, through careless disposal of smoking materials, or through natural causes. Uncontrolled fires could adversely affect the health and safety of workers and the public, wildlife, terrestrial and aquatic habitat, and air quality. The magnitude, extent, duration, and frequency of fires would be minimized by prevention and response procedures.

### *3.10.3 Spills of Fuel or Other Hazardous Materials*

A spill of fuel or other hazardous materials may occur during construction or operation of the highway. Potential risk activities include vehicle and equipment refueling, material transportation, transfer, and storage, and vehicle/equipment accidents.

Spills could adversely affect human health and safety, aquatic and terrestrial habitat, fish and wildlife, and air quality. The magnitude, duration, and extent of these effects would depend on the location and timing of the spill, the volume of the spill, and the material released. Prevention and emergency response procedures, equipment and training would minimize the likelihood of an accidental spill, and the resulting effects. Any spills would be reported to the NWT Hazardous Materials Spills Line as required by the Spill Planning and Contingency Regulations.

### *3.10.4 Vehicle or Equipment Accidents*

Vehicle-related accidents that could occur during construction and operation may include vehicle-vehicle, vehicle-wildlife, and vehicle/equipment-pedestrian collisions, and vehicle breakdowns. Road gradients and curve radii, posted speed limits, safe stopping and passing sight distances and signage would be incorporated into road design to enhance traffic safety. The relatively low traffic density would reduce the potential for vehicle collisions. Most vehicles using the highway would be equipped with radio telephones and some emergency equipment.

In areas of wildlife activity, signs would be posted to warn drivers of the presence of wildlife, and reduced speed limits will be posted as appropriate. Maintenance depots would be equipped with some emergency supplies and an airstrip for medical evacuations.

## 3.11 Decommissioning

An all-weather road into the SGP if constructed, is expected to remain in service until it is no longer required. The major objective of creating all-weather road access to the SGP is to reduce the costs of developing the mineral resources of the region, with a secondary objective of reducing the costs of the inter-community movement of people and goods. Once access is provided, it is expected that it would always be required. It may be necessary to decommission certain segments of the road due to inactivity or interference with sensitive habitat or species; however, it is unlikely that the entire road would be decommissioned.

All-weather roads in the NWT are designed and constructed to have a long useful life. Typically, reconstruction of certain portions of the road would be required during the lifetime of the road to address deteriorating conditions, increased maintenance expenditures, or the need to alter the alignment to avoid or access sensitive terrain or environmental resources. Depending on use, maintenance costs, environmental concern and public concern it is likely that certain segments of the road may be temporarily closed or permanently decommissioned.

## 3.12 Environmental Management

The proponents of a large project such as the SGP TC would be required to demonstrate a commitment to the protection of the environment throughout the planning, design, construction, and operations phases of the project.

The initial scoping effort and planning stage would identify environmental, cultural and socio-economic values, which must be protected throughout the duration of the project. Route reconnaissance during the design phase would identify micro-level environmental concerns which must be mitigated along with larger concerns, through the application of appropriate design strategies.

During the design and environmental review process, the proponents likely would be required to develop environmental management plans for construction and maintenance. These plans will specify construction and operational practices to mitigate environmental effects and are expected to address such issues as accessing and using granular materials, camp and other supporting infrastructure, watercourse crossings, construction and maintenance practices, use of hazardous materials, emergency response, seasonal restrictions, and other issues.

## 3.13 Bibliography


Armstrong, J. 1998. Mineral Potential of the Slave Geological Province: An Overview. Presentation to the NWT Highways Strategy, Preliminary Planning Workshop. June 4, 1998.

Arthur Anderson LLP et al. 1999. Slave Geological Province Transportation Corridor Need/Feasibility Study. Final report provided to the Department of Transportation GNWT.

Department of Transportation. 1990. Northwest Territories Transportation Strategy. Government of the Northwest Territories.

Department of Transportation. 1993. Highway Maintenance Manual. Prepared by Highway Operations Division, Department of Transportation.

Department of Transportation. 1995 Northwest Territories Transportation Strategy Update. Government of the Northwest Territories.

Department of Transportation. 1998. Northwest Territories Highway Traffic, 1996.

Dubose, L. 1979. Northeast Mackenzie District Transportation Study – Phase I. Prepared by Economic Analysis Division, Department of Indian Affairs and Northern Development.

Geowest, 1999. Multi – Level Mapping and Route Analysis, Slave Geological Province Transportation Corridor. Prepared for Highways and Engineering Division, Department of Transportation, Government of the Northwest Territories.

Robertson, R. G. 1955. The Northwest Territories Its Economic Perspective, A Brief Presented to the Royal Commission on Canada's Economic Prospectives. Government of the Northwest Territories

Klohn-Crippen Consultants Ltd. 1993. Environmental Evaluation of the Izok Project. Submitted to the Regional Environmental Review Committee, DIAND. Metall Mining Corporation.

# 4 REGULATORY AND ENVIRONMENTAL REVIEW REQUIREMENTS

## 4.1 Introduction

An important consideration in the planning for the development of a transportation corridor includes an examination of the regulatory and environmental assessment requirements that must be satisfied to achieve project approval. This chapter identifies authorizations, permits, and licences that may be required to develop the proposed SGP TC (as it is presently conceived) and the probable environmental assessment and review process that would apply to the project. Information contained in this section has been gathered from a review of existing legislation, regulations, guidelines, and operational procedures, and consultation with officials from regulatory and environmental assessment agencies.

There has been considerable change and evolution of the regulatory framework for environmental assessment, land use planning, and resource management in Canada's North in recent years, due to:

- New and revised federal legislation (*e.g.*, the *Canadian Environmental Assessment Act* (*CEAA*) and regulations, the *Mackenzie Valley Resource Management Act* (*MVRMA*) and regulations);
- The creation of Nunavut; and
- The finalization of Aboriginal land claims agreements (*e.g.*, Nunavut Land Claims Agreement (NLCA), Inuvialuit Final Agreement, Gwich'in Comprehensive Land Claim Agreement, Sahtu Dene and Metis Comprehensive Land Claim Agreement) (DIAND 1997a-d).

Through the land claim settlement process, jurisdictional responsibility over certain lands, resources, and land and water use has been and is being transferred to Aboriginal groups from the federal government (primarily Department of Indian Affairs and Northern Development (DIAND)). Through land claims agreements and new federal legislation aimed at implementing provisions of the agreements, new regulatory bodies are being established with responsibility for regulating the use of settlement and Crown lands and water within settlement areas and in areas where no claims have been settled. Concurrently, new procedures and requirements are being established for the review of applications for permits and licences for the use of land and water. Although similar, the specific provisions of each land claim settlement, and therefore the ensuing resource management system for each settlement area vary.

Consequently, the regulatory framework in Canada's North is becoming increasingly complex, with permitting and licensing responsibilities in Nunavut and the Northwest Territories held by federal and territorial government departments, Aboriginal organizations, and co-management agencies. Although existing review processes and procedures have been extensively adapted, the new regulatory framework remains largely untested, particularly with respect to the review of large development projects involving multiple jurisdictions. The regulatory framework will continue to evolve in coming years as additional land claims are settled, newly established regulatory processes are tested, and new (federal) enabling legislation is developed.

The following sections describe: the current regulatory regime for those lands likely to be crossed by the SGP TC; the evolving land use planning process that would apply to the future development of the SGP TC; and the existing and evolving environmental assessment processes that may apply to the future development of the SGP TC.

## 4.2 Current Regulatory Regime

Development of the SGP TC (as it is presently conceived) will involve a number of distinct undertakings and activities, requiring authorizations from a variety of federal, territorial, Aboriginal, and resource co-management agencies. Table 4.2.1 provides a preliminary listing of permits, licences, and authorizations that may be required to develop the SGP TC. Regulatory procedures that must be followed differ for each agency. The application for a permit, licence, or authorization will usually initiate a review of the project under one or more environmental assessment processes, unless the proposed activity has been explicitly exempted from assessment.

Within Nunavut, DIAND regulates land use on Crown lands, whereas Nunavut Tungavik Incorporated (NTI) and the regional Inuit associations regulate subsurface and surface land use on Inuit Owned Lands. The Nunavut Water Board regulates water use in Nunavut. Environmental screening and assessment is the responsibility of the Nunavut Impact Review Board (NIRB). The NLCA establishes these new boards and regulatory processes, with the *Nunavut Land Claim Settlement Act* and the *Nunavut Act* being the federal legislation enabling the implementation of the provision of the NLCA. It is expected that legislation implementing a comprehensive resource management system in Nunavut will be forthcoming.

Within the Mackenzie Valley area of the Northwest Territories, the *MVRMA* implements provisions of the Gwich'in Comprehensive Land Claim Agreement and the Sahtu Dene and Metis Comprehensive Land Claim Agreement, and establishes the following co-management boards as institutions of public government:

- Regional Land Use Planning and Land and Water Boards in the Gwich'in Settlement Area;
- Regional Land Use Planning and Land and Water Boards in the Sahtu Settlement Area;
- The Mackenzie Valley Land and Water Board (MVLWB); and
- The Mackenzie Valley Environmental Impact Review Board (MVEIRB).

The regional Gwich'in and Sahtu Land and Water Boards are permanent regional panels of the MVLWB, and regulate the use of settlement and Crown land and water use in the Gwich'in and Sahtu settlement areas, respectively. Additional regional boards are expected to be established as other land claim agreements are finalized. The MVLWB regulates the use of land and water for development activities that may affect more than one settlement area in the Mackenzie Valley, or whose effects may extend beyond the Mackenzie Valley. In unsettled land claim areas, DIAND will continue to be responsible for regulating land and water use until regional boards are established through land claim agreements. The *MVRMA* does not apply within the Inuvialuit Settlement Area. Figure 4.1 illustrates the geographical jurisdiction of the environmental assessment processes in Nunavut and the Northwest Territories.

## Table 4.2.1 Permits, Licences, and Authorizations That May be Required to Develop the SGP TC

| Permit/Approval | Legislation | Activity | Agency |
|---|---|---|---|
| ***Planning, Design, And Environmental Assessment Phase*** | | | |
| Land Use Permit | *MVRMA*<br>*Territorial Lands Act and regulations*<br>*Nunavut Land Claims Settlement Act* | Route clearing, location of camps, miscellaneous land use | Mackenzie Valley Land And Water Board<br>DIAND<br>Nunavut Tungavik Incorporated, Kitikmeot Inuit Association |
| Water Licence | *NWT Waters Act*<br>*Nunavut Waters Act* | Water use and waste disposal at camps | Nunavut Water Board<br>Mackenzie Valley Land and Water Board |
| Archaeological Research Permit | *Heritage Canada*<br>*NWT Archaeological Resources Act*<br>*Nunavut Land Claims Settlement Act* | Archaeological research and investigations | Heritage Canada<br>Prince of Wales Northern Heritage Centre, GNWT<br>Inuit Heritage Trust |
| Scientific Research Permit | *NWT Research Act*<br>*Nunavut Research Act*<br>*NWT Wildlife Act*<br>*Nunavut Wildlife Act* | Conduct of research and wildlife studies in support of environmental assessment | Aurora Research Institute<br>Nunavut Research Institute<br>GNWT Resources, Wildlife and Economic Development<br>Nunavut Department of Sustainable Development |
| ***Construction Phase*** | | | |
| Land Use Permit/Quarry Permit | *MVRMA*<br>*Territorial Lands Act*<br>*Nunavut Land Claims Settlement Act* | Route clearing, camps, laydown and staging areas, borrow sources, port construction, bridges | Mackenzie Valley Land And Water Board<br>DIAND<br>Nunavut Tungavik Incorporated, Kitikmeot Inu it Association |
| Authorization or Letter of Advice for Works or Undertakings Affecting Fish Habitat | *Fisheries Act* | Construction of watercourse crossings affecting fish habitat, construction of port facilities | Fisheries and Oceans Canada |
| Permit for construction within navigable waters | *Navigable Waters Protection Act*<br>*Navigable Waters Works Regulations* | Construction of bridges, culverts, or other structures across or over navigable water bodies. | Canadian Coast Guard, Fisheries and Oceans Canada |
| Water Licence | *NWT Waters Act*<br>*Nunavut Waters Act* | Water use and waste disposal at camps, bridge crossings | Nunavut Water Board<br>Mackenzie Valley Land and Water Board |
| Explosives Magazine Permit, Temporary Blasting Permit | *Explosives Act* | Temporary storage of explosives at laydown and work areas | Natural Resources Canada |
| Timber Permit | *NWT Forest Management Act*<br>*MVRMA* | Cutting of timber for road construction and support facilities | GNWT Resources, Wildlife and Economic Development<br>Mackenzie Valley Land and Water Board |
| Registration, permit | *Motor Vehicles Act* | Transportation, use of heavy | GNWT Transportation |

| Permit/Approval | Legislation | Activity | Agency |
|---|---|---|---|
| | | equipment | |
| ***Construction Phase cont'd*** | | | |
| Certificate, permit | *Transportation of Dangerous Goods Act* | Transportation of dangerous goods | Transport Canada |
| Permit, criteria | *Public Health Act* | Sewage disposal, food premises, sanitation at camps | NWT Health and Social Services |
| Port and Shipping Operation Authorizations | *Canada Shipping Act*<br>*Navigable Waters Protection Act*<br>*Arctic Waters Pollution Prevention Act*<br>*Fisheries Act*<br>*Transportation of Dangerous Goods Act,*<br>*Arctic Shipping Pollution Prevention Regulation*<br>*Oil Pollution Prevention Regulations* | Approval of port and shipping activities | Canadian Coast Guard, Fisheries and Oceans Canada<br>Nunavut Impact Review Board |
| ***Operations Phase*** | | | |
| Land Use Permit<br>Licence of Occupation | *MVRMA*<br>*Territorial Lands Act and regulations*<br>*Nunavut Land Claims Act*<br>*Public Highways Act*<br>*Federal Real Property Act* | Lease or other form of long - term land tenure | Mackenzie Valley Land and Water Board;<br>DIAND,<br>Nunavut Tungavik Incorporated, Kitikmeot Inuit Association |
| Port and Shipping Operation Authorizations | *Canada Shipping Act*<br>*Navigable Waters Protection Act*<br>*Arctic Waters Pollution Prevention Act*<br>*Fisheries Act*<br>*Transportation of Dangerous Goods Act,*<br>*Arctic Shipping Pollution Prevention Regulation*<br>*Oil Pollution Prevention Regulations* | Approval of port and shipping activities | Canadian Coast Guard, Fisheries and Oceans Canada<br>Nunavut Impact Review Board |

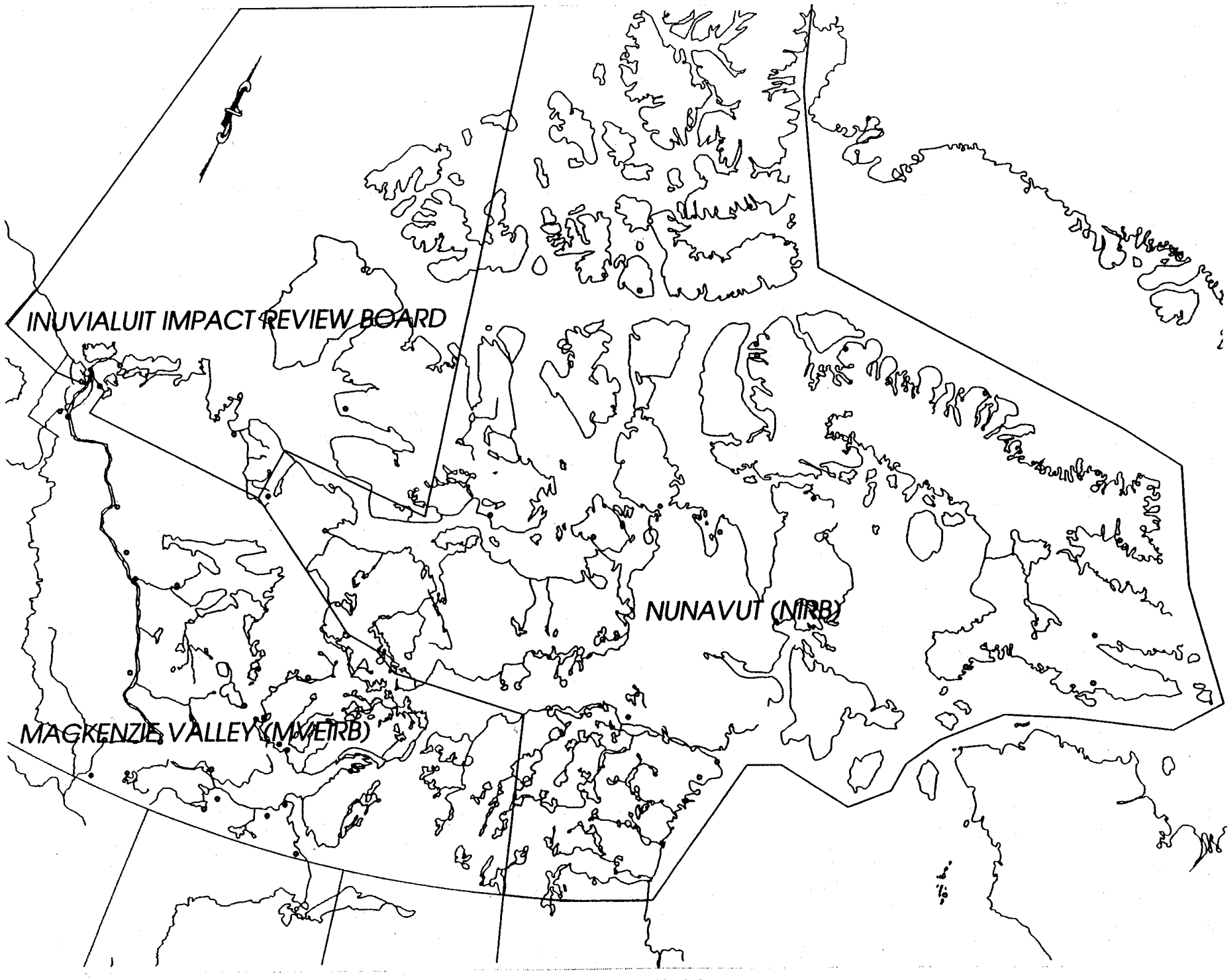



*FIGURE 4.1:*
*GEOGRAPHIC JURISDICTION OF ENVIRONMENTAL ASSESSMENT PROCESSES IN THE NORTHWEST TERRITORIES AND NUNAVUT*

New developments in the SGP may be subject to environmental assessment pursuant to one or more processes. NIRB has been established to screen and review the potential environmental effects of projects proposed within Nunavut, while for projects located within the Mackenzie Valley area of the Northwest Territories, these responsibilities lie with the MVEIRB. In addition, *CEAA* may also apply to projects within Nunavut that have federal involvement pursuant to ss. 5(1) of *CEAA*, or to any project that may cause transboundary effects (P. Scott, pers. comm. 1999). *CEAA* does not apply in the Mackenzie Valley unless referred to the federal Minister of the Environment by the responsible ministers pursuant to *ss*. 130 (1)(c) or by the MVEIRB pursuant to *ss*. 141 (2)(a) of the *MVRMA.*

### 4.3 Land Use Planning

Land use planning boards have been or will be established in both Nunavut and the Northwest Territories. When land use plans have been completed and approved for a region, all developments will be required to conform with such land use plans. During preliminary environmental screening, project proposals will be reviewed for conformance with approved land use plans. Non-conforming proposals will be rejected or may cause an amendment to the plan to be issued, enabling the proposed project to proceed through the regulatory process.

The Nunavut Planning Commission has been established as an institution of public government in Nunavut with the purpose of developing land use plans that guide and direct resource use and development in Nunavut. The Nunavut Planning Commission has prepared a draft land use plan for the West Kitikmeot region, which includes the area of the proposed SGP TC located in Nunavut. While the draft plan has yet to be approved, it does address the development of transportation corridors. The draft land use plan proposes the following process for the review of a proposed transportation corridor within the West Kitikmeot:

> "All parties wishing to develop a transportation and/or communications corridor must submit to the Nunavut Planning Commission a detailed application for the project. This application must include an assessment of alternate routes, plus the cumulative effects of the preferred route. It shall provide reasonable options for other identifiable transportation and utility facilities. The Nunavut Planning Commission and the Nunavut Impact Review Board shall publicly review the proposed corridor to determine whether the proposal adequately meets the guidelines set out in Appendix 6 and 7 (in draft land use plan). Once it is determined that a proposal does meet the guidelines, the Commission may request the Minister of DIAND to amend the plan to include the new corridor" (NPC 1998).

Future proponents should be aware of, and will be required to comply with, the provisions of the West Kitikmeot Land Use Plan, once it has received approval.

Within the Mackenzie Valley, land use planning boards have been established only for the Gwich'in and Sahtu settlement areas. Land use planning in that portion of the SGP located within the Northwest Territories likely will be addressed in land claim settlements between the federal government and the Dogrib Treaty 11 Council and the Akaitcho Territory Treaty 8 Tribal Council, in their respective settlement areas. Amendments to the *MVRMA* are contemplated to fully implement the potential provisions of future land claim settlements.

## 4.4 Environmental Assessment and Review Processes within the Slave Geological Province

As it is presently conceived, the potential SGP TC transects both Nunavut and the Northwest Territories, and would be subject to environmental assessment processes established in each jurisdiction. Additionally, *CEAA* may also apply, depending on the project scope. A summary of each of these environmental assessment processes is documented below, followed by a discussion of the potential process to which the proposed SGP TC may be subject.

### *4.4.1 Nunavut Impact Review Board*

#### 4.4.1.1 Background

Article 12 of the NLCA establishes processes for the screening and review of project proposals on land and marine areas within the Nunavut Settlement Area (including Inuit Owned Lands, Commissioner lands, and Crown lands) and to the Outer Land Fast Ice Zone. Shipping associated with project proposals within Nunavut is also subject to review under the NLCA. NIRB was established in 1996, under Article 12.2.1 of the NLCA, as an institution of public government with responsibilities for environmental assessment. NIRB's primary functions are to screen and review the ecosystemic and socio-economic effects of project proposals, and to make recommendations to the federal or territorial Minister(s) responsible for authorizing such projects to proceed. NIRB also can issue recommendations for monitoring of project effects, but the responsibility for enforcement of such provisions lies with the agency issuing a permit, licence, or authorization. NIRB's objectives are to protect the ecosystemic integrity of Nunavut, and to protect and promote the existing and future well-being of the residents and communities of Nunavut, and of Canada. It is anticipated that federal legislation to fully implement the resource management provisions of the NLCA will be developed (P. Scott, pers. comm. 1999).

#### 4.4.1.2 Review Paths

Under the Nunavut environmental screening and review process, there are three types of review to which project proposals may be subject, depending on the scope of the project, potential biophysical and socio-economic effects, potential cumulative effects, and degree of public concern.

The different types of possible review are:

- Screening;
- NIRB review; and
- Federal panel review.

Schedule 12-1 of Article 12 of the NLCA exempts certain project proposals from screening by NIRB, including:

- Land use activities not requiring a permit from the federal or territorial governments;
- Land use activities requiring only a Class B land use permit;
- Construction and operation of municipal infrastructure, excluding bulk fuel plants, nuclear power generation, hydro power, or any industrial activity;
- Tourist facilities of 20 beds or less outside of a municipality;
- Water uses that do not require a public hearing by the Nunavut Water Board;
- Prospecting, staking, or locating a mineral claim, unless it requires more than a Class B land use permit; and
- Such other activities and projects as may be agreed upon by the appropriate Minister.

Project proposals that are normally exempted can be referred (by the NPC) to NIRB for screening where there are concerns regarding potential cumulative effects. Also, project proposals located outside the Nunavut Settlement Area may be reviewed by NIRB if there may be significant adverse effects within the Nunavut Settlement Area. For projects outside of Nunavut, NIRB may, upon request by DIAND, or on request by a Designated Inuit Organization and consent of DIAND, review a project proposal located outside of Nunavut which may have significant adverse ecosystemic or socio-economic effects on Nunavut (NLCA 1993).

Unless exempted, all project proposals are subject to screening by NIRB. A project proposal may be approved at the screening stage if the adverse effects are not likely to be significant, and if the adverse effects are predictable and mitigable with known technology. If a project proposal may cause significant adverse effects or significant public concern, or involves unknown effects or technology, a review of the project proposal may be required. Such review may be carried out by a federal environmental assessment panel, where required by law, or by NIRB. Procedures for screening and review of project proposals are further described in NIRB's Operational Procedures (NIRB 1997a) and Draft Rules of Practice (NIRB 1997b).

#### 4.4.1.3 Process

The initial step in obtaining approval for a project proposal within the Nunavut Settlement Area is the submission of an application for a permit, licence, lease, or approval to an authorizing agency (*i.e.*, government department, Designated Inuit Organization, regulatory board). More than one authorization may be required for undertakings and activities on land or water.

Project proposal applications must contain the information specified by NIRB in Appendix B of the NIRB Operational Procedures (NIRB 1997a), including details regarding:

- Background information;
- Project description;
- Existing biophysical, social, cultural, and economic environment;
- Public consultation process;
- Biophysical, social, cultural, and economic effects;
- Cumulative environmental effects;
- Mitigation measures and residual effects;
- Abandonment/decommissioning plans;
- Monitoring and maintenance plans; and
- Information sources.

The authorizing agency is responsible for initial processing of the application. If regional land use plans are in place, the application is forwarded to the NPC for review of conformity with the land use plan. Where a project proposal conforms to approved land use plans, or if a variance has been approved, the NPC forwards the project proposal application to NIRB for screening. If no approved land use plans exist (as is currently the case in Nunavut), project proposal applications are referred directly by the authorizing agency to NIRB for screening.

**Screening**

The initial steps of the screening involve notification of the proponent and authorizing agencies, establishment of a timeline for a screening determination (where not specified by regulation), and distribution of the project proposal application to appropriate stakeholders. Taking into account all comments received from stakeholders regarding the project proposal, existing scientific information, Inuit traditional knowledge, and the information provided by the proponent, NIRB then reviews the potential effects of the project and the level of public concern about and/or support for the project proposal. Once the screening has been completed, NIRB will produce a Screening Decision Report that documents its determination as to whether the project proposal should be approved without further review, abandoned or modified by the proponent, or subject to review under Part 5 or 6 of the NLCA. The NIRB Screening Decision Report is submitted to the authorizing agency.

If NIRB determines that the project proposal should proceed without further review, NIRB may include in its Screening Decision Report terms and conditions to be attached to the authorizations to be issued. The authorizing agency will include the NIRB terms and conditions in the final authorization. However, where the authorizing agency disagrees with the recommended terms and conditions, the agency must provide NIRB with a rationale for omissions from the final authorization. Monitoring of adherence to terms and conditions is the responsibility of the authorizing agency. NIRB will complete its screening and issue its Screening Decision Report to the authorizing agency within applicable legislated timelines to allow the agencies to meet their legislative requirements. However, should an

agency have no legislated time limits regarding the issuance of permits, NIRB will provide its Screening Decision Report within 45 days of receiving the project proposal application.

If a review of the project proposal is determined to be required, NIRB will identify particular issues or concerns to be addressed in the review. The project proposal application will be referred either to the federal Minister of the Environment for review by a federal environmental assessment panel or to NIRB for review pursuant to the process set out in the NLCA. (Where the project proposal application is determined by NIRB to be inadequate for screening, or to be not in the national or regional interest, the proponent may be advised to provide clarification, to abandon the project, or to modify the project proposal and re-submit an application for screening by NIRB.)

**NIRB Review**

The scope of the project to be assessed and the scope of the assessment will be determined by NIRB. NIRB will hold a community meeting to facilitate public input into the scoping determination and the identification of Valued Environmental Components and Valued Socio-Economic Components upon which the review should be focused. Upon completion of the scoping exercise, a NIRB Panel will be established to carry out the environmental review. The NIRB Panel may comprise some or all of the regular NIRB members. When interjursidictional projects or projects with potential transboundary effects are being reviewed NIRB may invite individuals from other jurisdictions or environmental assessment boards to be part of the Panel. The NIRB Panel will determine if the review can proceed using the project proposal application document, or if an Environmental Impact Statement (EIS) will be required. (It is anticipated that for most project proposals reaching the review stage, an EIS will be required.)

If the NIRB Panel determines that an EIS is required, guidelines for the preparation of an EIS will be drafted, circulated to stakeholders for review and comment, finalized, then issued to the proponent by the NIRB Panel. It then will be the responsibility of the proponent to prepare an EIS in accordance with the guidelines issued by the NIRB Panel. Information to be contained in an EIS is specified in Article 12.5.2 of the NLCA; additional guidance with respect to general principles and recommended format for an EIS is contained in Appendix F of the NIRB Operational Procedures (NIRB 1997a). However, detailed information requirements will be specified in the guidelines.

Once submitted by the proponent to NIRB, the EIS will be subject to a conformity and deficiency review by the NIRB Panel and stakeholders. The proponent must provide any additional information requested by NIRB. (A program of public consultation by NIRB and/or the proponent may be appropriate to facilitate this review.)

Once accepted by NIRB as complete, the EIS will be subject to a technical and public review. NIRB may conduct its environmental review by means of correspondence, formal or informal public hearings, or other appropriate procedures. NIRB will provide the proponent with a summary of review participants' concerns; the proponent will have an opportunity to respond to any such concerns. The

proponent's responses will be considered by the NIRB Panel in making its determination. Article 12.5.5 of the NLCA specifies matters to be taken into account by NIRB during the review of a project proposal.

Upon completion of the review, the NIRB Panel will prepare a Decision and Assessment Report providing an assessment of the project proposal and potential effects, and the determination as to whether or not the project proposal should proceed. The Decision and Assessment Report will be submitted to the authorizing agency, and, where the determination is for the project proposal to proceed, will include recommended terms and conditions to be included in the authorization. The authorizing agency may accept or reject the NIRB Panel's determination and the recommended terms and conditions, but must provide a written rationale to NIRB regarding any modification or rejection of a determination or recommended terms and conditions. Where it has been determined that a project should proceed, NIRB will issue a Project Certificate including the terms and conditions accepted or varied by the authorizing agency.

To date, only one project proposal, for which the authorizing agency is DIAND, has been referred to NIRB for review; this review is expected to commence in the summer of 1999.

**Federal Environmental Assessment Panel Review**

Following NIRB's screening determination, the authorizing agency may refer the project to the federal Minister of the Environment to establish a federal environmental assessment panel where a project has federal involvement pursuant to ss. 5(1) of *CEAA*, or may cause transboundary effects (P. Scott, pers.comm. 1999). The assessment process likely would be negotiated between the Canadian Environmental Assessment Agency and NIRB officials (J. Edwards, pers. comm. 1999). The panel would comprise members nominated by the Designated Inuit Organization, territorial government Minister, and, if necessary and as appropriate, other Aboriginal groups from adjacent areas outside the Nunavut Settlement Area. The panel may issue to the proponent guidelines for the preparation of an EIS; NIRB would review and have input to such guidelines. Guidelines would include, as appropriate, the information specified in Article 12.5.2 of the NLCA.

Following public hearings and the completion of its review, the panel would prepare and submit its report to the federal Minister of the Environment and the authorizing agency, who shall make it public and forward a copy to NIRB for review. Within 60 days, NIRB will review the panel report and forward to the authorizing agency comments regarding potential effects within Nunavut, report deficiencies, and any additional recommended terms and conditions of approval. After consideration of the panel report and the recommendations of NIRB, the authorizing agency shall accept, reject, or vary the report and terms and conditions as they apply to Nunavut. Upon completion of the federal environmental assessment panel review, if the project proposal is to proceed, NIRB will issue a Project Certificate including any terms and conditions which have been accepted by the authorizing agency.

To date, no project proposals within Nunavut have been referred to the federal Minister of the Environment for review by a federal environmental assessment panel.

**Joint Reviews and Transboundary Effects**

The NLCA provides for joint reviews of transboundary environmental effects with neighboring jurisdictions (Part 11 of Article 12). NIRB may, upon request by government or a Designated Inuit Organization, review project proposals located outside of the Nunavut Settlement Area that may have significant adverse ecosystemic or socio-economic effects on the Nunavut Settlement Area. Additionally, the federal and territorial governments, with the assistance of NIRB, can negotiate agreements with other jurisdictions to collaborate on reviews of projects that may have significant transboundary effects.

In practice, NIRB has limited experience with the assessment of transboundary effects. Only one screening of a transboundary project has been completed. In this case, NIRB cooperated with the Inuvialuit Screening Board to screen a project with activities in both Nunavut and the Inuvialuit Settlement Region of the NWT. NIRB has recognized the need to pursue cooperative arrangements for the assessment of transboundary effects with assessment authorities in adjacent jurisdictions. Discussions have been held between NIRB and environmental assessment authorities in the Inuvialuit Settlement Region and the Mackenzie Valley regarding a draft "Northern Canada Convention on Environmental Impact Assessment." However, agreement on this process has not yet been reached. It is expected that with the recent promulgation of the *MVRMA* and the establishment of the MVEIRB, talks on the convention will recommence (H. Klein, pers. comm. 1999).

#### 4.4.1.4 Cumulative Effects

A project proposal application must include, among other information, identification of cumulative environmental effects (Appendix B of the NIRB Operational Procedures: NIRB 1997a). An applicant is required to identify the past, present, and imminent projects and/or activities occurring in the area, and to describe the potential cumulative effects of the project in combination with the effects of these other projects and/or activities.

#### 4.4.1.5 Public Involvement

The NIRB Operational Procedures (NIRB 1997a) outline opportunities for public involvement during both the screening and review processes. During the screening process, public involvement typically comprises distribution by NIRB of project proposals and opportunity for the public to provide written comment. At the review level, public involvement may include distribution of materials, community meetings, formal or informal public hearings, or other suitable procedures.

#### 4.4.1.6 Schedule and Timelines

Screening decisions are made within 45 days of acceptance of a project proposal application, unless specific regulatory processes require a shorter time period or a time extension is granted by the authorizing agency. Schedules for formal review have not been established but can be specified by the authorizing agency. The length of time for a NIRB Panel review or federal environmental assessment panel review would be dependent on the scope of the project under consideration and the agreed-upon review process. It is reasonable to expect that such reviews may take between six to eighteen months. These timelines do not include the proponent's time to prepare a project proposal application, EIS, or other necessary information.

### *4.4.2 Mackenzie Valley Environmental Impact Review Board*

#### 4.4.2.1 Background

The *MVRMA* came into effect in December, 1998. In addition to a new system of land and water regulation and land use planning, the *MVRMA* establishes a new environmental assessment process for development proposals located in or affecting the Mackenzie Valley. The new environmental assessment process will be administered by the MVEIRB, which will ensure that environmental effects of development proposals receive careful consideration prior to development. The MVEIRB takes over functions formerly performed primarily by the federal government under *CEAA*; *CEAA* will no longer apply in the Mackenzie Valley, except in very specific and limited cases (*e.g.*, project proposals with potential transboundary effects). The guiding principles of the MVEIRB are: to carry out its work in a timely and expeditious manner; to protect the environment from significant adverse effects of proposed developments; and to protect the economic, social, and cultural well-being of the residents and communities of the Mackenzie Valley.

#### 4.4.2.2 Review Paths

The *MVRMA* establishes a three-part environmental assessment process:

- Preliminary screening;
- Environmental assessment; and
- Environmental impact review (panel review).

A preliminary screening is triggered when a proponent applies to a regulatory authority for a permit, licence, or authorization that is listed in the *Preliminary Screening Requirements Regulation* pursuant to the *MVRMA*. The preliminary screening is an initial evaluation of the potential environmental effects of a proposed development, to determine the need for environmental assessment by the MVEIRB. Responsibility for conducting the preliminary screening lies with the authorizing agency (*e.g.*, land and water boards, federal and territorial agencies and departments, the National Energy Board, and Aboriginal organizations issuing permits, licences, or authorizations listed in the

*Preliminary Screening Requirements Regulation*). Certain proposed developments listed in the *Exemption List Regulation* are excluded or exempted from screening, if the potential effects are considered to be not significant.

A proposed development may be approved at the preliminary screening stage if there will be no significant adverse environmental effects and if there is no public concern. In such cases, the authorizing agency would proceed with its own established procedures for issuance of permits, licences, or authorizations.

If the preliminary screening determines that the proposed development may cause significant adverse effects or raise public concern, the proposed development is referred to the MVEIRB for an environmental assessment. Environmental assessment and environmental impact review procedures followed by the MVEIRB are documented in the *Environmental Assessment in the Mackenzie Valley: Interim Guidelines* (MVEIRB 1999). (Even if it is clear that an environmental impact review is likely to be required in respect of a project, the preliminary screening and environmental assessment stages must first be completed.)

#### 4.4.2.3 Process

**Preliminary Screening**

The *MVRMA* does not specify requirements to be met by the authorizing agencies during preliminary screening; however, the document *Environmental Assessment in the Mackenzie Valley: Interim Guidelines* (MVEIRB 1999) include a Screening Report form to be used by the agency(ies) conducting a preliminary screening.

If the proposed development is not excluded or exempted from preliminary screening, the authorizing agency must determine whether the proposed development conforms to approved land use plans for development in the Sahtu or Gwich'in settlement areas. (However, there are currently no approved land use plans in that portion of the SGP TC located within the Mackenzie Valley.)

Where more than one authorizing agency is required to complete a preliminary screening, the agencies may conduct a joint screening, adopt another agency's report, or consult each other during separate screenings. The authorizing agency will determine through the preliminary screening that:

- The environmental effects and/or public concern regarding the proposed development are potentially significant, and an environmental assessment of the proposed development is required; or
- The environmental effects and public concern regarding the proposed development are not likely to be significant, and the proposed development may proceed.

The results of the preliminary screening will be communicated to the MVEIRB, which would be responsible for conducting the environmental assessment, if one is determined to be required. Preliminary screening timelines are specified by the regulations specific to each permit or licence, but screenings are expected to be completed within a 45 day period. The preliminary screening process can not be bypassed, because of the need for documentation of the screening comments, even if the proponent believes an environmental assessment will be required.

**Environmental Assessment**

Regardless of the results of the preliminary screening, a proposed development could be referred to the MVEIRB for environmental assessment by a local, territorial, or federal government department or Aboriginal organization if the proposed development may have an adverse effect on lands within the jurisdiction of such agencies (even if the proposed development is exempt from preliminary screening).

When a decision to conduct an environmental assessment is made, the proponent and all regulatory agencies are notified. The scope of the project to be assessed and the scope of the assessment will be determined by the MVEIRB. The MVEIRB may hold public meetings to facilitate public input into the scoping determination and the identification of issues to be addressed in the assessment.

The proponent will then be required to prepare an environmental assessment document based on direction provided by the MVEIRB. Subsection 117(2) of the *MVRMA* specifies factors to be considered in every environmental assessment. The MVEIRB may hold public hearings during the environmental assessment process. On completing the environmental assessment, the MVEIRB will:

- Where the proposed development is unlikely to cause significant adverse effects on the environment or be a cause of significant public concern, determine an environmental impact review of the development is unnecessary;
- Where the proposed development is likely to have significant adverse environmental effects, either order an environmental impact review of the proposed development or recommend approval of the proposed development subject to implementation of mitigative measures;
- Where a proposed development is likely to cause significant public concern, order an environmental impact review of the proposed development; or
- Where the proposed development is likely to cause an adverse environmental effect so significant that it cannot be justified, recommend the proposed development be rejected without an environmental impact review.

If an environmental impact review is ordered, the MVEIRB's assessment report may identify areas within or outside of the Mackenzie Valley where a proposed development is likely to have a significant adverse environmental effect or be the cause of significant public concern.

The MVEIRB will submit its determination report to the Minister of DIAND, the proponent, and any authorizing agency involved in the preliminary screening. After consideration of the report of an environmental assessment, the federal Minister and other authorizing agencies may agree to adopt, modify, or reject the recommendations of the report, or refer the proposed development to the federal Minister of the Environment for the purpose of a joint review under *CEAA* where such action is determined to be in the national interest. Any First Nation, local government, regulatory authority, or department or agency of the federal or territorial government shall act in conformity with the decisions of the Ministers. The *MVRMA* does not specify a timeframe in which the environmental assessment must be completed.

**Environmental Impact Review**

An environmental impact review (also known as a panel review) may be ordered by the Minister of DIAND or the National Energy Board, on the recommendation of the MVEIRB. The environmental impact review, undertaken by a panel, is a more comprehensive investigation of outstanding issues associated with the proposed development, and involves:

- Appointment of a panel;
- Development of terms of reference for a panel;
- Preparation of EIS guidelines;
- Review of the EIS;
- Public hearings;
- Preparation of a panel report; and
- Government response.

The MVEIRB will select and appoint the review panel, except in cases such as cooperative or joint review panels discussed below. The MVEIRB will determine the scope of the proposed development to be assessed and the scope of the assessment, and will develop terms of reference for the panel, after consultation with the responsible ministers and any First Nation affected by the proposal. The panel will develop guidelines for the preparation of an EIS. During the preparation of the guidelines, the panel may conduct site visits, hold scoping meetings, and consult with experts. Draft guidelines will be issued for public comment, following which the panel will issue final guidelines to the proponent. Factors to be considered in an environmental impact review are specified in ss. 117(2) and 117(3) of the *MVRMA.*

The proponent will be responsible for preparing an EIS in accordance with the guidelines issued by the panel. Once submitted to the panel, the EIS will be subject to a conformity review prior to public hearings or consultations to facilitate public involvement in the review. The panel will prepare a report summarizing public comments, and documenting the panel's analysis, conclusions, and recommendation regarding whether the proposed development should be approved, with or without mitigative or remedial measures, or rejected. The panel's report will be submitted to the Minister of DIAND (or National Energy Board) and all responsible ministers. After consideration of the report,

the ministers may agree to accept, modify, or reject the panel's recommendations. Once a decision is taken by the responsible ministers, the affected First Nation, local government, regulatory authority, or department or agency of the federal and territorial government shall implement the recommendations. A timeline for completing an environmental impact review is not specified in the *MVRMA.*

**Joint Reviews and Transboundary Effects**

Sections 130, 139, 140, 141, and 142 of the *MVRMA* provide for the establishment of joint panel reviews and assessment of transboundary effects.

Where it is determined that a proposed development located wholly within the Mackenzie Valley may have significant adverse environmental effects outside of the Mackenzie Valley, the MVEIRB will advise the environmental assessment authority in that region and request its cooperation in the preparation of an environmental assessment. Further, the MVEIRB may, with the approval of the Minister of DIAND, enter into an agreement with the environmental assessment authority in the region potentially affected to coordinate the examination of environmental effects or to establish a joint review panel.

If a proposed development is located partly in the Mackenzie Valley and partly in an adjacent jurisdiction, the MVEIRB will endeavor to coordinate its environmental assessment with that of the environmental assessment authority in the adjacent jurisdiction. Where an environmental impact review is ordered for such a proposed development, the MVEIRB may, with the approval of the Minister of DIAND: enter into an agreement with the federal Minister of the Environment to provide for a review panel pursuant to *CEAA*; or enter into an agreement with the environmental assessment authority in the neighboring jurisdiction to coordinate reviews or establish a joint review panel.

If a proposed development is located outside of the Mackenzie Valley, but may have significant adverse environmental effects within the Mackenzie Valley, the MVEIRB may, with the approval of the Minister of DIAND, enter into an agreement with the environmental assessment authority in the other jurisdiction to allow for the MVEIRB's participation in the examination of environmental effects.

A joint review panel will be established with the Canadian Environmental Assessment Agency where it is determined that it is in the national interest to do so. A joint panel established pursuant to *CEAA* must include a consideration of the factors listed in ss. 16(1) and 16(2) of *CEAA.* Reports of joint panels will be submitted to the Minister of DIAND and responsible federal, territorial, and provincial ministers.

#### 4.4.2.4 Cumulative Effects

Every environmental assessment and environmental impact review of a proposal shall include an examination of the "cumulative impact that is likely to result from the development in combination with other developments" (ss. 117(2)(a), *MVRMA*). The scope of the required cumulative effects assessment is not specified in either the *MVRMA* or *Environmental Assessment in the Mackenzie Valley: Interim Guidelines* (MVEIRB 1999). An official of the MVEIRB indicated that they likely would follow the requirements for cumulative effects assessment developed by the Canadian Environmental Assessment Agency (Canadian Environmental Assessment Agency 1994) (H. Klein, pers. comm. 1999). Please refer to the discussion of cumulative effects in Section 4.4.3.4 below.

#### 4.4.2.5 Public Involvement

The *MVRMA* provides for public notification and participation during environmental assessments and environmental impact reviews. Public involvement during preliminary screening is the responsibility of the authority carrying out the preliminary screening, and is not addressed in the *MVRMA*. The MVEIRB encourages the proponent to undertake a public consultation program and requires submission of a record of public consultation as part of the EIS. The MVEIRB may conduct public hearings during an environmental assessment or environmental impact review. A development registry of all documents relating to environmental assessment and review in the Mackenzie Valley will be made available to the public at the office of the MVEIRB. During an environmental impact review, the panel will establish a public participation program to facilitate public involvement in the review, and a public registry will be established.

#### 4.4.2.6 Schedule and Timelines

Preliminary screenings will be undertaken in accordance with existing regulatory provisions. Typically, the timeline for a screening is a maximum of 45 days. Schedules for environmental assessments and environmental impact reviews have not yet been established. However, the MVEIRB does commit to a timely and expeditious process (MVEIRB 1999). It is expected that schedules and timelines will be highly variable, depending upon the nature of the proposed development, the potential environmental effects, and the degree of public concern.

### *4.4.3 Canadian Environmental Assessment Act*

#### 4.4.3.1 Background

The *Canadian Environmental Assessment Act*, which was passed in 1992 and came into effect in 1995, establishes a formal process by which the environmental effects of federal projects are assessed before irrevocable decisions in respect of such projects are made. For the purposes of *CEAA*, federal projects may be projects for which a federal department is the proponent, or projects undertaken on federal lands, with federal funding, or requiring certain federal permits or authorizations. Therefore, federal environmental assessments pursuant to *CEAA* may be undertaken for projects located anywhere in Canada that meet one of the triggering conditions specified in Section 5 of the Act. *CEAA* no longer applies to projects within the Mackenzie Valley, except in special cases (*e.g.*, projects with transboundary effects) (s. 166, *MVRMA*). The NLCA is silent on the applicability of *CEAA* within the Nunavut Settlement Area. The Canadian Environmental Assessment Agency therefore advises that *CEAA* still applies within the Nunavut Settlement Area; however, it is likely that federal authorities will, to the extent practical, use the results of NIRB reviews in making their determinations pursuant to *CEAA* (P. Scott, pers. comm. 1999).

#### 4.4.3.2 Review Paths

In the federal environmental assessment process under *CEAA*, there are four types of review to which projects may be subject, depending on such factors as the scale of the project, the potential for significant adverse environmental effects, potential for transboundary effects, and the degree of public concern. The different types of possible review are:

- Screening;
- Comprehensive study;
- Review panel; or
- Mediation.

The vast majority of federal projects are subject to screening level reviews. Such projects are typically small in scale, comprise routine or repetitive activities, and/or have known and predictable environmental effects for which proven effective mitigation is available. The *Comprehensive Study List Regulations* pursuant to *CEAA* list projects for which a comprehensive study is mandatory. Such projects may be large-scale, have the potential to generate considerable public concern, have potential significant adverse environmental effects, or the environmental effects may be unknown. In addition to a screening or comprehensive study level review, the federal Minister of the Environment, unilaterally or on the request of the Responsible Authority (RA)[1], may order a public review of the proposed project. There are two types of public review: a panel review, or mediation. The federal

[1] In the federal environmental assessment process, federal departments (or authorities) are responsible for ensuring environmental assessments are carried out prior to the federal department taking any action that may enable the project to proceed. A federal authority that has responsibility for carrying out an environmental assessment and making a decision pursuant to *CEAA* is referred to as a Responsible Authority (RA).

Minister of the Environment may decide, at her discretion, which type of public review is most appropriate for a given project. Mediation is a voluntary process of negotiation in which an independent, impartial mediator helps interested parties address contentious issues using a non-adversarial, collaborative approach. In cases where mediation is unsuccessful or inappropriate, the federal Minister of the Environment may appoint an independent panel to conduct a review of the proposed project. A public review may be triggered at any time before, during, or after a comprehensive study or screening, in cases where it is uncertain whether the project will cause significant adverse environmental effects, where the project is likely to cause significant adverse environmental effects, or where public concern warrants a further investigation of environmental effects.

#### 4.4.3.3 Process

In determining whether or not an assessment pursuant to *CEAA* is required in respect of a project, a federal authority reviews the possible triggers listed in Section 5 of the Act. A federal assessment may be required if the federal department is the proponent, or the project is to be undertaken on federal lands or with federal funding, or if certain federal permits or authorizations are required. Federal permits and authorizations that would trigger a federal environmental assessment are listed in the *Law List Regulations* pursuant to *CEAA*. If it is determined that a federal environmental assessment is required, the RA must determine what level of review is appropriate. If the project is not listed in the *Comprehensive Study List Regulations*, and a previous environmental assessment of the project has not been done, the RA must conduct a screening. If the project is listed in the *Comprehensive Study List Regulations*, the RA must conduct a comprehensive study.

Regardless of the level of review followed, the RA must comply with the *Regulations Respecting the Coordination by Federal Authorities of Environmental Assessment Procedures and Requirements* (*Federal Coordination Regulations*) in determining the scope of the project to be assessed, the factors to be assessed, and the scope of the factors to be assessed. Through this scoping process, the RA notifies other federal authorities and other potentially interested parties, including the public as appropriate, about the project, and solicits input regarding the scope of the project and of the assessment. The *Federal Coordination Regulations* also enable the early identification of other (likely) RAs, so that duplication of assessment requirements can be avoided. The need for environmental assessment under another jurisdiction may also be identified at this early stage in the review process, facilitating the development and implementation of agreements for joint or substitute assessment processes (ss. 12(1) and 12 (4), s. 40, 41, and 42 of *CEAA*).

Once the scope of the project and of the assessment has been determined, the assessment itself is undertaken. Regardless of the level of review and the trigger for the project, the RA must ensure an environmental assessment report is prepared (*CEAA* includes provisions for delegation of this task in ss. 17 (1)) and must make a decision pursuant to *CEAA*. For projects where the RA is the proponent or for projects subject to screenings, the assessment is often prepared by the RA with specialist input from other federal authorities. For larger projects subject to comprehensive study, panel review, or

mediation, and/or where the proponent is a party other than a federal authority, the environmental assessment report is prepared by the RA typically on the basis of an environmental assessment document prepared by the proponent or proponent's agent. Factors to be considered in a *CEAA* review are listed in ss.16(1) and 16(2). Additional guidance is provided by the *Responsible Authority's Guide* (1994) and other Agency documents.

**Screening**

A project may be approved at the screening stage, if, taking into account the implementation of mitigation measures, the project is not likely to cause significant adverse environmental effects. If the screening concludes that further investigation is needed, or if public concerns warrant, the RA refers the project to the federal Minister of the Environment for a referral to mediation or a panel review. (There is no provision under *CEAA* for a comprehensive study to be undertaken for a project following a screening determination.) A screening may range in duration from as little as a few days or weeks, up to a year in some cases.

**Comprehensive Study**

A comprehensive study is a more detailed level of environmental assessment. The Comprehensive Study Report (CSR) is prepared by the RA, typically on the basis of an environmental assessment document prepared by the proponent. Both the *Responsible Authority's Guide* (Canadian Environmental Assessment Agency 1994) and the *Guide to the Preparation of a Comprehensive Study under the Canadian Environmental Assessment Act* (Canadian Environmental Assessment Agency 1996) provide guidance to the proponent and RA regarding comprehensive studies. Following public review of the CSR (typically 30 to 45 days), the federal Minister of the Environment makes a determination on the basis of recommendations from the Agency. This determination is communicated to the RA, who then exercises its duty or function in respect of the project. A comprehensive study may range in duration from several months to a year or more, depending on the complexity of the project. Once a CSR is submitted by the RA to the Agency, a decision typically can be made within about 60 to 90 days.

**Panel Review**

Detailed procedures for an assessment by a review panel were recently issued by the federal Minister of the Environment (Public Works and Government Services 1997). These procedures provide for the development of project-specific procedures in the case of joint reviews conducted with other jurisdictions.

Where possible, the RA will provide written pre-referral notice to the Agency in advance of referring a project to assessment by a review panel. Based on recommendations by the Agency, and in

consultation with the RA, the federal Minister of the Environment will appoint review panel members. Terms of reference for the panel review will be drafted by the Agency in consultation with the RA, and issued by the Minister, after review by stakeholders. Issues to be examined in the environmental assessment will be determined through a scoping exercise involving public review of draft guidelines (drafted by the Agency) for the preparation of information required for the panel review. Final project-specific guidelines will be issued by the review panel.

The proponent then prepares an EIS in accordance with the guidelines. After the EIS is submitted to the review panel, information assessment meetings are held to review the adequacy of the information for public hearings. Additional information may be requested. When the EIS is determined to be complete, public hearings will be held. From the time an EIS is submitted to the commencement of hearings, the process may take up to 165 days.

Following community, general, and technical hearings, the review panel will prepare and submit a report to the federal Minister of the Environment and to the Minister of the RA. The Ministers will respond to the review panel report, and the RA will make a determination pursuant to *CEAA*.

**Joint Reviews and Transboundary Effects**

Sections 40, 41, and 42 of *CEAA* provide for the establishment of joint review panels with other jurisdictions. Sections 46 and 48 of *CEAA* give the federal Minister of the Environment the discretion to require a public review of a project that may have significant adverse (domestic) transboundary effects, even if no federal involvement in the project exists. The Minister also may approve the substitution of another process for an environmental assessment by a review panel under *CEAA*, where the other assessment process is appropriate, addresses the factors listed in ss. 16(1) and 16(2), and provides opportunity for public participation (ss.43(1) and s. 44 of *CEAA*).

### *4.4.3.4* Cumulative Effects

Every assessment conducted pursuant to *CEAA* must consider any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out. Further clarification in this regard was provided by the review panel for the joint National Energy Board - Canadian Environmental Assessment Agency review of the Express Pipeline Project (NEB-Canadian Environmental Assessment Agency 1996). The joint review panel ruled that certain requirements must be met for the joint review panel to consider cumulative environmental effects:

- There must be an environmental effect of the project being assessed;
- That environmental effect must be demonstrated to operate cumulatively with the environmental effects of other projects or activities; and

- It must be known that the other projects or activities have been, or will be, carried out and are not hypothetical.

The joint review panel also indicated that, to be considered, cumulative effects must be likely to result, meaning "that there must be some probability, rather than a mere possibility, that the cumulative environmental effect will occur" (NEB-Canadian Environmental Assessment Agency 1996). When advising proponents what future actions to consider in cumulative effects assessment, the Agency recommends consideration of projects or activities that have been approved or that are in a government approvals process (Canadian Environmental Assessment Agency 1994). The Agency also states that the environmental effects of uncertain or hypothetical projects or activities need not be considered to meet *CEAA* requirements (Canadian Environmental Assessment Agency 1994).

There exist numerous methodological approaches to the assessment of cumulative environmental effects; however, *CEAA* and the *Responsible Authority's Guide* (Canadian Environmental Assessment Agency 1994) do not require any specific method to be used. Various RAs have confirmed that one or more methods may be used, as appropriate for the project and the potential environmental effects.

#### 4.4.3.5 Public Involvement

Comments from the public that are received in accordance with *CEAA* and the regulations must be considered in every environmental assessment conducted pursuant to *CEAA*. The timing and nature of public involvement in a federal environmental assessment vary according to the level of review, and is largely at the discretion of the RA and/or the federal Minister of the Environment. The public has an opportunity to review and comment on a CSR, as well as on terms of reference and guidelines for a panel review, and can participate in a public review.

#### 4.4.3.6 Schedule and Timelines

Typically, the timeline for a screening can range from one to six weeks or longer (up to a year), and the timeline for a comprehensive study can range from 60 to 90 days or longer (following submission of the CSR to the Agency). The timeline for a panel review is approximately twelve to eighteen months, from the date of the initial referral of the project to the Agency for a panel review to the submission of the review panel report to the RA. However, these timelines are highly variable from project to project, and depend upon the nature of the project and the degree of public concern. These timelines do not include the proponent's time to prepare an environmental assessment report.

## 4.5 Possible Environmental Assessment Path for the SGP TC

As it is presently conceived, the proposed SGP TC would be located within both the Northwest Territories and Nunavut. During the environmental issues scoping for the proposed SGP TC (documented elsewhere in this report), involving consultation with the public, NIRB, MVEIRB, and various federal and territorial agencies, as well as review of pertinent literature, several important and recurring issues were raised, including, but not limited to:

- The need and rationale for the SGP TC;
- Alternatives to the SGP TC;
- Potential effects on the Bathurst Caribou Herd;
- Potential effects of new shipping in Bathurst Inlet and the Arctic Ocean;
- Potential effects on natural resources, harvesting opportunities, tourism and social and economic conditions as a result of developing all-weather road access within the SGP; and
- The potential cumulative effects of the project and mining development attracted by the transportation corridor.

It is reasonable to expect that the SGP TC may generate significant public concern, and may have potentially significant adverse local and/or transboundary environmental effects. Therefore, it is likely that the SGP TC would be subject to review pursuant to *CEAA*, the *MVRMA*, and the *NLCSA*. It also is likely that the SGP TC would be subject to review by a (joint) panel.

### *4.5.1 Initiating the Review Process*

The environmental review process within Nunavut and the Mackenzie Valley would be initiated by application for regulatory approvals. Both the Nunavut and Mackenzie Valley processes have provisions for the involvement of their respective review boards in interjurisdictional projects and projects with potential transboundary effects. For projects outside of Nunavut, NIRB may, upon request of DIAND, or on request by a Designated Inuit Organization and consent of DIAND, review a project proposal located outside of Nunavut which may have significant adverse ecosystemic or socio-economic effects on Nunavut (NLCA 1993). For projects outside of the Mackenzie Valley which might have a significant adverse effect on the environment in the Mackenzie Valley, the MVEIRB may, with the approval of DIAND, enter into an agreement with the authority responsible for the examination of the environmental effects of such developments to provide for the participation of the MVEIRB in the examination of the environmental effects (*MVRMA* 1998). Review pursuant to *CEAA* may be initiated by: application for a federal authorization listed in the *Law List Regulations*; the provision of federal funding or federal lands for the SGP TC; a federal authority acting as the proponent of the SGP TC; or referral by the federal Minister of the Environment.

In Nunavut, a project proposal application will be forwarded to NIRB by the authorizing agency to which an application has been submitted, or by the NPC following a review of conformance with approved land use plans. A screening to determine the need for more detailed review of the project

proposal will be conducted by NIRB. It is reasonable to expect that NIRB will determine that a review of the project proposal is required.

In the Mackenzie Valley, the authorizing agency to which an application has been submitted would conduct a preliminary screening of the proposed development to determine the need for more detailed review. It is reasonable to expect that the authorizing agency will determine that an environmental assessment by MVEIRB is required.

A federal authority that receives a project description or identifies another *CEAA* trigger will be required to comply with the provisions of the *Federal Coordination Regulations* regarding notification of other federal authorities, and, where an environmental assessment is determined to be required, determination of the scope of the project to be assessed, the factors to be considered in the assessment, and the scope of those factors.

### *4.5.2 Environmental Assessment and Review Requirements*

Under the *CEAA* process, a project may be referred to a public review at any time before, during, or after a screening. An environmental assessment pursuant to *CEAA* must consider the factors listed in ss. 16(1) and 16(2) of *CEAA*, as well as any other matter required by the RA and/or the federal Minister of the Environment to be considered.

In Nunavut, a project proposal application can be referred to review by a NIRB Panel or a federal environmental assessment panel following a screening determination. A review also may be conducted by a joint panel. Information to be contained in an EIS submitted to NIRB is specified in Article 12.5.2 of the NLCA, and matters to be taken into account by NIRB are specified in Article 12.5.5.

Under the *MVRMA*, however, an environmental assessment must be conducted by the MVEIRB for any proposed development referred to it by the authorizing agency conducting the preliminary screening, prior to determination of the need for an environmental impact review (panel review). Factors to be considered in an environmental assessment and additional factors to be considered in an environmental impact review are specified in ss. 117(2) and 117(3), respectively, of the *MVRMA*. While the MVEIRB is required by the enabling legislation to undertake an environmental assessment prior to an environmental impact review, the MVEIRB may minimize duplication through its determination of the scope of the assessment and/or review (G. Stewart, pers. comm. 1999). A simple process flow chart of the Nunavut, Mackenzie Valley and CEAA processes is provided in figures 4.2, 4.3, and 4.4, respectively.

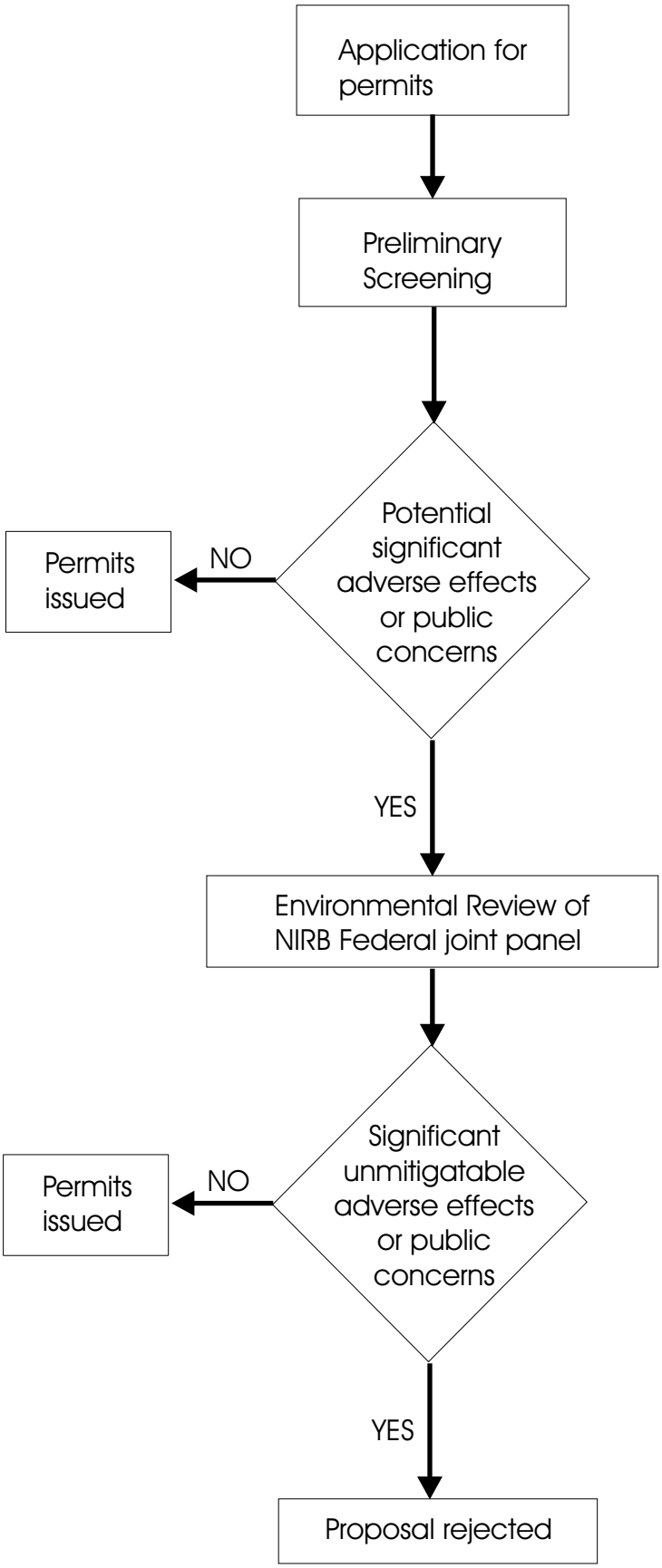



Figure 4.2:
NUNAVUT IMPACT REVIEW BOARD PROCESS (*SIMPLIFIED)*

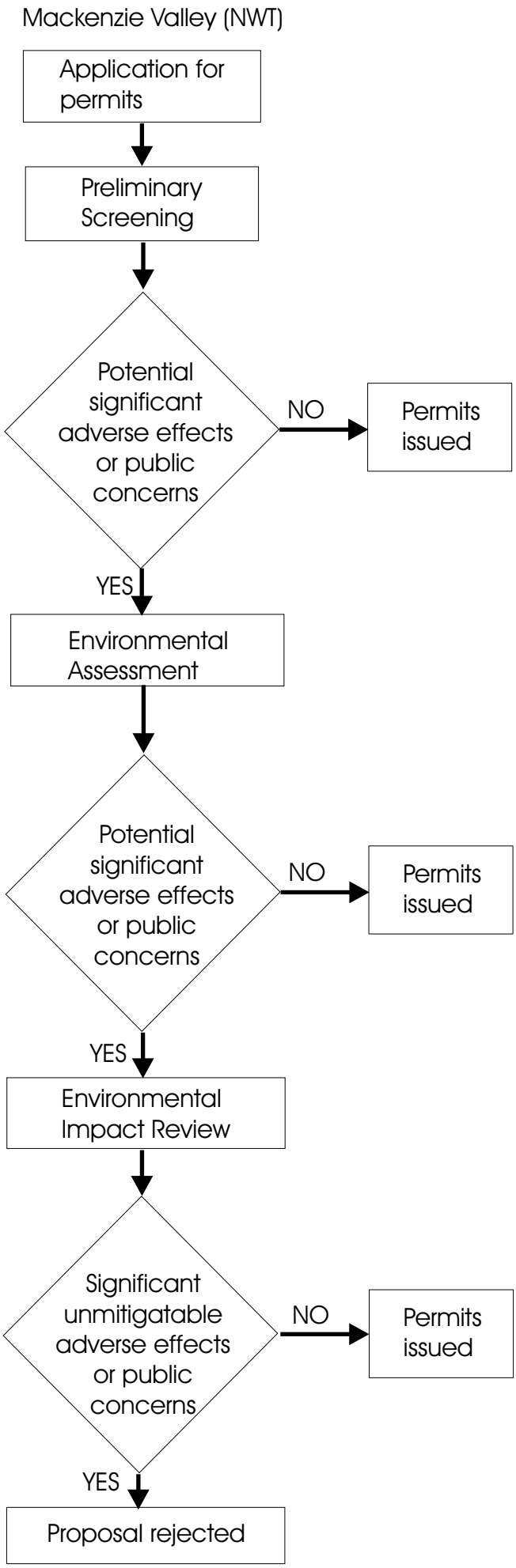



Figure 4.3:
MACKENZIE VALLEY ENVIRONMENTAL IMPACT PROCESS (*SIMPLIFIED)*

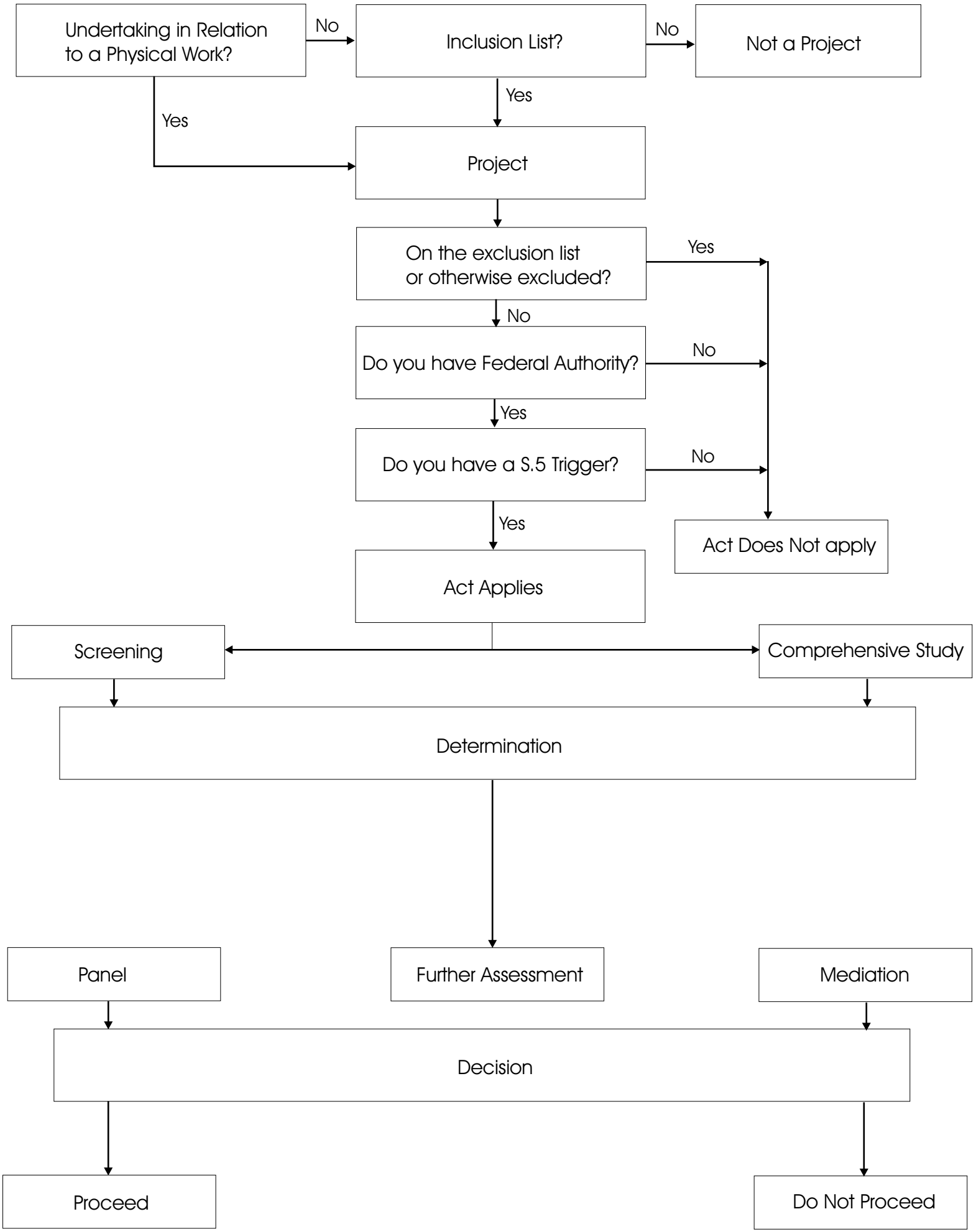



Figure 4.4:
CANADIAN ENVIRONMENTAL ASSESSMENT ACT PROCESS (*SIMPLIFIED)*

#### 4.5.2.1 Joint Review

Given the geographic extent of the SGP TC (as it is presently conceived), and the potential for significant public concern and local and transboundary environmental effects, it is reasonable to expect that a joint panel review will be warranted. Provisions for joint review are described above for each applicable process. In addition to these provisions, there have been discussions between NIRB and other environmental assessment authorities regarding the establishment of a "Northern Canada Convention on Environmental Impact Assessment" that would address coordination of environmental assessment functions. (The Canada-Wide Accord on Environmental Harmonization and Sub-Agreement on Environmental Assessment does not apply in areas where an environmental assessment process exists pursuant to a land claim agreement.)

A joint review process likely would be established through negotiations between NIRB, MVEIRB, the Canadian Environmental Assessment Agency, and the RAs pursuant to *CEAA*. An agreement between the parties may comprise a project-specific Memorandum of Understanding (MOU) (P. Scott, pers. comm. 1999) that specifies: the process to be followed; the roles and responsibilities of the proponent and of each party to the MOU; the scope of the project to be assessed; the factors to be considered in the assessment and the scope of those factors; the nature of public involvement; and a timeline for review and decisions by regulatory authorities, among other things.

Alternatively, *CEAA* requirements may be met through substitution by a joint NIRB-MVEIRB review. However, the establishment of such a process also would likely require negotiations to ensure the federal Minister of the Environment is satisfied that the requirements of *CEAA*, as set out in s.44, would be met.

### *4.5.3 Other Transportation Corridor Proposals*

It is possible that a future proponent may propose to develop only a portion of the SGP TC. For example, Nuna Logistics and the Kitikmeot Corporation have developed a proposal to construct a port on Bathurst Inlet and an all-weather road south from the port to existing mines (Nuna Logistics 1998). Such a proposed development may be located wholly within either Nunavut or the Mackenzie Valley. It is reasonable to expect that such a proposed development would generate significant public concern and, further, that many of the issues raised in respect of the SGP TC, as noted above and in Chapters 5 and 6 of this report, would be relevant. Therefore, it is reasonable to expect that an environmental assessment (if in the Mackenzie Valley) and/or panel review (in either jurisdiction) would be required. Participation of either NIRB or the MVEIRB in the review of environmental effects of a project outside of their respective jurisdictions requires the approval of the Minister of DIAND.

Depending on the configuration of the proposed development, transboundary effects may be of concern. For example, the proposed development may affect the migratory Bathurst Caribou Herd and may have other effects on the adjacent jurisdiction due to increased access. However, as in this

scenario the project would be located wholly within only one jurisdiction, it is not certain that a joint review panel (NIRB-MVEIRB) would be established. Rather, a review process may be established that accommodates the interests and enables the participation of the adjacent jurisdiction. For example a project located wholly within Nunavut may be reviewed by a NIRB panel that includes representation from the MVEIRB (see Section 4.4.1 above). In this scenario, *CEAA* requirements may be met either through a joint panel (with one or both of NIRB and MVEIRB) or process substitution. If a joint review is conducted, an MOU or other agreement as described above may be established.

### *4.5.4 Responsibilities of a Future Proponent*

#### 4.5.4.1 Project Planning Stage

Consideration should be given to environmental matters as early in the planning stages of a project as possible. Relevant factors, including biophysical, social, cultural, and economic issues, should be considered together with engineering and technical matters during project design and route/site selection. The results of the environmental scoping exercise documented elsewhere in this report will assist a future proponent in identifying and focusing on relevant issues. Further public consultation during the planning stage will be required.

Existing environmental conditions and trends in the project area will need to be understood to enable effective assessment and management of potential project effects. Regulatory and environmental assessment officials (J. Ahmad, and L. Azzolini, pers. comm. 1999) have stressed the need to begin collecting baseline information well in advance of submitting a project application. Baseline data to support an environmental assessment of the project must be adequate to enable a thorough and accurate assessment of potential effects. Environmental investigations and studies to address data gaps in existing literature and to define existing site-specific conditions should be initiated during the planning and design phases of project development. Data gaps and recommended future studies are described for various environmental components in Chapter 6 of this report.

Effective and meaningful public consultation by the proponent will be essential for the successful development of the SGP TC. Consultation should begin early in project development, to ensure that community issues are taken into account. A future proponent would build on the consultation undertaken during the environmental scoping exercise documented elsewhere in this report (Chapter 5) to further refine issues and to focus the assessment on relevant considerations. Consultation should also be undertaken to collect traditional and community knowledge relevant to the assessment.

A future proponent should consult with key regulatory agencies to confirm regulatory review process and requirements. In particular, a future proponent should seek multi-jurisdictional discussion involving representatives of NIRB, MVEIRB, the Canadian Environmental Assessment Agency, and relevant federal authorities (that may be RAs pursuant to *CEAA*) to initiate the establishment of an agreement for coordinated and/or joint review of the project. Such discussion would, among other things (see comments regarding MOUs above), clarify issues to be addressed and information to be

provided by the proponent. The establishment of multi-jurisdictional agreements for assessment can be time-consuming (even between jurisdictions with well-established and tested procedures), and should be initiated as early as possible.

#### 4.5.4.2 Environmental Assessment and Review

It is likely that a future proponent will be required to prepare and submit an EIS for regulatory and public review. (In a substitution process or a coordinated or joint review for which a multi-jurisdictional agreement is established, it is likely that one EIS can be prepared to satisfy the requirements of all jurisdictions.) Information required to be included in the EIS likely will be specified in an MOU established for the joint review of the project or in guidelines issued by the environmental assessment authority. It is likely that the guidelines will include the factors specified in s. 16 of *CEAA*, Article 12.5.2 of the NLCA, and s. 117 of the *MVRMA*, as applicable. At a minimum, the EIS should include information regarding:

- The purpose of, and need for, the project;
- Alternatives to the project and alternative means of carrying out the project;
- Description of the project (*e.g.*, proposed physical works and activities for all phases, including construction, operation and maintenance, decommissioning, and malfunctions and accidents, schedule, costs, labour requirements, environmental control technologies, waste management, contingency and emergency response plans);
- Land ownership and jurisdictions in project area;
- Documentation of public consultation, issues raised, and how such issues have been or will be addressed in project planning and assessment;
- Existing environmental conditions in the project area;
- Evaluation of potential environmental effects of all project phases, including cumulative effects;
- Measures to be employed to mitigate adverse environmental effects and to optimize project benefits;
- Determination of the significance of residual environmental effects; and
- Recommended follow-up studies and monitoring of ecosystemic and socio-economic effects.

With respect to the evaluation of cumulative effects, a future proponent should identify those past, present, and future projects and activities, the effects of which may interact cumulatively with the potential effects of the SGP TC. The scope of the other projects and activities to be considered with respect to cumulative effects likely will be determined by the environmental assessment authorities for the SGP TC. However, at a minimum, the proponent should consider future projects and activities that will have been approved or that will be in a regulatory review process at the time the assessment of the SGP TC is being conducted. There are many methods of assessing cumulative effects (*cf.* Canadian

Environmental Assessment Agency 1997), and the proponent may seek guidance from environmental assessment practitioners and the environmental assessment authorities with respect to appropriate methods for the SGP TC.

When conducting an environmental assessment of the SGP TC, a future proponent should use standard, accepted methods for impact analysis that include consideration of criteria for determining adverse effects and for determining significance.

Criteria for determining adverse effects include:

- Loss of rare or endangered species;
- Reductions in species diversity;
- Loss of critical/productive habitat;
- Transformation of natural landscapes;
- Toxicity effects on human health;
- Reductions in the capacity of renewable resources to meet the needs of present and future generations;
- Loss of current use of lands and resources for traditional purposes by aboriginal persons; and
- Foreclosure of future resource use or production.

Criteria for determining significance include:

- Magnitude;
- Geographic extent;
- Duration and frequency;
- Irreversibility; and
- Ecological context.

A future proponent may be required to provide additional information to the environmental assessment authorities to enable a public review of the SGP TC. The proponent will be required to support and participate in any public hearings, meetings, or other forms of public participation, as required by the (project-specific) process established for the SGP TC.

Following the environmental assessment and review of the SGP TC, it is likely that a future proponent will be required (through terms and conditions of approvals) to implement follow-up studies and monitoring programs, and to report the results of such studies and programs to appropriate regulatory agencies. The need for, and scope of, follow-up studies and monitoring programs would be determined through the assessment process.

#### 4.5.4.3 Public Involvement During the Review

The environmental assessment and review of the SGP TC under the authority of any or all of the three potentially applicable processes will provide for public involvement. For projects assessed under *CEAA* and the *MVRMA*, a public registry of all project information will be maintained and made accessible to the public. Under all processes, the public will be notified of opportunities for public involvement which may include public meetings and hearings, circulation of documents for comment, or such other means as determined necessary. An agreement establishing a joint review process would specify the nature of public participation.

#### 4.5.4.4 Schedule and Timeline

None of the environmental assessment processes to which the proposed SGP TC would be subject have established legislated timelines for environmental assessment or environmental impact review. Based on previous assessments of large development projects, it is reasonable to expect that the review and assessment of the SGP TC would take a minimum of 12 to 18 months from the time an application is submitted triggering the environmental assessment process. This does not include the time for the collection of baseline information, specific environmental studies, or the preparation of the EIS. In addition, the development of multi-jurisdictional agreements for assessment can lengthen the review timeline.

## 4.6 Bibliography

### *Personal Communications*

Ahmad, J. Executive Director. Nunavut Impact Review Board. Cambridge Bay, Nunavut. 1999.

Azzolini, L. Environmental Assessment Officer. Mackenzie Valley Environmental Impact Review Board, Yellowknife, Northwest Territories. 1999.

Edwards, J. Environmental Screener. Nunavut Impact Review Board. Cambridge Bay, Nunavut. 1999.

Klein, H. Executive Director. Mackenzie Valley Environmental Impact Review Board. Yellowknife, Northwest Territories. 1999.

Scott, P. Regional Director. Canadian Environmental Assessment Agency. Vancouver, British Columbia. 1999.

Stewart, G. Environmental Assessment Officer. Mackenzie Valley Environmental Impact Review Board. Yellowknife, Northwest Territories. 1999.

### *Existing Information*

*An Act to amend the Canadian Environmental Assessment Act*. Statutes of Canada 1994, C-46.

*Canadian Environmental Assessment Act (CEAA). Statutes of Canada 1992, C-37. (Amended.)*

Canadian Environmental Assessment Agency. 1997. Cumulative Effects Assessment Practitioners Guide, Draft for Discussion. Prepared by the Cumulative Effects Assessment Working Group and Axys Environmental Consulting Ltd.

Canadian Environmental Assessment Agency. 1996. Guide to the Preparation of a Comprehensive Study under the *Canadian Environmental Assessment Act* for Proponents and Responsible Authorities. Draft.

Canadian Environmental Assessment Agency. 1994. *Canadian Environmental Assessment Act*, Responsible Authority's Guide.

*Comprehensive Study List Regulations*. SOR/94-638. 7 October 1994. Canada Gazette Part II, Vol. 128, No. 21.

*Environmental Assessment Review Panel Service Charges Order*. SOR/98-443. 26 August 1998. Canada Gazette Part II, Vol. 132, No. 19.

*Exclusion List Regulations*. SOR/94-639. 7 October 1994. Canada Gazette Part II, Vol. 128, No. 21.

*Inclusion List Regulations*. SOR/94-637. 7 October 1994. Canada Gazette Part II, Vol. 128, No. 21.

Indian and Northern Affairs Canada (INAC). 1997a. Jurisdictional Responsibilities for Land Resources, Land Use and Development in the Yukon Territory and Northwest Territories. Book One, Northwest Territories First Nations Settlement Areas. Land Management Division, Northern Affairs Program.

Indian and Northern Affairs Canada (INAC). 1997b. Jurisdictional Responsibilities for Land Resources, Land Use and Development in the Yukon Territory and Northwest Territories. Book Two, Northwest Territories Inuvialuit Settlement Region Lands. Land Management Division, Northern Affairs Program.

Indian and Northern Affairs Canada (INAC). 1997c. Jurisdictional Responsibilities for Land Resources, Land Use and Development in the Yukon Territory and Northwest Territories. Book Three, Northwest Territories Nunavut Settlement Area Lands. Land Management Division, Northern Affairs Program.

Indian and Northern Affairs Canada (INAC). 1997d. Jurisdictional Responsibilities for Land Resources, Land Use and Development in the Yukon Territory and Northwest Territories. Book Four, Other Northwest Territories Federal Lands. Land Management Division, Northern Affairs Program.

Indian and Northern Affairs Canada and Tungavik Federation of Nunavut. 1993. Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada.

*Law List Regulations*. SOR/94-636. 7 October 1994. Canada Gazette Part II, Vol. 128, No. 21.

Mackenzie Valley Environmental Impact Review Board. 1999. Environmental Assessment in the Mackenzie Valley: Interim Guidelines.

Mackenzie Valley Environmental Impact Review Board. 1999. Environmental Impact Assessment in the Mackenzie Valley.

*Mackenzie Valley Land Use Regulations*. SOR/98-429. 26 August 1998. Canada Gazette Part II, Vol. 132, No. 19.

*Mackenzie Valley Resource Management Act* (*MVRMA*). S.C. 1998, c.25. Assented June 18, 1998. Proclaimed December 22, 1998.

National Energy Board (NEB) and Canadian Environmental Assessment Agency. 1996. Express Pipeline Project, Report of the Joint Review Panel.

Nuna Logistics Ltd. 1998. Port and Road Infrastructure Project – Concept Paper.

Nunavut Impact Review Board. 1997a. Nunavut Impact Review Board Operational Procedures.

Nunavut Impact Review Board. 1997b. Nunavut Impact Review Board Draft Rules of Practice, Revision 2.

Nunavut Impact Review Board. (no date). A Summary of the Nunavut Impact Review Board's Environmental Assessment Process.

Nunavut Planning Commission (NPC). 1998. West Kitikmeot Regional Land Use Plan. Draft *produced for Informal Public Hearing, Ikaluktutiak (Cambridge Bay), Northwest Territories.*

*Nunavut Land Claims Settlement Act (NLCSA), Statutes of Canada 1993.*

*Nunavut Act (NA), Statutes of Canada 1999.*

Public Works and Government Services. 1997. Procedures for an Assessment by a Review Panel. A guideline issued by the Honourable Christine S. Stewart, Minister of the Environment, pursuant to s. 58(1) of the *Canadian Environmental Assessment Act*.

Quiring, A. (no date). Authorizations Generally Required to Develop a Project in the Mackenzie Valley. Mackenzie Valley Land and Water Board.

*Regulations Amending the Territorial Land Use Regulations*. SOR/98-430. 26 August 1998. Canada Gazette Part II, Vol. 132, No. 19.

*Regulations Respecting the Coordination by Federal Authorities of Environmental Assessment Procedures and Requirements.* SOR/97-181. 8 April 1997. Canada Gazette Part II, Vol. 131, No. 9.

*Statute List Regulations*. JUS-0/97-(SOR). Draft for Discussion and Comments, Annotated Version.

# 5 CONSULTATION

## 5.1 Introduction

Scoping requires consultation with project stakeholders to determine what aspects of the environment are important to them and, ultimately, to help focus future assessment activities. Issues identified during the consultation component of the scoping project are intended to facilitate the selection of VECs and VSC's, which in turn serve as the primary focus of a future environmental assessment of the proposed SGP TC.

Issues identified during consultation are documented in this section. All issues raised have been analyzed to determine if they interact with a component of the proposed project or if they relate to larger concerns such as need and rationale of the project. Each of the specific issues identified during consultation has been cross-referenced to a section in this report where they are discussed in relation to existing conditions, data gaps, and future study requirements.

This chapter documents of the consultation process, including traditional knowledge consultation, and reports on the results of the process.

## 5.2 Consultation Methods

To be effective, public consultation must use methods most appropriate to the stakeholders. As there are a number of different stakeholders in the SGP, several different approaches to consultation were used.

Initially, a public information document entitled, "Slave Geological Province Transportation Corridor Proposal Environmental Scoping Information" was developed and distributed to First Nation Councils, municipal governments, industry associations, territorial and federal government departments, regulatory agencies, and Aboriginal organizations. A summary of this document was translated into Inuinnaqtun, Dogrib, and Chipewyan, and accompanied the public information document. The document served as the primary source of public information about the proposed SGP TC. Included in the public document was a response form for the public to submit their comments about the proposal to DOT. Approximately 1,100 of the public information documents were distributed throughout the Northwest and Nunavut Territories (Appendix A).

The mining industry was identified as a key project stakeholder and special attention was given to ensure industry participants had an opportunity to provide input to the scoping project. The Project Team and DOT staffed an information booth at the NWT Geoscience Forum in Yellowknife during November 1998. This event provided an opportunity to disseminate project information and discuss the proposed corridor with industry participants and regulatory agencies.

Public meetings in communities in and around the SGP were the main instrument for gathering public input to the scoping project. Public meetings included a brief overview of the SGP TC proposal and the scoping project, followed by an opportunity for participants to provide their comments about the proposal. Attempts were made to hold public meetings in all communities; however, this was not possible. Table 5.2.1 indicates the communities in which meetings were held.

**Table 5.2.1 Locations of Community Meetings**

| Community | Community Meeting | Date |
|---|---|---|
| Yellowknife | Yes | Jan 27,1999 |
| Rae | Yes | Jan 28,1999 |
| Wha Ti | No | |
| Rae Lakes | No | |
| Wekweti | No | |
| Bathurst Inlet | Yes | Feb 8, 1999 |
| Umingmaktok | Yes | Feb 8, 1999 |
| Cambridge Bay | Yes | Feb 10, 1999 |
| Kugluktuk | Yes | Feb 11, 1999 |
| Lutsel K'e | Yes | May 19, 1999 |
| Dettah | Yes | Feb 16-17, 1999 |

During a meeting with the Dogrib Treaty 11 Chiefs on January 14, 1999, the Project Team was asked not to travel to the communities of Wha Ti, Rae Lakes, and Wekweti without the expressed consent of the chiefs. While a public meeting was held in Rae, consent of the chiefs to meet in the other Dogrib communities was not received despite several requests by the Project Team. As a result, only the political leaders from the three outlying Dogrib communities were consulted. Due to scheduling difficulties the public meeting in Lutsel K'e was not held until May 19, 1999. The Yellowknives Dene First Nation requested a workshop with its Lands and Environment Committee be held in substitution for a public meeting. This request was accommodated and the session proved to be one of the more productive consultation events. In an attempt to gather the input of various Non-Government Organizations (NGOs), a focus group session was held with several NGOs in Yellowknife. Also an open house was held in Kugluktuk after a well attended public meeting in the community. Summary notes from all of the public consultation sessions are included in Appendix B.

Interviews were held with regulatory and government agencies with either a potential regulatory responsibility for the project or a program or service delivery function related to the SGP and/or the surrounding communities. Consultations were also held with officials from the three environmental assessment authorities with potential jurisdiction over the assessment of the project.

Incorporation of traditional knowledge is important at all stages of an environmental assessment, especially during the scoping stage. The Aboriginal residents of the SGP area possess a wealth of traditional knowledge gained from generations of land and resource use. Methods used to consult with traditional knowledge holders and the results of the consultation are described in the following section.

The results of each consultation were recorded and all issues raised have been analyzed to determine if they interact with a component of the proposed project or if they relate to larger concerns such as need and rationale of the project.

## 5.3 Traditional Knowledge

### *5.3.1 Introduction*

Dene, Metis and Inuit people have been resident in the SGP for generations. Over time these Aboriginal cultures have developed a knowledge system based on their close relationship and dependence on the environment. Referred to as traditional knowledge or traditional environmental knowledge; the benefits of including traditional knowledge with western scientific knowledge in environmental impact assessment are being recognized by environmental assessment agencies across Canada, and in particular the Northwest and Nunavut Territories where a significant proportion of the population is of Aboriginal descent.

In their work to document traditional environmental knowledge, the Dene Cultural Institute (1992) provide some insight to the existence of and potential benefits of using traditional environmental knowledge:

> "For thousands of years, aboriginal peoples around the world have used knowledge of their local environment to sustain themselves and to maintain their cultural identity. Only in the past decade, however, has this knowledge been recognized by the Western scientific community as a valuable source of ecological information. Today, a growing body of literature attest not only to the presence of a vast reservoir of information regarding plant and animal behavior but also to the existence of effective indigenous strategies for ensuring the sustainable use of local natural resources."

Furthermore, the Dene Cultural Institute (1992) developed a definition of traditional environmental knowledge:

> "Traditional environmental knowledge (TEK) can generally be defined as a body of knowledge built up by a group of people through generations of living in close contact with nature. It includes a system of classification; a set of empirical observations about quantity and quality of traditional environmental knowledge varies among community profession (hunter, spiritual leader, healer, etc.) With its roots firmly in the past, traditional environmental knowledge is both cumulative and dynamic, building upon the experience of earlier generations and adapting to the new technological and socioeconomic changes of the present."

Recognizing the value of traditional knowledge, the GNWT developed a policy to incorporate traditional knowledge into government decisions and actions where it is appropriate. The GNWT

defines traditional knowledge as "knowledge and values which have been acquired through experience, observation, from the land or from spiritual teachings, and handed down from one generation to another".

While definitions vary somewhat, it can be concluded that traditional knowledge (TK) is based on experience gathered during generations of living in harmony with the environment. The Aboriginal people of the SGP, like other aboriginal cultures, possess a tremendous amount of traditional environmental knowledge which could benefit environmental assessment and management in the SGP. Including traditional knowledge in the environmental scoping of the SGP TC is considered essential prerequisite to inclusion of traditional knowledge in a future environmental assessment. Accordingly, a component of the environmental scoping of the SGP TC is directed at providing an opportunity for traditional knowledge to provide input to the identification of issues for study during a future environmental assessment.

The objectives of the traditional knowledge component of the environmental scoping project were as follows:

- To identify issues and concerns of traditional knowledge holders with respect to the proposed SGP TC; and
- To identify how traditional knowledge should be addressed in an environmental assessment of the project, should it proceed.

The method by which these two objectives were addressed is discussed in the following section.

### *5.3.2 Methodology*

Aimm North Heritage Consulting coordinated the traditional knowledge component of the scoping project. Originally, the project was conceived as a directed interview process undertaken by community organizations within the SGP and coordinated by Aimm North. The original methodological design was intended to ensure uniformity of data collection and delivery while maximizing cultural sensitivity and community benefits. The original methodology proposed:

- An initial training workshop for all community data collectors to inform them about the scoping project, traditional knowledge project requirements, interview methods, and recording techniques;
- Data collection where community data collectors would interview traditional knowledge holders in their respective communities;
- Community visits and ongoing support by the Coordinator to assist community data collectors and collect results of interviews; and
- Preparation of a final report on results of traditional knowledge project

Soon after initiation of the project, it became apparent that the methodology for traditional knowledge component of the scoping project would have to be flexible to suit the priorities and resources of the communities. Some communities were satisfied with the proposed methodology; however, others felt a different approach was better suited to their needs.

Community data collectors were hired through the following organizations:

- Lutsel K'e Dene Council (Lutsel K'e)
- North Slave Metis Alliance (Yellowknife and Rae-Edzo)
- Kugluktuk Hunters and Trappers Organization (HTO)(Kugluktuk, Cambridge Bay, Umingmaktok and Bathurst Inlet)

Community data collectors received training in interview and recording methods from the Project Coordinator before commencing interviews. Interview results were provided by the North Slave Metis Alliance and Kugluktuk HTO; however, while interviews were completed in Lutsel K'e, the Dene Council was unable to verify the information in time to be used in the scoping project.

The Yellowknives Dene Band's preference for inclusion of TK holders from Dettah and Ndilo was through a two-day workshop with the Band's Land and Environment Committee. The Project Team facilitated a two-day workshop during which time committee members provided valuable input to the environmental scoping project.

The Project Team met with the Dogrib Chiefs to discuss participation in the study. It was agreed that the Dogrib Traditional Knowledge Projects Group, under the direction of the Dogrib Treaty 11 Council would undertake the traditional knowledge data collection and reporting for the SGP TC scoping project. The report produced by the Dogrib region has been included in the following analysis and is also appended for review.

### *5.3.3 Results*

Interview responses were received from the North Slave Metis Alliance and the Kugluktuk Hunters and Trappers Organizations. These organizations interviewed Metis elders in Yellowknife and Rae and Inuit elders from the Kitikmeot communities respectively. Unfortunately, due to scheduling difficulties, most interviews in the Kitikmeot were held with residents of Kugluktuk; however, some residents of the other communities were also interviewed.

The Dogrib Treaty 11 Council submitted a report titled " Dogrib Concerns about the Environmental Impacts of the Proposed SGP Transportation Corridor" which is included in Appendix C. Summary notes from the workshop with the Yellowknives Lands and Environment Committee are included in Appendix B.

Issues identified during this component of the scoping process, outlined above, are summarized in table 5.3.1. Issues from Table 5.3.1 are also included in Table 5.4.1 with the other issues identified during other components of the project.

**Table 5.3.1 Issues Raised During Traditional Knowledge Data Collection**

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| ***Project Need, Alternatives and Rationale*** | | | |
| NSMA | Studies are a waste of time. | Yellowknife | - |
| YKDFN | Need to consider types of economic development which result in long term benefits to people. | Dettah | 6.12.2, 6.14.5, 7.2 |
| YKDFN | Mineral development is a short term form of economic development. | Dettah | 6.12.2, 6.14.5, 7.2 |
| YKDFN | Need to consider SGP TC in terms of agreed upon long term objectives for area | Dettah | 3.3, 6.14.5 |
| YKDFN | Road development based on mining is a short term approach to development. | Dettah | 3.3, 6.12.2, 6.14.5, 7.2 |
| YKDFN | Non-Aboriginal people want road and the government wants it done. | Dettah | - |
| YKDFN | Why not just maintain ice road rather than construct an all-weather road. | Dettah | 3.6 |
| YKDFN | Development of roads results in increased activity and pollution, eliminating Dene use of area | Dettah | 6.10.3 |
| ***Consultation/Local Involvement in Decision Making*** | | | |
| YKDFN | Project like this must be discussed with Chief and Council before making a decision. | Dettah | 7.2 |
| YKDFN | YKDFN should conduct independent study of road impacts involving elders. | Dettah | - |
| YKDFN | Need for public consultation and sharing of information about the project. | Dettah | 7.2 |
| YKDFN | YKDFN, Treaty 11 and KIA should have joint elders meeting to discuss project. | Dettah | 7.2 |
| YKDFN | Need for more consultation amongst people from potentially affected communities. | Dettah | 6.11.3, 7.2 |
| NSMA | If there are registered tramlines or known family groups who use the area they should consent to development. | Yellowknife | 7.2 |
| Dogrib Treaty 11 Council | Dogrib want to be involved in all planning, design and assessment studies with respect to corridor. | North Slave Region | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| ***Land Claims, Local Controls*** | | | |
| NSMA | Dene/Metis must control all development or there should be no road. | Yellowknife | 6.12.3 |
| YKDFN | First Nation control over developments on their land to ensure local benefits and environmental protection. | Dettah | 6.12.3 |
| Dogrib Treaty 11 Council | Dogrib want control of developments on their land. | North Slave Region | 6.12.3 |
| YKDFN | Land claim must be settled before any further development on traditional lands. | Dettah | - |
| YKDFN | Should be no development until land claims are settled. | Dettah | - |
| YKDFN | Land owners should be involved in decisions about SGP TC. | Dettah | 6.11 |
| YKDFN | Must settle land claim boundary between Treaty 8 and 11. | Dettah | - |
| NSMA | Should be Dene/Metis owned and controlled hunting lodges along road. | Yellowknife | 6.12.3 |
| NSMA | Dene/Metis should own, control, build, the road and all sites along it. | Yellowknife | 6.12.3 |
| NSMA | Should have strong rules- development should be controlled in the north by Aboriginals. | Yellowknife | 6.12.3 |
| Dogrib Treaty 11 Council | Management plan fully involving Dogrib people must be designed and implemented. | North Slave Region | - |
| YKDFN | YKDFN may want to build, own and control the road after claim is settled. | Dettah | 6.12.3 |
| NSMA | No road unless Dene/Metis are ready even if it takes 100 years. | Yellowknife | - |
| NSMA | Road may bleed the north dry, no road unless Dene/Metis controlled. | Yellowknife | 6.12.3 |
| NSMA | Quarry service for road building should come from Aboriginal claim owners | Yellowknife | - |
| ***Caribou*** | | | |
| NSMA | Caribou are not bothered by roads. | Yellowknife | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| NSMA YKDFN | Effects of road on caribou should be studied. | Yellowknife Dettah | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| NSMA | Should use studies of impacts on caribou from other roads and pipelines to assess impacts. | Yellowknife | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| NSMA | Study caribou first, then route road and campsites away from best caribou habitat. | Yellowknife | - |
| Dogrib Treaty 11 Council | Elders remain convinced of the on going accumulative negative impact on the Bathurst Herd from present development, and that this will be increased by a road. | North Slave Region | 5.3.4 |
| Dogrib Treaty 11 Council, YKDFN | Risk of forest fire increases with road, fires destroy caribou habitat. | North Slave Region Dettah | 3.10 |
| Dogrib Treaty 11 Council | Worried about the impacts on the Bathurst Caribou calving grounds especially concerning the proposed port on the Arctic coast and at Izok Lake mineral property. | North Slave Region | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Dogrib Treaty 11 Council YKDFN | In relation to the road elders must be involved in developing caribou management plan and monitoring and mitigation measures to protect caribou. | North Slave Region Dettah | 5.3.4 |
| Public | If the road crosses caribou migration routes, make the road low so caribou can cross it easier. | Kugluktuk | - |
| Public | Caribou seem tamer and less afraid of people since the ice roads have been built. | Kugluktuk | - |
| Public | Echo Bay and ice road have been in operation for years and it doesn't negatively affect caribou. | Kugluktuk | - |
| Public | If there is no garbage smell or waste the caribou will not change their normal course because of the corridor. | Kugluktuk | - |
| Public | If people are careful there will be no effect, if they are not it might make caribou go far away from current habitat and that would not be good. | Kugluktuk | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Some impact on caribou will occur initially if there is heavy traffic on the road. | Kugluktuk | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | The road should not bother them; we have seen caribou and other animals come right into Kugluktuk. | Kugluktuk | - |
| ***Fish, Wildlife and Birds*** | | | |
| NSMA | Road is good for fish stocks in most lakes along the route, clean up the lakes and stock with fish. | Yellowknife | 6.7 |
| NSMA | Commercial fishing should not be allowed along the road. | Yellowknife | |
| NSMA | Sport fishing is good and can be monitored to protect populations. | Yellowknife | 6.7 |
| NSMA | Fish should be studied, people use this resource. | Yellowknife | 6.7 |
| NSMA | Dene/Metis must control all fisheries in their traditional areas. | Yellowknife | 6.12 |
| NSMA | People should study how much fish is eaten, what types and sizes, where are the fisheries, how healthy, what the condition of the water is now and during development. | Yellowknife | 6.7 |
| NSMA | Sport fishing should not be allowed on road – fish to eat or not at all. | Yellowknife | - |
| YKDFN | Concerns about the potential effects on aquatic ecosystems and fish. | Dettah | 6.7 |
| Public | Area good for fishing in the lakes and the river near Napaktulik Lake. | Kugluktuk | 6.7 |
| NSMA | Affects of road on other animals (wolves and arctic hare) should be studied. | Yellowknife | 6.6 |
| NSMA YKDFN | Should talk to elders about all animals they know more than scientists | Yellowknife Dettah | 5.3.4, 7.2 |
| NSMA | Put road in then study animals, it will be easier. | Yellowknife | - |
| NSMA YKDFN | Animals must be protected. | Yellowknife Dettah | - |
| NSMA | Many animals like to stand in the breeze along the road, could be affected by traffic. | Yellowknife | 6.6 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| NSMA | Maybe develop animal overpasses. | North Slave Region | 6.6 |
| Dogrib Treaty 11 Council | Potential terrain instability and erosion resulting from road construction may destroy wildlife and aquatic habitat. | North Slave Region | 6.2, 6.5, 6.7 |
| Dogrib Treaty 11 Council YKDFN | Concerns about the serious long-term effects that the construction and operation of an all-weather road could have on wildlife within our territory. | North Slave Region Dettah | 6.6, 7.2 |
| Dogrib Treaty 11 Council | Wildlife habitat loss associated with roads extends well beyond the area of direct environmental disturbance. | North Slave Region | 6.6 |
| Dogrib Treaty 11 Council | Concern about the impact of "noise" on certain wildlife species, from construction and later truck traffic. | North Slave Region | 6.6 |
| Dogrib Treaty 11 Council | What measures will be taken to mitigate impacts to wildlife affected during use of granular materials from eskers? | North Slave Region | - |
| YKDFN | Use of esker materials a concern due to impacts on wildlife and burial sites. | Dettah | 6.6.1, 6.6.2, 6.6.3, 6.6.4, 6.6.5, 6.9.1, 6.9.2, 6.9.3 |
| Dogrib Treaty 11 Council | Increased wildlife mortality due to collisions with vehicles. | North Slave Region | 6.6 |
| YKDFN | Wildlife, and harvesting opportunities, disappear from areas where roads have been developed. | Dettah | 6.6.2, 6.6.3,6.6.4 |
| Dogrib Treaty 11 Council | Road could provide barriers to wildlife, forcing them to less suitable habitat and more difficult travel routes. | North Slave Region | 6.6 |
| Dogrib Treaty 11 Council | "Fragmentation" of wildlife habitat and associated negative effects on wildlife. | North Slave Region | 6.6 |
| Public | The whole area is good for hunting; I still use a number of areas for hunting myself. | Kugluktuk | 6.6, 6.10 |
| Public | Within a 50 mile radius of Contwoyto lake was the camping area during the summer for fishing and hunting, in winter people followed the caribou that's how people came to live in Bathurst, Bay Chimo, and Kugluktuk | Kugluktuk | 6.9, 6.10 |
| Public | Some hunters from here still use the Contwoyto Lake area. | Kugluktuk | 6.10 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Families still live in Contwoyto Lake area carrying on hunting and fishing. | Kugluktuk | 6.10 |
| Public | Still used for fishing, need to be very careful not to contaminate this area and the surrounding lakes. | Kugluktuk | 6.7 |
| Public | Good hunting area for caribou, wolf, and wolverine. Some years are also good for foxes in this area. This should be preserved. | Kugluktuk | 6.10 |
| Public | There has been a winter road and DEW line sites for years and there has been no negative effects. There are still animals all over. | Kugluktuk | 6.6 |
| Public | One time when I was working at Lupin, a fish was caught with a tag that was traced to Edmonton. Wildlife have roads we don't even know about any kind of spills can negatively affect the wildlife if its not properly looked after. | Kugluktuk | 6.6, 6.7 |
| Public | Any kind of spills can negatively affect the wildlife if its not properly looked after and because we eat the wildlife it will affect us too. | Kugluktuk | 6.6 |
| ***Environmental Protection*** | | | |
| Public | Clean up needs to be stressed, so often Non- Aboriginal people build things- roads, mines, camps etc. and then leave them with garbage, contaminated things etc. Need to ensure this doesn't happen. | Kugluktuk | - |
| Public | Just be respectful of the land, most whites are not because they have not been raised in this manner. | Kugluktuk | 6.2, 6.4, 6.5, 6.6, 6.7, 6.9 |
| Public | Keep the land very well, respect it and preserve it for our future and our children's future. | Kugluktuk | 6.2, 6.4, 6.5, 6.6, 6.7, 6.9 |
| Public | If the road is to be built, do not rush, do it right and carefully respect and take care of the land. | Kugluktuk | 6.2, 6.4, 6.5, 6.6, 6.7, 6.9 |
| YKDFN | Mining companies don't care about environmental protection. | Dettah | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | If they build it right it won't negatively affect the environment. | Kugluktuk | - |
| YKDFN | Need to protect heritage and cultural sites. | Dettah | 6.9 |
| Public | If something spills onto the land it will come down the Kugluktuk River and we will be affected. This is dangerous. We don't want the rich companies to get richer while we get poisoned. | Kugluktuk | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.5.2, 6.5.5, 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.7.5, 6.9.2 |
| Dogrib Treaty 11 Council | Impacts of using and spilling of hazardous materials on environment. | North Slave Region | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.5.2, 6.5.5, 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.7.5, 6.9.2 |
| Dogrib Treaty 11 Council | Concerned about effects of road on water quality and quantity, in stream channels and groundwater | North Slave Region | 6.7, 6.8 |
| Dogrib Treaty 11 Council | Effects of stream crossing structures on aquatic environment and fish<br>. | North Slave Region | 6.7, 6.8 |
| NSMA | Use huge (taller than a man) culverts they're good for animals and fish, swamps won't dry up, spring thaw can move through easily. | Yellowknife | 6.6 |
| ***Vegetation*** | | | |
| Dogrib Treaty 11 Council<br>YKDFN | Elders have called particular attention to the potential effects of dust from the road on vegetation, and want to know how these will be minimized. | North Slave Region<br>Dettah | 6.3.3, 6.3.4, 6.3.5 |
| Public | Elders say the plant life in this area was used for medicines. | Kugluktuk | 6.5.5 |
| YKDFN | Effects of road on plants, berries and roots used by First Nation. | Dettah | 6.5.2, 6.5.4 |
| ***All-weather access to SGP*** | | | |
| YKDFN | People could get in trouble along the road during a storm. | Dettah | |
| YKDFN | Road will provide access to people from the south and result in pressures on the environment. | Dettah | 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.10.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| YKDFN | Don't support a southern connection to road as it will increase access and attract other land uses. | Dettah | 6.6.2, 6.6.3, 6.7.2, 6.7.3 |
| YKDFN | Corridor will provide increased access and increased hunting pressure on resources. | Dettah | 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.10.3, 6.11.3 |
| | ***Harvesting*** | | |
| NSMA | Licenses would restrict number of kills along the road. | Yellowknife | - |
| YKDFN | Road will likely cause changes to harvesting practices of YKDFN | Dettah | 6.11.3 |
| YKDFN | Hunting opportunities reduced if caribou migration route changes as a result of transportation corridor. | Dettah | 6.6.2, 6.6.3 |
| YKDFN | Compensation should be provided for lost or diminished harvesting opportunities. | Dettah | 7.4 |
| NSMA | Renewable Resources could police road. | Yellowknife | - |
| NSMA<br>YKDFN | Strict licensing and seasons should be enforced. | Yellowknife<br>Dettah | - |
| NSMA | Hunting will not create undo pressure on animals. | Yellowknife | 6.6.2, 6.6.3, 6.7.3 |
| NSMA | People should be able to hunt off road. | Yellowknife | - |
| NSMA | Metis/Dene should be able to fish with nets along road. | Yellowknife | 6.7.3 |
| NSMA | Road should go to good hunting areas. | Yellowknife | - |
| NSMA | Cameras only along road. | Yellowknife | - |
| NSMA | Should see if people can raise Ptarmigans, rabbits, and caribou to let some go and eat some. | Yellowknife | - |
| NSMA | Harvesting strictly enforced with checkpoints and gates manned cabins. | Yellowknife | - |
| YKDFN | YKDFN have hunting, trapping and fishing treaty rights in the area. | Dettah | 6.10.3, 6.11.3 |
| NSMA | Non –Aboriginal use should not interfere with subsistence use | Yellowknife | - |
| NSMA | During caribou migration- it should be "cameras only". | Yellowknife | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| NSMA | Caribou must be protected- no shooting 1 mile either side of the road; make sure caribou population remains high. | Yellowknife | - |
| YKDFN | If mines close we might starve because we supported road and wildlife is gone. | Dettah | 7.2 |
| YKDFN | Will YKDFN be restricted from harvesting within the corridor, like the restrictions on NWT highways? | Dettah | 6.10.3 |
| Dogrib Treaty 11 Council | Road will allow access to traditional Dogrib land and resources, possibly leading to over-harvesting and resource depletion. | North Slave Region | 6.6.3, 6.7.3, 6.10.3, 6.11.3 |
| Dogrib Treaty 11 Council | Harvesting economy in Dogrib region is based largely upon access to Bathurst Caribou Herd. | North Slave Region | 5.3.4 |
| ***Tourism*** | | | |
| NSMA | Road would increase demand for modern, good campsites along roadway. | Yellowknife | 6.10.3, 6.12.3, 6.12.4 |
| NSMA | Road should not divert to good campsites but sites should be built at best spots on route (with water and sand). | Yellowknife | - |
| NSMA | Campsites should be better monitored than on Mackenzie Highway. | Yellowknife | - |
| YKDFN | No other developments on corridor, no tourism, no leases, no cabins | Dettah | 6.10 |
| ***Economic Benefits*** | | | |
| YKDFN | Roads have provided little economic benefit to the Dene in the past – results in costs to Dene life. | Dettah | 6.12.3 |
| NSMA | Resource development should not be restricted to mining. | Yellowknife | 7.2 |
| Dogrib Treaty 11 Council | Substantial economic benefits could accrue to Dogribs during construction and operation of an all-weather road from reduced transportation costs and improved access to opportunities in and outside the Dogrib region | North Slave Region | 6.12.4 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| YKDFN | People and mines want road to make money; Inuit want road to make money, based on past experience Dene won't make money from road. | Dettah | - |
| YKDFN | Mines have a short life, what if road is built and mines close? | Dettah | 7.2 |
| YKDFN | What jobs related to road construction and operation could YKDFN members do? | Dettah | 6.12.3 |
| YKDFN | Need to ensure training opportunities are provided during construction. | Dettah | 6.12.3 |
| YKDFN | Road may provide some jobs but not enough for everyone. | Dettah | 6.12 |
| Public | Road construction will provide jobs for our young people. | Kugluktuk | 6.12.3 |
| NSMA | Cheaper food for communities could be provided by an all-weather road. | Yellowknife | 6.12.3 |
| Public | A road to Kugluktuk will lower food prices and air fares if things come to Kugluktuk by truck. | Kugluktuk | 6.12.3 |
| Public | Road to Kugluktuk would benefit other communities in the Kitikmeot. | Kugluktuk | 6.12.3 |
| Public | An all-weather road would make fuel and other necessities cheaper. | Kugluktuk | 6.12.3 |
| ***Social and Cultural*** | | | |
| NSMA | May not affect historical sites as they are mostly along the river. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| YKDFN | Past developments have caused environmental changes and changes to Dene lifestyle. Change is constant. | Dettah | 6.11.3 |
| YKDFN | Communities are currently experiencing social problems from existing changes. | Dettah | 6.11.3 |
| YKDFN | Changes are diminishing the quality of life leading to poorer quality lifestyles. | Dettah | 6.11.3, 6.13.3 |
| YKDFN | Increased social problems may result from development of SGP TC. | Dettah | 6.11.3, 6.11.5 |
| YKDFN | All- weather access to communities may increase negative effects like an increase in drugs. | Dettah | 6.12.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| YKDFN | Drug problem in Yellowknife could spread to other communities with road development. | Dettah | 6.11.3, 6.13.3 |
| NSMA | Some historic sites could be upgraded to modern campgrounds. | Yellowknife | - |
| NSMA | Some historic sites may have to be sacrificed for road that is more important. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | Avoid any historic sites that are known. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | People may want access to grave sites so they could go there and pray (Aboriginals should decide). | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | Should build cabins for oldtimers at traditional sites. | Yellowknife | - |
| NSMA | Sacred sites could be fixed up if people want. | Yellowknife | - |
| NSMA | Many traditional sites in barrens, along Beaulieu and Cameron rivers, many sites between Prelude and Gordon Lake. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | There is a big graveyard close to Mackenzie Lake, if the road is good people could visit it. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | Graveyard Act protects sacred sites, this topic is overstudied. | Yellowknife | - |
| NSMA | Sacred sites should be preserved, identified by signs. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Dogrib Treaty 11 Council | Cultural and historic sites are of intense interest to elders and need to be identified and protected. | North Slave Region | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Dogrib Treaty 11 Council | The protection of Dogrib sacred and burial sites are priorities followed by campsites and abandoned quarries. | North Slave Region | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Dogrib Treaty 11 Council | Dogrib sites are on shorelines and prominent landforms like eskers so they are in danger during construction. What mitigation measures will be used? | North Slave Region | 6.2.2, 6.2.3, 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Dogrib Treaty 11 Council | Sites could be vandalized by influx of non-residents on road . | North Slave Region | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Dogrib Treaty 11 Council | Multi-year study inventory and study of sites must be instituted with elders playing a key role. | North Slave Region | 6.9.5 |
| YKDFN | Heritage and cultural sites must be protected. | Dettah | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | Should study communities now – road will bring in southern workers then they will leave. They will also leave children, disease, criminal records, we will have a generation of fatherless kids. | Yellowknife | 6.13.3, 6.13.4, 6.13.5 |
| Dogrib Treaty 11 Council | Road may result in significant, irreversible impacts on Dogribs' land based way of life, in particular on harvesting activities. | North Slave Region | 6.12.3, 6.13.3 |
| Dogrib Treaty 11 Council | Fear that a road may be accompanied by a rise in alcohol and drug abuse, family disputes, vandalism and other crimes and traffic accidents | North Slave Region | 6.13.3, 6.13.4, 6.14.3, 6.14.4 |
| Public | I used to live in this area (SGP TC) with my family when I was a young boy. I still see the remnants of our site when I traveled back up there as an adult. It's like that throughout the whole subject area. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | Lots of artifacts in area but we leave them where they are. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | Many camps from long ago still in evidence in proposed area for corridor. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | Old campsites are still there, scattered all over the place. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | Road builders should avoid burial sites. | Kugluktuk | 6.9.2, 6.9.3, 6.9.4 |
| Public | We don't have "sacred" sites but burial sites should be avoided and respected. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | Inukshuks were also left to mark peoples travels. These are still standing in some places too. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | Lots of burial sites in the project area. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | In the old days we could not carry dead people to a central location, we wrapped them in caribou skins and covered them with rocks. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4 |
| Public | Three or four families still live year round in the areas of Contwoyto and Pellat Lakes. | Kukluktuk | 6.10 |
| Public | Long ago the area known as Lac de Gras was a normal place and "owned" by Inuit- now Dene claim it. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4 |
| Public | Remains of old Inuit campsites are visible in Lac de Gras area, even in areas currently used by Dene. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4 |
| ***Environmental Assessment*** | | | |
| YKDFN | Traditional knowledge needs to be included in environmental assessment of project. | Dettah | 4.4.5, 4.5.5, 4.5.5, 4.6.3, 4.6.5, 4.7.5, 4.9.5, 4.4, 7.4 |
| YKDFN | YKDFN want to do their own environmental assessment of project. | Dettah | 7.4 |
| ***Cumulative Effects*** | | | |
| Dogrib Treaty 11 Council | Concerned about cumulative effects of existing industrial developments in combination with proposed corridor on caribou. | North Slave Region. | 6.6.2, 6.6.3, 6.6.4 |
| YKDFN | What might be the cumulative effects of building the SGP TC? | Dettah | 4.4, 4.5, 7.4 |
| Dogrib Treaty 11 Council | Impacts of corridor on terrain/vegetation, water/fisheries, and wildlife will interact with each other as well as the impacts of other developments currently underway. | North Slave Region | 6.2.2, 6.2.3, 6.4.3, 6.5.2, 6.5.3, 6.6.2, 6.6.3, 6.7.3,6.9.2, 6.9.3, 7.4 |
| Dogrib Treaty 11 Council | Potential cumulative effects of incremental developments stimulated by development of road corridor. | North Slave Region | 6.2.2, 6.2.3, 6.4.3, 6.5.2, 6.5.3, 6.6.2, 6.6.3, 6.7.3,6.9.2, 6.9.3, 7.4 |
| ***Routing*** | | | |
| NSMA | Make it as straight as possible. | Yellowknife | - |
| NSMA | Follow eskers where possible, NE of Tibbet lake. | Yellowknife | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| NSMA | Build road from YK straight to destination first and build side roads later (to communities). | Yellowknife | - |
| NSMA | Should follow easiest route. | Yellowknife | - |
| NSMA | Road should pass by historic places | Yellowknife | - |
| NSMA | Road should go to where people live (Lac la Martre, Rae Lakes, Wekweti). | Yellowknife | - |
| NSMA | Road should follow Diefenbaker route that was cut out for 90 km. | Yellowknife | - |
| Dogrib Treaty 11 Council | Elders must be given full consideration in determining the route alignment with least environmental impact on Dogrib lands and resources. | Yellowknife | 5.3.4 |
| YKDFN | Elders possess unique knowledge about terrain, vegetation, waterbodies and other resources, inclusion of this knowledge ensures the most cost-effective route with minimum environmental impacts | Dettah | 5.3.4 |
| Public | The road should go to Kugluktuk. If the road is built just to where it is proposed the only benefit will be to the mining companies and this is not fair to the Inuit. | Kugluktuk | - |
| NSMA | Road should be routed close to traditional fishing spots. | Yellowknife | - |
| Public | It would be better if they make the road by land only and not on the lakes. | Kugluktuk | - |
| NSMA | Road should replace river travel to Old Fort Rae. | Yellowknife | - |
| NSMA | Road should go to Old Fort Rae and Trout Rock so people can get there by truck not canoe. | Yellowknife | - |
| Public | If they are going to build a road I would like to see it all the way to Kugluktuk. If they build it to another spot it will not benefit our community not even a bit. | Kugluktuk | - |
| ***General*** | | | |
| NSMA | Road should begin as soon as possible. | Yellowknife | - |
| NSMA | Should build cabins with outhouses for hunters and travelers. | Yellowknife | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| NSMA | Several small 1 or 2 man gold mines should be opened (about 100 tons) – could be milled at Treminco or Giant – Lots of these sites at Tibbett, Pensive, Dome, Gordon, Beaulieu River. | Yellowknife | - |
| NSMA | Road could go to good garden places in the bush. | Yellowknife | - |
| NSMA | Must protect water – USA is watching for water ownership possibilities | Yellowknife | - |
| NSMA | Develop road before Inuit develop deep water port | Yellowknife | - |
| NSMA | Should be developed faster and better than Mackenzie highway, chip seal right away | Yellowknife | - |
| Public | Curious as to whether the Dene is conducting a survey of area close to Yellowknife because any information gathered is important and useful when contemplating a project of this size. | Kugluktuk | - |
| Public | Building a road is good, it makes jobs and might make groceries cheaper but do not destroy our traditional way of life or our diet of country foods | Kugluktuk | - |
| Public | Many of us will not/can not survive without country foods as our system cannot handle too much "white man" food. | Kugluktuk | - |
| Public | Not very happy with where the boundaries are at all because where the two territories are splits my lake, Pellet lake, in half. Long ago this whole lake and surrounding area was populated by Inuit only and not the Indians | Kugluktuk | - |
| YKDFN | Who will pay for ongoing monitoring? | Dettah | - |
| Public | A road is ok as long as there are no pipelines or fuel spills with it. | Kugluktuk | - |
| NSMA | Land use plan for non-aboriginal use in area should be developed and adjusted as required. | Yellowknife | 7.2 |

Unfortunately, due to the varied research methodology and project submissions it was not possible to determine the significance of issues identified. The concern of one individual may well have been given the same weight as a concern expressed by a large number of individuals. In spite of the methodological limitations a number of issues were raised which should receive further attention during a future environmental assessment of the potential project. A brief discussion of some of the most common issues identified is provided below.

### *5.3.4 Discussion*

Of the Aboriginal groups with traditional and current land use in the SGP, only the Inuit have settled a land claim. Dogrib Treaty 11 Council is actively negotiating a claim, which includes parts of the SGP, with the federal government and expects to reach an agreement-in-principle in 1999. The Akaitcho Territory Tribal Council, representing NWT signatories to Treaty 8, and the North Slave Metis Alliance are pursuing aboriginal rights settlements in areas covering portions of the SGP, but the status and potential form of these settlements are presently unknown. Through their land claim settlement, the Inuit have acquired ownership and control over certain lands and joint management authority over other lands within Nunavut. It is expected that the Dogrib Treaty 11 Council will receive similar rights and benefits in their settlement.

Aboriginal groups are gaining control over, and involvement in, development within their traditional territories through settlement of land claims. Increasingly, Aboriginal groups are also becoming participants in development within and outside of their traditional territories. Understandably, the Aboriginal groups, and their members, expect to be involved in decisions affecting their traditional areas and also to receive benefits from such development. Proponents of a future SGP TC must recognize the evolving jurisdictions and expectations and ensure thorough Aboriginal involvement through the project.

In addition to the role of Aboriginal peoples in the development of the SGP TC, a number of participants expressed the need for more discussion about the proposal. The scoping project represented the first public consultation opportunity in relation to the proposal; some participants felt that there was a need for more discussion before any decisions should be made. In particular, elders of the Yellowknife Dene First Nation recommended that the elders from Treaty 8, Treaty 11 and the Kitikmeot Region of Nunavut should meet together to discuss the project.

Caribou is at the centre of Aboriginal cultures in the North. It is, therefore, not surprising that elders across the study area are concerned about the potential effects of development of the SGP TC on caribou. Concerns included mortality associated with vehicle/wildlife collisions, over-harvesting, and loss and/or fragmentation of habitat. While concerns were raised about the negative effects of roads on caribou and caribou habitat, some respondents indicated that there is a general belief that roads do not greatly affect the movement of caribou herds and that there have been studies and observations by local people to support this belief. It was also recognized that a great deal of care must be taken to ensure potential impacts from the project to caribou remain minimal.

The SGP is home to a variety of fish and wildlife species harvested by Aboriginal residents for food and income. Concerns generally related to protection of wildlife and wildlife habitat to enable harvesting to continue as it occurs today. The need for mitigative measures to prevent the road acting as a barrier was identified as was the need for control, monitoring and enforcement of hunting and fishing along the corridor. Many respondents raised a concern that the road will provide increased access to harvesting areas and that existing subsistence harvesting in these areas should be protected in light of potential increasing pressures. While many identified a potential need for some form of controls to prevent over-harvesting, others feared that hunting restrictions now in place on some NWT highways might be extended to the SGP TC, in conflict of Aboriginal treaty rights. Additionally, the potential loss of terrestrial and aquatic habitat as a result of construction and operation of the corridor and associated effects on harvesting was also identified as an important concern.

Experience of some respondents identifies the concern that in the past, developers have conducted their activities on the land with little regard for the environment, often abandoning materials and equipment on site once the job is complete. Few specific concerns were identified; however, a number of people stated that the project should not result in negative effects to land and waters in the project area. Concern over the potential for spills and effects on the environment was also raised as a concern.

Plants within the SGP have been used by Aboriginal residents for medicinal purposes. It was felt that knowledge pertaining to the medicinal use of plants was being lost and that steps should be taken to preserve this knowledge. The potential effects of road dust on vegetation, and associated indirect effects on habitat and wildlife is a concern to some participants.

The most common cultural concern was the need to identify and protect burial and other cultural sites within the SGP prior to construction of the SGP TC. Concern was also raised regarding the potential negative social effects of the project and potential all-weather road access to communities which presently do not have road access. Potential increases in drug and alcohol abuse, family problems and crime were identified as possible social problems resulting from the development of the SGP TC.

On the other hand several participants noted potential benefits from the SGP TC, including, cheaper food and fuel prices in communities, business and employment opportunities and increased access within and outside of the region.

Dogrib Treaty 11 Council stated that the cumulative effects of existing development in the SGP on caribou is not currently understood, thereby increasing concern over potential cumulative effects resulting from the SGP TC and associated mineral development. The Dogrib Treaty 11 Council paper also identified concern over the cumulative effects of the potential interaction of project impacts on terrain, vegetation, water, fisheries and wildlife. Finally, concern about the potential cumulative effects of the industrial developments expected to result from the provision of all-weather road access into the SGP was identified.

Other than identifying the need to incorporate traditional knowledge into a future environmental assessment, participants did not provide any specific recommendations about how traditional knowledge should be incorporated into an environmental assessment. Elders from the Yellowknives Dene First Nation stated that they wished to conduct their own environmental assessment of the project.

### *5.3.5 Conclusions*

The traditional knowledge consultation program received input from traditional knowledge holders from the Yellowknives Dene First Nation, North Slave Metis Alliance, Dogrib Treaty 11 Council and Kitikmeot Inuit. While information was collected from traditional knowledge holders in Lutsel K'e, it was not made available to the Project Team. A variety of issues were identified by participants and are recorded in table 5.3.1 and have been included with other issues identified during the project in table 5.4.1.

Most concerns identified related to the protection of wildlife and wildlife habitat, and the ability of Aboriginal peoples to continue to harvest fish and wildlife resources. Prime among these concerns was the recognition that the Bathurst Caribou Herd is an essential part of Aboriginal culture and its health must be protected, as should the ability of Aboriginal people to continue to harvest this resource. Participants also stated that Aboriginal groups whose traditional territory includes the SGP should be involved in studies and decisions about the potential project. Some participants stated that Aboriginal groups should control development within their territory. Potential positive and negative social and economic benefits associated with the project were identified; however, widespread concern was noted with respect to the need to identify and protect burial and other sacred sites within the SGP. Unfortunately, participants did not provide any specific recommendations as to how traditional knowledge should be incorporated in a future environmental assessment.

While the benefits of including traditional knowledge in an environmental assessment, including scoping, are widely recognized, it remains a challenge to achieve ensure full integration of traditional knowledge with western scientific knowledge. In preparation for a possible future environmental assessment of the potential SGP, some observations from this scoping project are in order. Recognizing the issue over "ownership" of traditional knowledge the Project Team attempted to have Aboriginal groups undertake the collection and reporting within their own communities. While this approach resulted in input from most communities, the volume of information provided was less than expected. The specific reasons for the provision of limited information are not known but may be influenced by:

- Short timeframe for project;
- Limited budget available for community research;
- Other priorities within communities;
- Limited human resources in communities committed to other activities;

- "Ownership" of information issues; and
- Feeling of "consultation overload" by many residents who have participated in a large number of similar consultations during the past few years.

Should the project proceed to the assessment stage, it is suggested that the future proponent take action early in the process to try and ensure full participation of traditional knowledge holders. Such action could include pre-consultation sessions with Aboriginal groups and communities, definition of traditional knowledge research projects with Aboriginal groups and provision of assistance to enable the Aboriginal groups to carry out the studies.

## 5.4 Issues Documentation

Table 5.4.1 lists all of the issues identified during the consultation process. This list includes issues raised during the public consultation sessions, in the traditional knowledge component of the project, in letters to DOT and the media, in newspaper articles during the project and in interviews with project stakeholders. The table indicates the party who raised the issue, the issue raised, where the issue was raised, and the section of this report in which the issue is addressed. Some of the issues raised relate directly to the proposed SGP TC, while others should be considered in the broader context of the ongoing development of the Northwest and Nunavut Territories. All of the issues raised during the environmental scoping project are also included in an electronic database which will allow the issues to be tracked through a future environmental assessment of the project.

**Table 5.4.1 Issues Raised During Environmental Scoping**

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| | ***Project Need, Alternatives, and Rationale*** | | |
| Ecology North | Extensive public consultation needed on rationale for project. | Yellowknife | 7.2 |
| Public | What is the justification for preliminary studies if need for project not yet confirmed. | Yellowknife | 7.2, 1.3 |
| Public | Who will benefit from the transportation corridor? | Lutsel K'e | 7.2 |
| Public | Alternative methods of transportation should be included in the analysis. | Yellowknife | 3.6 |
| Public | Total (economic, environmental, social) cost benefit analysis of project required. | Cambridge Bay Yellowknife | 6.12.5 |
| Ecology North | Strongly opposes concept of building a road from Rae or Yellowknife to Arctic Coast. | Letter | - |
| Public | Potential changes brought about by road corridor are irreversible. | Yellowknife | 7.2 |
| Public | Planning road location based on known mineral potential is a short-sighted view. | Kugluktuk | 6.12.2, 6.14.5, 7.2 |
| Public | Should have public involvement in determining need for project. | Yellowknife | 7.2 |
| Public | Has the need for the project been demonstrated? | Yellowknife | 3.3, 7.2 |
| Public | Need for public involvement in need/feasibility study. | Yellowknife | 7.2 |
| Public | Need to publicly discuss appropriate forms of economic development. | Yellowknife | 6.14.5 |
| Public | The need for such a project should be confirmed before spending money on it. | Yellowknife | 3.3 |
| Public | Building roads for potential mineral prospects is speculative- roads should be built to benefit residents. | Kugluktuk | 6.12.3, 7.2 |
| Public | Need for corridor to be considered in terms of long term economic development goals. | Cambridge Bay | 3.3, 7.2 |
| Public | Need for long term stable economic opportunities – not boom/bust cycle of mining. | Cambridge Bay | 7.2, 6.12.2, 6.12.3, 6.14.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Need for consideration of alternate projects for government spending, that might have better economic returns. | Yellowknife | 7.2 |
| YKDFN | Need to consider types of economic development which result in long term benefits to people. | Dettah | 6.12.2, 6.14.5, 7.2 |
| YKDFN | Mineral development is a short term form of economic development. | Dettah | 6.12.2, 6.14.5, 7.2 |
| YKDFN | Need to consider SGP TC in terms of agreed upon long term objectives for area. | Dettah | 3.3, 6.14.5 |
| Public | Others will benefit from the road at the expense of the caribou and the people of Lutsel K'e who depend on the caribou. | Lutsel K'e | 7.2 |
| YKDFN | Road development based on mining is a short term approach to development. | Dettah | 3.3, 6.12.2, 6.14.5, 7.2 |
| Ecology North | Need to consider appropriateness, economic impact and benefit/cost analysis of the SGP TC proposal before making decisions. | Letter to DOT | 6.12.2, 6.12.5, 6.14.5, 7.2 |
| Public | Need for environmental and socio-economic cost/benefit analysis of project. | Yellowknife | 6.12.5, 7.4 |
| Public | Development based on non-renewable resources provides only short term benefits- need to examine alternative types of economic development which are sustainable. | Yellowknife | 7.2 |
| Public | Need for sustainable economic development. | Yellowknife | 6.12.2, 6.14.5, 7.2 |
| Public | Taxpayers should not be subsidizing mining development. | Yellowknife | - |
| Public | Costs and benefits of SGP TC must be considered when making decisions. | Kugluktuk | 6.12.3, 6.12.5 |
| Public | Lack of connection between SGP TC to a long term economic development strategy for the NWT. | Yellowknife | 6.14.5, 7.2 |
| Gameti FN | Connecting communities should be the priority for new transportation infrastructure. | Yellowknife | 6.12.3, 6.12.5, 7.2 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Road should be built to serve people in the region, the greatest number of people. | Kugluktuk | 6.12.3, 6.12.5, 7.2 |
| Public | Road development must serve people first: minerals will be found wherever the road goes. | Kugluktuk | 6.12.3, 6.12.5, 7.2 |
| Public | Supports road connecting Dogrib communities and developments in region with NWT highway system. | Rae-Edzo | 6.12.3 |
| Public | Supports a road from Rae connecting the Dogrib communities. | Rae-Edzo | 6.12.3 |
| Treaty 11 | Support road if it will provide access to Dogrib communities. | Rae-Edzo | 6.12.3 |
| RWED | Provision of services in communities may become less costly if connected by all-weather road. | Yellowknife | 6.12.3 |
| YKDFN | Need to consider long term effects of road on environment and traditional way of life. | Dettah | 6.11.2, 6.11.3, 7.2 |
| NTI | Need to balance economic development with environmental protection. | Cambridge Bay | 6.12 |
| Ecology North | Recognize the need for long term, sustainable benefit to northern residents with a benign effect on our environment. | Letter | 7.2 |
| Public | Need for land use planning prior to development. | Yellowknife | 6.10 |
| BHP | Do not want an all-weather road, vagueness of concept hinders environmental management for other projects in SGP. | Yellowknife | - |
| YKDFN | Development of roads results in increased activity and pollution, eliminating Dene use of area. | Dettah | 6.10.3 |
| NSMA | Studies are a waste of time. | Yellowknife | - |
| YKDFN | White people want road and the government wants it done. | Dettah | - |
| YKDFN | Why not just maintain ice road rather than construct an all-weather road. | Dettah | 3.6 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| ***Consultation/Local Involvement in Decision Making*** | | | |
| Public | Need for more public discussion of proposal. | Yellowknife | 6.14.5, 7.2 |
| NTI | There is a need for thorough public consultation on a project such as this. | Cambridge Bay | 7.2 |
| Public | Need to consult with public, including youth. | Cambridge Bay | 7.2 |
| Public | Development process without consultation with local people | Lutsel K'e | 7.2 |
| YKDFN | Need for public consultation and sharing of information about project. | Dettah | 7.2 |
| YKDFN | Need for more consultation amongst people from all potentially affected communities. | Dettah | 6.11.3, 7.2 |
| YKDFN | Road will result in substantial change – the project must be discussed thoroughly. | Dettah | 7.2 |
| YKDFN | Project like this must be discussed with Chief and Council before making a decision. | Dettah | 7.2 |
| Public | Need for consultation activities early in process. | Kugluktuk | 7.2 |
| Public | Need public discussion on need for road. | Yellowknife | 7.2 |
| Public | Need for consultation with affected communities. | Kugluktuk | 7.2 |
| Public | People in community not aware of SGP TC or Nuna/KC proposal- have not been consulted. | Bathurst Inlet | 7.2 |
| Public | Development of transportation corridor needs public discussion. | Yellowknife | 7.2 |
| Public | Preliminary studies about proposed SGP TC not needed, issues already known. | Yellowknife | 7.2 |
| Public | People know very little about the SGP TC or Nuna/KC proposals. | Umingmaktok | 7.2 |
| YKDFN | Need for extensive consultation and public participation in decision making process. | Dettah | 6.11.3, 7.2 |
| YKDFN | Treaty 8, Treaty 11 and Inuit elders should be brought together to discuss proposed SGP TC. | Dettah | 7.2 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Need to ensure public is aware of terms and conditions for using road. | Cambridge Bay | 7.2 |
| Public | Need to involve communities in decisions affecting their future. | Cambridge Bay | 6.11.3 |
| Public | Local people should be involved in decisions affecting their future. | Cambridge Bay | 6.11.3 |
| YKDFN | YKDFN should conduct independent study of road impacts involving elders. | Dettah | - |
| NSMA | If there are registered traplines or known family groups who use the area they should consent to development. | Yellowknife | - |
| Dogrib Treaty 11 Council | Dogrib want to be involved in all planning, design and assessment studies with respect to corridor. | North Slave Region | 5.3 |
| ***Land Claims, Local Controls*** | | | |
| KIA, KC | Inuit should control and benefit from development of SGP TC. | Cambridge Bay | 6.12.3 |
| NTI | Inuit want control over development in Nunavut. | Cambridge Bay | 6.12.3 |
| YKDFN | First Nation control over developments on their land to ensure local benefits and environmental protection. | Dettah | 6.12.3 |
| YKDFN | Land owners should be involved in decisions about SGP TC. | Dettah | 6.11 |
| YKDFN | Landowners must be recognized as having a role in decisions affecting project. | Dettah | 6.11 |
| YKDFN | First Nation control over road required because it will be on their land. | Dettah | 6.12.3 |
| YKDFN | Need for YKDFN control of and benefits from development on their land. | Dettah | 6.12.3 |
| Dogrib Treaty 11 Council | Dogrib Nation will exercise control over their lands. | Rae-Edzo | 6.12.3 |
| NSMA | Dene/Metis must control all development or there should be no road. | Yellowknife | 6.12.3 |
| NSMA | Should be Dene/Metis owned and controlled hunting lodges along road. | Yellowknife | - |
| NSMA | Dene/Metis should own, control, build, the road and all sites along it. | Yellowknife | 6.12.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| NSMA | Should have strong rules- development should be controlled in the north by Aboriginal. | Yellowknife | 6.12.3 |
| NSMA | No road unless Dene/Metis are ready even if it takes 100 years. | Yellowknife | - |
| NSMA | Road may bleed the north dry, no road unless Dene/Metis controlled. | Yellowknife | 6.12.3 |
| YKDFN | Land claim must be settled before any further development on traditional lands. | Dettah | - |
| YKDFN | YKDFN may want to build, own and control the road after claim settled. | Dettah | 6.12.3 |
| Dogrib Treaty 11 Council | Dogrib Nation may be interested in being a partner in developing the road. | Rae-Edzo | 6.12.3 |
| YKDFN | Do not support further development until land claim settled. | Yellowknife | - |
| Lutsel K'e | Question of who holds title to the land must be resolved before further development can occur. | Lutsel K'e | - |
| Public | Do not support further development on Treaty 8 lands until a land claim is settled | Lutsel K'e | - |
| NTI | Nunavut claim documents compensation responsibilities for use and/or expropriation of Inuit owned lands and resources. | Cambridge Bay | 6.10.1, 6.12.3 |
| Public | Community will only benefit from project if a land claim has been settled. | Lutsel K'e | - |
| YKDFN | YKDFN and Dogrib Treaty 11 Council need to resolve boundaries. | Dettah | - |
| NSMA | Quarry service for road building should come from Aboriginal claim owners | Yellowknife | - |
| ***Caribou*** | | | |
| Public | Road may alter caribou migration and negatively affect wildlife populations in corridor. | Kugluktuk | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| YKDFN | Effects of road corridor on caribou migration. | Dettah | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Road may affect caribou migration. | Yellowknife | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Conflict between location of corridor and migration routes of Bathurst Caribou. | Kugluktuk | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Effects of road on caribou calving and migration. | Bathurst Inlet | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| YKDFN | Caribou migration routes are affected by current developments. | Dettah | 6.6.2, 6.6.3, 6.6.5 |
| Public | Concerned about road's effects on caribou migration. | Rae-Edzo | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Concerned about effects of road on caribou migration. | Yellowknife | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Dogrib Treaty 11 Council | Concerned about project effects on caribou migration. | Rae-Edzo | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | The Transportation corridor route should avoid the Bathurst Caribou Migration route. | Lutsel K'e | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Dogrib Treaty 11 Council | Concerned caribou migration may be affected by construction of road. | Rae | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Caribou should not be disturbed during calving period. | Rae-Edzo | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Effects of project on caribou and caribou calving grounds. | Bathurst Inlet | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Proposed port and road intersect caribou calving area. | Kugluktuk | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | The road may act as a barrier which could prevent caribou from coming near to Lutsel K'e. | Lutsel K'e | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Believes that current nearby developments are the reason caribou did not come close to the community this year. | Lutsel K'e | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| YKDFN | Effects of corridor on caribou migration and resulting harvesting opportunities. | Dettah | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Concerned about effects on caribou migration and sustainability of harvest. | Rae-Edzo | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Effects of the project on caribou and furbearers. | Bathurst Inlet | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Effects of project on caribou – needs to be monitored. | Umingmaktok | 6.6.2, 6.6.3, 6.6.4, 6.6.5, 7.4 |
| Public | Lights from vehicles may disorient caribou and other animals resulting in vehicle/wildlife collisions. | Lutsel K'e | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Potential vehicle-caribou interactions as caribou likely attracted to smooth road surface. | Kugluktuk | 6.6.2, 6.6.3 |
| Public | Will potential effects on caribou migration affect the ability of Lutsel K'e to harvest caribou? | Lutsel K'e | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Concerned about effects of road and traffic on caribou, especially at critical times. | Rae-Edzo | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| YKDFN | Need to learn from other experiences where roads have been built through caribou migration routes. | Dettah | 6.6.5, 6.6.6 |
| Ecology North | No one knows the long term effects mining development in the SGP will have on caribou. | News North article | 6.6.2, 6.6.3, 6.6.5 |
| YKDFN | Caribou will soon be a transboundary resource which Inuit and Dene depend on. | Dettah | 6.6.1 |
| NSMA | Caribou are not bothered by roads. | Yellowknife | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Concerned about caribou being affected by pollution from mines and the effects on people who eat those animals. | Lutsel K'e | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| NSMA YKDFN | Effects of road on caribou should be studied. | Yellowknife Dettah | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| NSMA | Should use studies of impacts on caribou from other roads and pipelines to assess impacts. | Yellowknife | 6.6.4, 6.6.5 |
| NSMA | Study caribou first, then route road and campsites away from best caribou habitat. | Yellowknife | - |
| Dogrib Treaty 11 Council | Elders remain convinced of the on going accumulative negative impact on the Bathurst Herd from present development, and that this will be increased by a road. | North Slave Region | 5.3 |
| Dogrib Treaty 11 Council, YKDFN | Risk of forest fire increases with road, fires destroy caribou habitat. | North Slave Region Dettah | 3.10 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Dogrib Treaty 11 Council | Worried about the impacts on the Bathurst Caribou calving grounds especially concerning the proposed port on the Arctic coast and at Izok Lake mineral property. | North Slave Region | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Dogrib Treaty 11 Council YKDFN | In relation to the road elders must be involved in developing caribou management plan and monitoring and mitigation measures to protect caribou. | North Slave Region Dettah | 5.3 |
| Public | If the road crosses caribou migration routes, make the road low so caribou can cross it easier. | Kugluktuk | - |
| Public | Caribou seem tamer and less afraid of people since the ice roads have been built. | Kugluktuk | - |
| Public | Echo Bay and ice road have been in operation for years and it doesn't negatively affect caribou. | Kugluktuk | - |
| Public | If there is no garbage smell or waste the caribou will not change their normal course because of the corridor. | Kugluktuk | - |
| Public | If people are careful there will be no effect, if they are not it might make caribou go far away from current habitat and that would not be good. | Kugluktuk | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Some impact on caribou will occur initially if there is heavy traffic on the road. | Kugluktuk | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | The road should not bother them; we have seen caribou and other animals come right into Kugluktuk. | Kugluktuk | - |
| ***Fish, Wildlife and Birds*** | | | |
| Public | Concerned about effects of project construction and operation on wildlife. | Umingmaktok | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Loss of marine and terrestrial wildlife in Bathurst Inlet resulting from ship and road traffic. | Kugluktuk | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.6.2, 6.6.3, 6.6.4, 6.6.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| YKDFN | Wildlife, and harvesting opportunities, disappears from areas where roads have been developed. | Dettah | 6.6.2, 6.6.3, 6.6.4 |
| Public | Road would impact wildlife less if developed to Kugluktuk in between Bathurst and Bluenose caribou calving areas. | Kugluktuk | - |
| RWED | Need to mitigate traffic/wildlife interactions. | Yellowknife | 6.4.4, 6.4.5, 6.6.4, 6.6.5 |
| Public | Road and associated activity will add additional stresses to grizzly bear population. | Yellowknife | 6.6.2, 6.6.3, 6.6.4 |
| RWED | Need model to describe how construction and operation would affect small and large carnivores. | Yellowknife | 6.6.5 |
| Ecology North | Development of roads decreases wildlife diversity. | Edmonton Journal | 6.6.2, 6.6.3 |
| CWS | Potential loss of migratory bird and wildlife habitat associated with road construction and operation. | Yellowknife | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.6.1, 6.6.2, 6.6.3, 6.6.4, 6.6.5. |
| CWS | Dust from road may result in early thaw along road and present opportunities for early spring duck hunting. | Yellowknife | 6.6.3 |
| CWS | Endangered *Anatum* sub species of peregrine falcon known to nest in Lac de Gras area. | Yellowknife. | 6.6.1, 6.6.4 |
| RWED | Effects of blasting on raptors – nest locations need to be mapped. | Yellowknife | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| DFO | Need for improvement to fisheries knowledge base in the region. | Yellowknife | 6.7.5 |
| DFO | Will need information on water bodies adjacent to road (habitat, species, etc). | Yellowknife | 6.7.4, 6.7.5 |
| DFO | Mitigation needed in construction to prevent impacts to fish and fish habitat. | Yellowknife | 6.7.5, 7.4 |
| YKDFN | Use of esker materials a concern due to impacts on wildlife and burial sites. | Dettah | 6.6.1, 6.6.2, 6.6.3, 6.6.4, 6.6.5, 6.9.1, 6.9.2, 6.9.3 |
| Public | Topographic relief such as eskers provide important habitat for wildlife. | Lutsel K'e | 6.6.1, 6.6.2, 6.6.3, 6.6.4, 6.6.5. |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Ecology North | Eskers are vital to the survival of biodiversity in the SGP. | Letter | 6.6 |
| Public | Effects on wildlife and wildlife habitat of using esker material for construction. | Bathurst Inlet | 6.6.1, 6.6.2, 6.6.3, 6.6.4, 6.6.5. |
| RWED | Mapping and composition details of eskers south of treeline is insufficient. | Yellowknife | 6.2 |
| RWED | Data on habitat potential and use south of treeline is insufficient. | Yellowknife | 6.6.5, 6.7.5 |
| MVEIRB | Potential impacts to wildlife habitat of using eskers for granular material. | Yellowknife | 6.6.1, 6.6.2, 6.6.3, 6.6.4, 6.6.5, 6.9.3 |
| Public | Road should avoid critical wildlife areas (caribou calving, raptor nesting, esker systems, tree islands). | Yellowknife | 6.5.2, 6.5.3, 6.5.4, 6.6.1, 6.6.2, 6.6.3, 6.6.4, 6.6.5. |
| NSMA | Road is good for fish stocks in most lakes along the route, clean up the lakes and stock with fish. | Yellowknife | 6.7 |
| NSMA | Commercial fishing should not be allowed along the road. | Yellowknife | 6.7 |
| NSMA | Sport fishing is good and can be monitored to protect populations. | Yellowknife | 6.7 |
| NSMA | Fish should be studied, people use this resource. | Yellowknife | 6.7 |
| NSMA | Dene/Metis must control all fisheries in their traditional areas. | Yellowknife | 6.12 |
| NSMA | People should study how much fish is eaten, what types and sizes, where are the fisheries, how healthy, what the condition of the water is now and during development. | Yellowknife | 6.7 |
| NSMA | Sport fishing should not be allowed on road – fish to eat or not at all. | Yellowknife | - |
| YKDFN | Concerns about the potential effects on aquatic ecosystems and fish. | Dettah | 6.7 |
| NSMA | Affects of road on other animals (wolves and arctic hare) should be studied. | Yellowknife | 6.6 |
| NSMA | Put road in then study animals, it will be easier. | Yellowknife | - |
| NSMA YKDFN | Should talk to elders about all animals they know more than scientists | Yellowknife Dettah | 5.3,7.2 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| NSMA<br>YKDFN | Animals must be protected. | Yellowknife<br>Dettah | - |
| NSMA | Many animals like to stand in the breeze along the road, could be affected by traffic. | Yellowknife | 6.6 |
| NSMA | Maybe develop animal overpasses. | North Slave Region | 6.6 |
| Dogrib Treaty 11 Council | Potential terrain instability and erosion resulting from road construction may destroy wildlife and aquatic habitat. | North Slave Region | 6.2, 6.6, 6.7 |
| Dogrib Treaty 11 Council<br>YKDFN | Concerns about the serious long-term effects that the construction and operation of an all-weather road could have on wildlife within our territory. | North Slave Region<br>Dettah | 6.6, 7.2 |
| Dogrib Treaty 11 Council | Wildlife habitat loss associated with roads extends well beyond the area of direct environmental disturbance. | North Slave Region | 6.6 |
| Dogrib Treaty 11 Council | Concern about the impact of "noise" on certain wildlife species, from construction and later truck traffic. | North Slave Region | 6.6 |
| Dogrib Treaty 11 Council | What measures will be taken to mitigate impacts to wildlife affected during use of granular materials from eskers? | North Slave Region | - |
| Dogrib Treaty 11 Council | Increased wildlife mortality due to collisions with vehicles. | North Slave Region | 6.6 |
| Dogrib Treaty 11 Council | Road could provide barriers to wildlife, forcing them to less suitable habitat and more difficult travel routes. | North Slave Region | 6.6 |
| Dogrib Treaty 11 Council | "Fragmentation" of wildlife habitat and associated negative effects on wildlife. | North Slave Region | 6.6 |
| Public | The whole area is good for hunting; I still use a number of areas for hunting myself. | Kugluktuk | 6.6, 6.10 |
| Public | Area good for fishing in the lakes and the river near Napaktulik Lake. | Kugluktuk | 6.7 |
| Public | Within a 50 mile radius of Contwoyto lake was the camping area during the summer for fishing and hunting, in winter people followed the caribou that's how people came to live in Bathurst, Bay Chimo, and Kugluktuk | Kugluktuk | 6.9, 6.10 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Some hunters from here still use the Contwoyto Lake area. | Kugluktuk | 6.10 |
| Public | Families still live in Contwoyto Lake area carrying on hunting and trapping. | Kugluktuk | 6.10 |
| Public | Still used for fishing, need to be very careful not to contaminate this area and the surrounding lakes. | Kugluktuk | 6.7 |
| Public | One time when I was working at Lupin, a fish was caught with a tag that was traced to Edmonton. Wildlife have roads we don't even know about any kind of spills can negatively affect the wildlife if its not properly looked after. | Kugluktuk | 6.6, 6.7 |
| Public | Good hunting area for caribou, wolf, and wolverine. Some years are also good for foxes in this area. This should be preserved. | Kugluktuk | 6.10 |
| Public | There has been a winter road and DEW line sites for years and there has been no negative effects. There are still animals all over. | Kugluktuk | 6.6 |
| Public | Any kind of spills can negatively affect the wildlife if its not properly looked after and because we eat the wildlife it will affect us too. | Kugluktuk | 6.6 |
| ***Environmental Protection*** | | | |
| Wha Ti FN | Need to protect water, land and wildlife during construction of project. | Yellowknife | 6.2.2, 6.2.3, 6.2.4, 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.5.2, 6.5.3, 6.5.4, 6.5.5, 6.6.2, 6.6.3, 6.6.4, 6.6.5, 6.7.2, 6.7.3, 6.7.4, 6.7.5, 6.9.2, 6.9.3, 6.9.4, 6.9.5, 3.9 |
| Public | Road to Bathurst Inlet is the wrong thing to do and wrong concept. Construction in that area will have dramatic environmental effects, changing the flow of rivers and landforms. | Kugluktuk | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| YKDFN | Need to protect heritage and cultural sites. | Dettah | 6.9 |
| Public | Utilize existing mining infrastructure to minimize environmental impacts. | Kugluktuk | - |
| Public | Damages to environment take a long time to recover. | Kugluktuk | - |
| Dogrib Treaty 11 Council | Impacts of corridor on water quality. | Rae-Edzo | 6.4.2, 6.4.3, 6.4.4, 6.7.2, 6.7.3, 6.7.4, 6.8.2, 6.8.3, 6.8.4 |
| NSMA | Use huge (taller than a man) culverts they're good for animals and fish, swamps won't dry up, spring thaw can move through easily. | Yellowknife | 6.6 |
| Dogrib Treaty 11 Council | Concerned about effects of road on water quality and quantity, in stream channels and groundwater | North Slave Region | |
| Dogrib Treaty 11 Council | Effects of stream crossing structures on aquatic environment and fish. | North Slave Region | |
| Public | Effect of oil spills on marine environment. | Kugluktuk | 6.4.2, 6.4.3, 6.4.4, 6.4.5 |
| Dogrib Treaty 11 Council | Impacts of using and spilling of hazardous materials on environment. | North Slave Region | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.5.2, 6.5.5, 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.7.5, 6.9.2 |
| Public | If something spills onto the land it will come down the Kugluktuk River and we will be affected. This is dangerous. We don't want the rich companies to get richer while we get poisoned. | Kugluktuk | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.5.2, 6.5.5, 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.7.5, 6.9.2 |
| NSMA | Need to develop preventive measures and contingency plans for transportation of dangerous goods. | Yellowknife | 3.9 |
| Public | What happens if fuel is spilled in the water? | Lutsel K'e | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.5.2, 6.5.5, 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.7.5, 6.9.2 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| DFO | Storage of hazardous materials near water bodies. | Yellowknife | 6.4.2, 6.4.3, 6.7.2 |
| DFO | Risk analyses required for transportation of dangerous goods. | Yellowknife | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.5.2, 6.5.5, 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.7.5, 6.9.2 |
| YKDFN | Effects of hazardous material spills on environment. | Dettah | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.5.2, 6.5.5, 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.7.5, 6.9.2 |
| Public | Need contingency plans and emergency response team to address environmental emergencies. | Kugluktuk | 3.9 |
| Public | Do not support barging of fuel and other materials on Contwoyto Lake. | Rae-Edzo | 6.7.3, 6.83 |
| Public | Effects of spills of hazardous materials on environment. | Bathurst Inlet | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.5.2, 6.5.3, 6.5.4, 6.5.5, 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.7.5, 6.8.2, 6.9.2 |
| RWED | Potential for fires, fuel or other contaminant spills and effects on wildlife. | Yellowknife | 6.4.3, 6.4.4, 6.4.5, 6.5.3, 6.5.5, 6.6.3, 6.7.2, 6.7.3, 6.7.4 |
| Public | Clean up needs to be stressed, so often Non- Aboriginal people build things- roads, mines, camps etc. and then leave them with garbage, contaminated things etc. Need to ensure this doesn't happen. | Kugluktuk | - |
| Public | If the road is to be built, do not rush, do it right and carefully respect and take care of the land. | Kugluktuk | 6.2, 6.4, 6.5, 6.6, 6.7, 6.9 |
| Public | If they build it right it won't negatively affect the environment. | Kugluktuk | - |
| Public | Just be respectful of the land, most whites are not because they have not been raised in this manner. | Kugluktuk | 6.2, 6.4, 6.5, 6.6, 6.7, 6.9 |
| Public | Keep the land very well, respect it and preserve it for our future and our children's future. | Kugluktuk | 6.2, 6.4, 6.5, 6.6, 6.7, 6.9 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| YKDFN | Mining companies don't care about environmental protection. | Dettah | - |
| Dogrib Treaty 11 Council | Environmental protection measures must be developed prior to construction. | Rae-Edzo | 6.4.5, 6.5.5, 6.6.3, 6.6.5, 6.7.5, 6.9.4, 3.9 |
| YKDFN | Recognition of Aboriginal stewardship of land and resources. | Dettah | 6.2, 6.4, 6.5, 6.6, 6.7, 6.9 |
| ***Shipping and Marine Environment*** | | | |
| Public | Concerned about safety of shipping in Bathurst Inlet and potential accidents and oil spills. | Kugluktuk | 6.4.2, 6.4.3, 6.4.4, 6.4.5 |
| Public | Shipping safer to Kugluktuk because shipping channel in Bathurst Inlet is narrow and there are islands and shallow area. | Kugluktuk | 6.4.2, 6.4.3, 6.4.4, 6.4.5 |
| Public | Concerned about safety of shipping in Bathurst Inlet and environmental consequences of accidents. | Kugluktuk | 6.4.2, 6.4.3, 6.4.4, 6.4.5 |
| Public | Port should not be built in Bathurst Inlet because of safety concerns and potential environmental consequences. | Kugluktuk | 6.4.2, 6.4.3, 6.4.4, 6.4.5 |
| Public | Loss of marine and terrestrial wildlife in Bathurst Inlet resulting from ship and road traffic. | Kugluktuk | 6.4.2, 6.4.3, 6.6.2, 6.6.3 |
| Public | Effects of ships and ship accidents on marine environment. | Bathurst Inlet | 6.4.2, 6.4.3, 6.4.4, 6.4.5 |
| Public | Don't support shipping in Bathurst Inlet because of potential impact to wildlife and marine resources. | Kugluktuk | 6.4.2, 6.4.3, 6.4.4, 6.4.5, 6.6.2 |
| Public | Concerned that shipping may extend beyond open water season and affect safety of travel on ice by humans and wildlife. | Kugluktuk | 6.4.3, 6.6.2, 6.10 |
| Public | Break-up of ice by ships may limit ability of people to travel to other communities and for harvesting. | Bathurst Inlet | 6.4.3, 6.10 |
| Public | Effects of ice breakage from ship traffic on movement of caribou between islands and mainland. | Bathurst Inlet | 6.4.3, 6.6.2 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| RWED | Effects of ice breakage from shipping on movement of animals between islands and mainland. | Yellowknife | 6.4.3, 6.6.2, 6.10 |
| RWED | Ship routing decisions are essential for reduction of potential spills. | Yellowknife | - |
| Public | Port near Kugluktuk would have a longer shipping season than a port in Bathurst Inlet. | Kugluktuk | - |
| ***Climate, Air Quality, Emissions*** | | | |
| Ecology North | Effects of global warming on project and vice versa. | Yellowknife | 6.3.1, 6.3.2, 6.3.3, 6.3.4 |
| Ecology North | All-weather road would cause global warming gas emissions to soar. | Letter | 6.3.1, 6.3.2, 6.3.3, 6.3.4 |
| YKDFN | Dust from road negatively affects vegetation which provides food for wildlife. | Dettah | 6.5.2 |
| YKDFN | Effects of road dust and vehicle emissions on environment. | Dettah | 6.5.2, 6.6.3 |
| RWED | Effect of road dust on environment. | Yellowknife | 6.5.2, 6.6.3 |
| ***Vegetation*** | | | |
| RWED | Need for inventory of rare vegetation species in corridor. | Yellowknife | 6.5.5 |
| RWED | Effects of introduction of foreign vegetation species to SGP. | Yellowknife | 6.5.2 |
| YKDFN | Effects of road on plants, berries and roots used by the First Nation. | Dettah | 6.5.2, 6.5.4 |
| Dogrib Treaty 11 Council YKDFN | Elders have called particular attention to the potential effects of dust from the road on vegetation, and want to know how these will be minimized. | North Slave Region Dettah | 6.3.3, 6.3.4, 6.3.5 |
| Public | Elders say the plant life in this area was used for medicines. | Kugluktuk | 6.5.5 |
| Public | Need to protect plants used for traditional medicine. | Lutsel K'e | 6.3.3, 6.3.4, 6.3.5, 6.5.5 |
| RWED | Relationship between plant communities and wildlife use needs to be considered during route selection. | Yellowknife | 6.4.2, 6.4.4, 6.4.5, 6.5.2, 6.5.3, 6.5.4, 6.6.2, 6.6.3, 6.6.5 |
| ***Wilderness*** | | | |
| Public | There is an intrinsic value to wilderness. | Yellowknife | 6.10, 6.11, 6.13 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Effect of road on wilderness, including human value of wilderness, value for wildlife habitat and recreation value (separate from tourism). | Yellowknife | 6.6.2, 6.6.3, 6.6.4, 6.6.5 |
| Public | Development of corridor will result in loss of wilderness. | Yellowknife | 6.2.2, 6.5.2, 6.6.2, 6.7.2, 6.10 |
| ***All-weather access to SGP*** | | | |
| City of Yellowknife | Access to SGP by all-weather road is critical to growth and prosperity of Kitikmeot and Western NWT. | Yellowknife | 6.11.4 |
| YKDFN | Road will provide access to people from the south and result in pressures on environment. | Dettah | 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.10.3 |
| Public | Road connecting region to south would be bad as it provides access to resources to others. | Kugluktuk | 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.9.2, 6.9.3 |
| YKDFN | Don't support a southern connection to road as it will increase access and attract other land uses. | Dettah | 6.6.2, 6.6.3, 6.7.2, 6.7.3 |
| Dogrib Treaty 11 Council | Need controls to prevent unauthorized development along road corridor. | Rae-Edzo | 6.10.3 |
| Public | Road access from the south has both potential social costs and benefits. | Kugluktuk | 6.11.3, 6.12.3 |
| Public | Legislative controls to prevent access are not adequate – need physical controls. | Yellowknife | 6.10 |
| PWNHC | Increased access may result in disturbance to heritage sites. | Yellowknife | 6.9.2 |
| Dogrib Treaty 11 Council | Road will provide access to non-traditional land users and possibly result in over hunting, other uses. | Rae | 6.6.2, 6.6.3, 6.10.3, 6.11.3 |
| YKDFN | Increased access from road will result in increased hunting pressures. | Dettah | 6.6.2, 6.6.3 |
| YKDFN | Road will bring more people to area and increase hunting pressures on Bathurst caribou. | Dettah | 6.6.2, 6.6.3 |
| Dogrib Treaty 11 Council | Road will enable increased access to fish and wildlife resources. | Rae-Edzo | 6.6.2, 6.6.3, 6.7.2, 6.7.3 |
| Public | Access may result in over harvesting of wildlife and decline in future harvesting opportunities. | Yellowknife | 6.6.2, 6.6.3, 6.7.2, 6.7.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Road will increase human pressures on caribou and grizzly bears. | Yellowknife | 6.6.2, 6.6.3 |
| Public | Access to SGP provided by the road will lead to a decline in wildlife | Yellowknife | 6.6.2, 6.6.3, 6.10.3, 6.11.3 |
| Public | Corridor could provide increased access to resources and increased hunting pressures. | Bathurst Inlet | 6.6.2, 6.6.3, 6.10.3, 6.11.3 |
| YKDFN | Corridor will provide increased access and increased hunting pressures on resources. | Dettah | 6.6.2, 6.6.3, 6.10.3, 6.11.3 |
| Public | Road will provide increased access which will increase hunting and fishing pressures. | Yellowknife | 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.10.3, 6.11.3 |
| YKDFN | People could get in trouble along the road during a storm. | Dettah | - |
| ***Harvesting*** | | | |
| Public | Increased development could conflict with and negatively affect ability of people to harvest resources. | Cambridge Bay | 6.10.3, 6.11.3 |
| YKDFN | Road will likely cause changes to harvesting practices of YKDFN. | Dettah | 6.11.3 |
| YKDFN | Will YKDFN be restricted from harvesting within corridor, like the restrictions on NWT highways? | Dettah | 6.10.3 |
| Public | All-weather road will enable over-harvesting of renewable resources by providing easy access to wildlife. | Kugluktuk | 6.6.2, 6.6.3, 6.7.2, 6.7.3, 6.10.3, 6.11.3 |
| RWED | Hunting and trapping pressure will be redistributed with new access. | Yellowknife | 6.6.2, 6.6.3 |
| YKDFN | Hunting opportunities reduced if caribou migration route changes as a result of transportation corridor. | Dettah | 6.6.2, 6.6.3 |
| YKDFN | Compensation should be provided for lost or diminished harvesting opportunities. | Dettah | 7.4 |
| Public | Will compensation be provided for loss of caribou harvesting opportunities? | Lutsel K'e | 7.4 |
| Public | Effects of project construction and operation on domestic and sport fishery opportunities and catches. | Bathurst Inlet | 6.7.2, 6.7.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Effects of ship traffic on people's ability to harvest caribou. | Bathurst Inlet | 6.4.2, 6.4.3, 6.6.2, 6.6.3, 6.10.3 |
| Dogrib Treaty 11 Council | Changes in caribou migration route may affect ability to harvest caribou. | Rae-Edzo | 6.6.2, 6.6.3 |
| RWED | Effects of road traffic and harvesting activities on caribou migration. | Yellowknife | 6.6.2, 6.6.3 |
| NSMA | Licenses would restrict number of kills along the road. | Yellowknife | - |
| NSMA | Renewable Resources could police road. | Yellowknife | - |
| NSMA YKDFN | Strict licensing and seasons should be enforced. | Yellowknife Dettah | - |
| NSMA | Hunting will not create undo pressure on animals. | Yellowknife | 6.6.2, 6.6.3, 6.7.3 |
| NSMA | People should be able to hunt off road. | Yellowknife | - |
| NSMA | Metis/Dene should be able to fish with nets along road. | Yellowknife | 6.7.3 |
| NSMA | Road should go to good hunting areas. | Yellowknife | - |
| NSMA | Cameras only along road. | Yellowknife | - |
| NSMA | Should see if people can raise Ptarmigans, rabbits, and caribou to let some go and eat some. | Yellowknife | - |
| NSMA | Harvesting strictly enforced with checkpoints and gates manned cabins. | Yellowknife | - |
| YKDFN | YKDFN have hunting, trapping and fishing treaty rights in the area. | Dettah | 6.10.3, 6.11.3 |
| NSMA | Non –Aboriginal use should not interfere with subsistence use | Yellowknife | - |
| NSMA | During caribou migration- it should be "cameras only". | Yellowknife | - |
| NSMA | Caribou must be protected- no shooting 1 mile either side of the road; make sure caribou population remains high. | Yellowknife | 6.6.3, 6.6.4 |
| YKDFN | If mines close we might starve because we supported road and wildlife is gone. | Dettah | 7.2 |
| YKDFN | Hunting restrictions on Mackenzie Highway alienates people from their lands. Will this happen on this road? | Dettah | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Dogrib Treaty 11 Council | Road will allow access to traditional Dogrib land & resources, possibly leading to over harvesting and resource depletion. | | 6.6.3, 6.7.3, 6.10.3, 6.11.3 |
| Dogrib Treaty 11 Council | Harvesting economy in Dogrib region is based largely upon access to Bathurst Caribou Herd. | North Slave Region | 5.3 |
| | ***Tourism*** | | |
| Public | SGP TC should be a circular road primarily for tourism. | Yellowknife | 7.2 |
| Dechi Laoti Council | Road should promote tourism and community development. | Yellowknife | 6.12.4 |
| RWED | Tourism provides longer term benefits than mining does and therefore should be addressed in road development. | Yellowknife | 6.12.3 |
| Public | Road should provide access to parks and tourism sites in area. | Yellowknife | 7.2 |
| RWED | Tourism opportunities should dominate route planning between ore bodies and destinations. | Yellowknife | 7.2 |
| Public | Potential negative impacts to tourism activities in Bathurst Inlet and effects on Umingmaktok and Bathurst Inlet. | Kugluktuk | 6.12.3 |
| Public | Road could negatively impact on existing tourism operations in SGP. | Yellowknife | 6.12.3, 6.12.4 |
| Public | Effects of road on tourism operations that sell the wilderness experience. | Yellowknife | 6.12.3, 6.12.4 |
| Public | Effects of the project on existing tourism operation in Bathurst Inlet. | Bathurst Inlet | 6.12.3 |
| NSMA | Road would increase demand for modern, good campsites along roadway. | Yellowknife | 6.10.3, 6.12.3, 6.12.4 |
| NSMA | Road should not divert to good campsites but sites should be built at best spots on route (with water and sand). | Yellowknife | - |
| NSMA | Campsites should be better monitored than on Mackenzie Highway. | Yellowknife | - |
| YKDFN | No other developments on corridor, no tourism, no leases, no cabins | Dettah | 6.10 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| | ***Economic Benefits*** | | |
| KC | Mining in the Kitikmeot is the cornerstone for the creation of economic self-sufficiency for the region. | Cambridge Bay | 6.11.4, 6.12.4 |
| KC | Mining will be the prime economic development sector in the Kitikmeot. | Cambridge Bay | 6.11.4 |
| Public | Development of non-renewable resources is our economic future. | Yellowknife | 6.12.4 |
| RWED | Economic benefits of mineral development. | Yellowknife | 6.12.3 |
| KC | Road and port in Kitikmeot will open the mineral potential in the region, stimulating long term business development, employment and training, career development and creation of an economic base for the region. | News North letter | 6.11.3, 6.12.3 |
| Public | Need to ensure mining is pursued as a long term economic activity. | Kugluktuk | 6.12.3 |
| NSMA | Resource development should not be restricted to mining. | Yellowknife | 7.2 |
| YKDFN | YKDFN must receive economic benefits from road if developed. | Dettah | 6.11.3 |
| Public | Proposal by Inuit organization for SGP TC will provide benefits to the Inuit. | Umingmaktok | - |
| YKDFN | Roads have provided little economic benefit to Dene in past- results in costs to Dene life. | Dettah | 6.12.3 |
| Public | Mines have not benefited the community in the past. | Lutsel K'e | 6.12.3 |
| YKDFN | Need to ensure training opportunities are provided during construction. | Dettah | 6.12.3 |
| Public | Employment opportunities should be available to local residents. | Umingmaktok | 6.11.3 |
| Hamlet of Rae-Edzo | People need the jobs created by the construction and maintenance of the road. | News North letter | 6.11.4, 6.12.3 |
| Public | Effects of different project routes on employment, income and tourism. | Bathurst Inlet | - |
| Public | Project should provide employment and income. | Bathurst Inlet | 6.11.3, 6.12.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Development should provide jobs, and the required training, for the Dene. | Lutsel K'e | 6.12.3 |
| Public | Road may provide economic benefits – jobs, business opportunities, reduced living costs. | Rae-Edzo | 6.12.3 |
| Public | People are used to working in camps at remote sites – would be the same for SGP TC. | Kugluktuk | 6.12.3 |
| YKDFN | Road may provide some jobs but not enough for everyone. | Dettah | 6.12 |
| Public | Project proponent must negotiate an Inuit Impacts and Benefits Agreement. | Kugluktuk | 6.12.3 |
| Public | Community needs jobs, especially as population increases. | Kugluktuk | 6.11.3, 6.11.4 |
| Public | Community needs long term employment and benefits from development. | Kugluktuk | 6.12.3 |
| Public | Dogrib should get jobs and business opportunities from development of road. | Rae-Edzo | 6.12.3 |
| YKDFN | What jobs related to road construction and operation could YKDFN members do? | Dettah | 6.12.3 |
| Public | Road construction will provide jobs for our young people. | Kugluktuk | 6.12.3 |
| Dogrib Treaty 11 Council | People need economic opportunities such as the road and spin off developments. | Rae-Edzo | 6.12.3 |
| Public | Inuit Impact and Benefits Agreements would have to be negotiated for SGP TC. | Kugluktuk | 6.12.3 |
| Public | Need for local benefits (employment, business opps) of development in region | Kugluktuk | 6.12.3 |
| Public | Supports development to provide jobs. | Kugluktuk | 6.12.3 |
| RWED | Cost of living in communities should be reduced if road connects communities. | Yellowknife | 6.12.3 |
| Public | Need to reduce cost of living in communities – increased transportation infrastructure could help. | Cambridge Bay | 6.12.1.6, 6.12.3 |
| KC | Port would provide stimulus to lower cost of living by affording cheaper fuel, building materials and bulk goods. | News North Article | 6.12.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| KC | Infrastructure development will support economic development and lowering cost of living. | Cambridge Bay | 6.12.3 |
| NTI | Need to reduce the cost of living in communities. | Cambridge Bay | 6.12.3 |
| Dogrib Treaty 11 Council | Road connecting communities should reduce the high cost of living. | Rae-Edzo | 6.12.3 |
| NSMA | Cheaper food for communities could be provided by an all-weather road. | Yellowknife | 6.12.3 |
| Public | Need to reduce cost of living in communities. | Kugluktuk | 6.12.3 |
| City of Yellowknife | Change in current resupply routes could result in negative impacts to existing business infrastructure in Yellowknife and the Western Arctic. | Letter to DOT | 6.11.4, 6.12.4 |
| Public | Yellowknife may lose some benefits with an all-weather road corridor currently enjoyed by being a staging point for the Lupin Winter Road. | Yellowknife | 6.11.4, 6.12.4 |
| Public | If corridor is built without a connection to the existing NWT highway system in western NWT, there will be negative economic consequences for the NWT. | Yellowknife | 6.11.4, 6.12.4 |
| Public | SGP TC may result in benefits to some people and locations but negative impacts to others. | Cambridge Bay | 6.11.3 |
| Public | Development of SGP TC may have negative impacts on resupply to other Kitikmeot communities. | Kugluktuk | 6.14.3 |
| NWTPC | New corridor could have effect on existing resupply system, especially Hay River. | Yellowknife | 6.12.1, 6.12.2, 6.12.3 |
| Dogrib Treaty 11 Council | Concerned about potential economic effects to NWT if only northern section of road built. | Rae-Edzo | 6.12 |
| Public | Development of SGP TC could have negative cost implications for other travel modes (air). | Cambridge Bay | 6.12.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Road to Kugluktuk would benefit other communities in the Kitikmeot. | Kugluktuk | 6.12.3 |
| Public | Need to ensure benefits of road are achieved in Kitikmeot – road must go south from Kugluktuk for this to happen. | Kugluktuk | 6.11.3 |
| Public | Benefits of non-renewable resource development leak to the south – need to examine alternative forms of economic development. | Yellowknife | 6.11.4 |
| Public | Don't need a road connection to the south as benefits would flow south. | Kugluktuk | 6.11.3 |
| Public | What will be the effect of the project on the economy of Yellowknife? | Yellowknife | 6.12.4 |
| Public | What benefits will the NWT acquire or lose if fuel is brought into the mines from the north, rather than the south which is currently the case? | Lutsel K'e | 6.11.3, 6.11.4, 6.12.3, 6.12.4 |
| KIA | Project will only be built if economically feasible. | Cambridge Bay | - |
| Public | Need to achieve balance between economic development and environmental protection. | Cambridge Bay | 6.11.3, 6.11.4 |
| KIA | Need for balance between economic development and environmental protection. | Cambridge Bay | 6.11.3, 6.11.4 |
| Public | Need for greater financial independence from federal government – expenditures related to corridor development will provide benefits. | Yellowknife | 6.12.4 |
| Dogrib Treaty 11 Council | Substantial economic benefits could accrue to Dogribs during construction and operation of an all-weather road from reduced transportation costs and improved access to opportunities in and outside the Dogrib region | North Slave Region | 6.12.4 |
| YKDFN | People and mines want road to make money; Inuit want road to make money, based on past experience Dene won't make money from road. | Dettah | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| YKDFN | Mines have a short life, what if road is built and mines close? | Dettah | 7.2 |
| Public | A road to Kugluktuk will lower food prices and air fares if things come to Kugluktuk by truck. | Kugluktuk | 6.12.3 |
| Public | An all-weather road would make fuel and other necessities cheaper. | Kugluktuk | 6.12.3 |
| ***Social and Cultural*** | | | |
| Public | Corridor project will result in changes to existing way of life in communities. | Cambridge Bay | 6.11.2, 6.11.3 |
| YKDFN | Past developments have caused environmental changes and changes to Dene lifestyle. Change is constant. | Dettah | 6.11.3 |
| YKDFN | Communities are currently experiencing social problems from existing changes. | Dettah | 6.12.3, 6.13.3 |
| Public | Building a road is good, it makes jobs and might make groceries cheaper but do not destroy our traditional way of life or our diet of country foods | Kugluktuk | 6.11.3, 6.12.3 |
| Public | Many of us will not/can not survive without country foods as our system cannot handle too much "white man" food. | Kugluktuk | 6.11.3 |
| YKDFN | Changes are diminishing the quality of life leading to poorer quality lifestyles. | Dettah | 6.11.3, 6.13.3 |
| KC | SGP TC could help reduce cost of living in communities. | Cambridge Bay | 6.12.3 |
| Public | Road should be built to connect and benefit communities. | Cambridge Bay | 6.12.3 |
| Public | Will new communities be established along the Transportation Corridor? | Lutsel K'e | - |
| Public | If road connects Kitikmeot to south then potential for increased importation of illegal drugs. | Cambridge Bay | 6.12.3 |
| NTI | Negative social impacts of project need to be mitigated. | Cambridge Bay | 6.11.3, 6.13.4 |
| YKDFN | Increased social problems may result from development of SGP TC. | Dettah | 6.11.3, 6.11.5 |
| Ecology North | Predict social impacts and family strife in communities being connected to road. | Letter | 6.11.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| YKDFN | All-weather road access to communities may have negative effects like an increase in drugs. | Dettah | 6.12.3 |
| YKDFN | Drug problem in Yellowknife could spread to other communities with road development. | Dettah | 6.11.3, 6.13.3 |
| Public | Positive and negative changes could be expected in socio-cultural environment. | Yellowknife | 6.12.3 |
| NSMA | Should study communities now – road will bring in southern workers then they will leave. They will also leave children, disease, criminal records, we will have a generation of fatherless kids. | Yellowknife | 6.13.3, 6.13.4, 6.13.5 |
| Dogrib Treaty 11 Council | Road may result in significant, irreversible impacts on Dogribs' land based way of life, in particular on harvesting activities. | North Slave Region | 6.12.3, 6.13.3 |
| Dogrib Treaty 11 Council | Fear that a road may be accompanied by a rise in alcohol and drug abuse, family disputes, vandalism and other crimes and traffic accidents | North Slave Region | 6.13.3, 6.13.4, 6.14.3, 6.14.4 |
| Public | Project may result in more people coming to live in the community. | Umingmaktok | 6.11.3, 6.12.3, 6.14.3 |
| KC | Mitigate family impacts resulting from project by working with whole family. | Cambridge Bay | 6.11.5, 6.13.4 |
| Public | Expectations for future development of community is to remain much the same as today. | Bathurst Inlet | 6.11.3 |
| Public | Umingmaktok has a vision for the future of being much the same as it is today. | Umingmaktok | 6.11.3 |
| Ecology North | Project would almost certainly lead to loss of cultural diversity and the extinction of languages. | Letter | 6.11.3 |
| Public | Effects of project on cultural activities. | Umingmaktok | 6.11.3 |
| PWNHC | Archaeological sites are commonly on eskers. | Yellowknife | 6.2.2, 6.2.3, 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | May not affect historical sites as they are mostly along the river. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | Some historic sites could be upgraded to modern campgrounds. | Yellowknife | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| NSMA | Some historic sites may have to be sacrificed for road that is more important. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | Avoid any historic sites that are known. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | People may want access to grave sites so they could go there and pray (Aboriginals should decide). | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | Should build cabins for oldtimers at traditional sites. | Yellowknife | - |
| NSMA | Sacred sites could be fixed up if people want. | Yellowknife | - |
| NSMA | Many traditional sites in barrens, along Beaulieu and Cameron rivers, many sites between Prelude and Gordon Lake. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | There is a big graveyard close to Mackenzie Lake, if the road is good people could visit it. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| NSMA | Graveyard Act protects sacred sites, this topic is overstudied. | Yellowknife | - |
| NSMA | Sacred sites should be preserved, identified by signs. | Yellowknife | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Dogrib Treaty 11 Council | Cultural and historic sites are of intense interest to elders and need to be identified and protected. | North Slave Region | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Dogrib Treaty 11 Council | The protection of Dogrib sacred and burial sites are priorities followed by campsites and abandoned quarries. | North Slave Region | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Dogrib Treaty 11 Council | Dogrib sites are on shorelines and prominent landforms like eskers so they are in danger during construction. What mitigation measures will be used? | North Slave Region | 6.2.2, 6.2.3, 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Dogrib Treaty 11 Council | Sites could be vandalized by influx of non-residents on road. | North Slave Region | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Dogrib Treaty 11 Council | Multi-year study inventory and study of sites must be instituted with elders playing a key role. | North Slave Region | 6.9.5 |
| YKDFN | Heritage and cultural sites must be protected. | Dettah | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | I used to live in this area (SGP TC) with my family when I was a young boy. I still see the remnants of our site when I traveled back up there as an adult. It's like that throughout the whole subject area. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3,6.9.4, 6.9.5 |
| Public | Lots of artifacts in area but we leave them where they are. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | Many camps from long ago still in evidence in proposed area for corridor. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | Old campsites are still there, scattered all over the place. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Public | Road builders should avoid burial sites. | Kugluktuk | 6.9.3, 6.9.4, 6.9.5 |
| Public | We don't have "sacred" sites but burial sites should be avoided and respected. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.5 |
| Public | Inukshuks were also left to mark peoples travels. These are still standing in some places too. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | Lots of burial sites in the project area. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5 |
| Public | In the old days we could not carry dead people to a central location, we wrapped them in caribou skins and covered them with rocks. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4 |
| Public | Three or four families still live year round in the areas of Contwoyto and Pellat Lakes. | Kukluktuk | 6.10 |
| Public | Long ago the area known as Lac de Gras was a normal place and "owned" by Inuit- now Dene claim it. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4 |
| Public | Remains of old Inuit campsites are visible in Lac de Gras area, even in areas currently used by Dene. | Kugluktuk | 6.9.1, 6.9.2, 6.9.3, 6.9.4 |
| ***Cumulative Effects*** | | | |
| Dogrib Treaty 11 Council | Potential cumulative effects of road and other mineral developments on environment. | Yellowknife | 6.2.2, 6.2.3, 6.4.3, 6.5.2, 6.5.3, 6.6.2, 6.6.3, 6.7.3, 6.9.2, 6.9.3, 7.4 |
| Public | What will be impact on existing highway system of developing SGP TC. | Yellowknife | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| MVEIRB | Cumulative effects assessment required as part of environmental assessment of project. | Yellowknife | 4.4, 4.5, 7.4 |
| NWTPC | Corridor could also house power transmission facilities in future. | Yellowknife | 3.2 |
| YKDFN | What might be the cumulative effects of building the SGP TC. | Dettah | 4.4, 4.5, 7.4 |
| Public | At present it is difficult to adequately assess the cumulative effects of projects. | Yellowknife | 7.4 |
| Public | No one knows how to do a cumulative effects assessment. | Yellowknife | 7.4 |
| Public | Cumulative effects of project need to be adequately assessed or project should not be allowed to proceed. | Yellowknife | 4.4, 4.5, 7.4 |
| Public | Corridor will induce other roads and developments increasing cumulative effects. | Yellowknife | 7.4 |
| DFO | What will cumulative effects be? | Yellowknife | 7.4 |
| Public | All-weather road has greater environmental and cumulative effects than a winter road. | Yellowknife | 7.4 |
| CWS | Cumulative developments may impact upon bird habitat. | Yellowknife | 6.6.2, 6.6.3 |
| Public | Project will cause loss of wilderness and large scale cumulative effects. | Yellowknife | 6.10.3, 7.4 |
| CWS | Cumulative effects of increased development may impact birds and habitat. | Yellowknife | 6.6.2, 6.6.3 |
| Dogrib Treaty 11 Council | Concerned about cumulative effects of existing industrial developments in combination with proposed corridor on caribou. | North Slave Region. | 6.6.2, 6.6.3 |
| Dogrib Treaty 11 Council | Impacts of corridor on terrain/vegetation, water/fisheries, and wildlife will interact with each other as well as the impacts of other developments currently underway. | North Slave Region | 6.2.2, 6.2.3, 6.4.3, 6.5.2, 6.5.3, 6.6.2, 6.6.3, 6.7.3, 6.9.2, 6.9.3, 7.4 |
| ***Environmental Assessment*** | | | |
| NIRB | Need to begin collecting baseline data in advance of formal project proposal. | Cambridge Bay | 6.2.5, 6.4.5, 6.5.5, 6.6.5, 6.7.5, 6.9.5 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Need to incorporate traditional knowledge in environmental assessment. | Cambridge Bay | 6.4.5, 6.5.5, 6.6.3, 6.6.5, 6.7.5, 6.9.5, 4.4, 7.4 |
| KIA | Traditional knowledge should be given equal consideration to scientific knowledge in an environmental assessment. | Cambridge Bay | 6.4.5, 6.5.5, 6.6.3, 6.6.5, 6.7.5, 6.9.5, 4.4, 7.4 |
| NIRB | Need to include traditional knowledge in environmental assessment of project. | Cambridge Bay | 6.4.5, 6.5.5, 6.6.3, 6.6.5, 6.7.5, 6.9.5, 4.4, 7.4 |
| YKDFN | Traditional knowledge needs to be included in environmental assessment of project. | Dettah | 6.4.5, 6.5.5, 6.5.5, 6.6.3, 6.6.5, 6.7.5, 6.9.5, 4.4, 7.4 |
| MVL&WB | MVRMA defines proponents responsibilities – including community consultation. | Yellowknife | 4.4 |
| Public | Environmental assessment of shipping should include potential routes to site from Lancaster Sound to Alaska. | Yellowknife | 4.4, 6.4 |
| DFO | Marine assessment should not be limited to port but entire shipping corridor. | Yellowknife | 4.4, 6.4 |
| PWNHC | Need for archaeological assessment of route prior to construction. | Yellowknife | 6.9 |
| Public | Volumes and locations of granular sources along road should be specified for assessment. | Kugluktuk | 6.2.5 |
| Public | Need to examine effects of current developments in SGP as part of process to analyze potential effects of corridor proposal. | Yellowknife | 6.2.2, 6.2.3, 6.4.3, 6.5.2, 6.5.3, 6.6.2, 6.6.3, 6.7.3, 6.9.2, 6.9.3 |
| Public | Need to examine similar circumstances to better understand and react to potential changes brought about by the project. | Yellowknife | 6.1 |
| RWED | Need to examine similar experiences of caribou and roads – Dempster Highway. | Yellowknife | 6.6.5, 6.6.6 |
| YKDFN | YKDFN want to do their own environmental assessment of project. | Dettah | 7.4 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| | ***Routing*** | | |
| Public | Road should be built to Kugluktuk not to Bathurst Inlet. | Kugluktuk | - |
| Public | People do not want road and port development at Bathurst Inlet. | Kugluktuk | - |
| Public | Need to take a broad look at all base metal potential before route is finalized. | Kugluktuk | - |
| Public | Routing should also look at base metal properties in Bear Province next to SGP. | Kugluktuk | - |
| Public | Topography in area of Bathurst Inlet very rough and difficult to build a road through. | Kugluktuk | 6.2 |
| City of Yellowknife | Supports a Yellowknife based road. Wants City to be mining centre for SGP. | Letter to DOT | - |
| Hamlet of Rae-Edzo | Supports road going from Rae and connecting Dogrib communities to lower cost of living. | News North letter | - |
| NSMA | Make it as straight as possible. | Yellowknife | - |
| NSMA | Follow eskers where possible, NE of Tibbet lake. | Yellowknife | - |
| NSMA | Build road from YK straight to destination first and build side roads later (to communities). | Yellowknife | - |
| NSMA | Should follow easiest route. | Yellowknife | - |
| NSMA | Road should pass by historic places | Yellowknife | - |
| NSMA | Road should go to where people live (Lac la Martre, Rae Lakes, Wekweti) | Yellowknife | - |
| NSMA | Road should follow Diefenbaker route that was cut out for 90 km. | Yellowknife | - |
| Dogrib Treaty 11 Council | Elders must be given full consideration in determining the route alignment with least environmental impact on Dogrib lands and resources. | Yellowknife | 5.3 |
| Public | Elders possess unique knowledge about terrain, vegetation, waterbodies and other resources, inclusion of this knowledge ensures the most cost-effective route with minimum environmental impacts | Yellowknife | 5.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | The road should go to Kugluktuk. If the road is built just to where it is proposed the only benefit will be to the mining companies and this is not fair to the Inuit. | Kugluktuk | - |
| NSMA | Road should be routed close to traditional fishing spots. | Yellowknife | - |
| | It would be better if they make the road by land only and not on the lakes. | Kugluktuk | - |
| NSMA | Road should replace river travel to Old Fort Rae. | Yellowknife | - |
| NSMA | Road should go to Old Fort Rae and Trout Rock so people can get there by truck not canoe. | Yellowknife | - |
| Public | If they are going to build a road I would like to see it all the way to Kugluktuk. If they build it to another spot it will not benefit our community not even a bit. | Kugluktuk | - |
| | ***General*** | | |
| Public | Project must adhere to environmental legislation. | Umingmaktok | 4.2, 6.4.5, 6.6.1, 6.7.4, 6.9.4 |
| Public | If laws are followed and enforced the environment will be protected. | Umingmaktok | 3.2, 6.4.5, 6.6.1, 6.7.4, 6.9.4 |
| RWED | Need for a land use plan for SGP prior to development of SGP TC. | Yellowknife | 6.10.1,6.10.4 |
| RWED | If corridor built out of Yellowknife then Ingraham Trail may need upgrading. | Yellowknife | - |
| YKDFN | Approval of project must come with conditions such as no development of cabins or tourist facilities within corridor. | Dettah | 6.10 |
| YKDFN | Priority should be upgrade of Highway # 3. | Dettah | - |
| NTI | Need to coordinate transportation with communications in one corridor as proposed in West Kitikmeot Land Use Plan | Cambridge Bay | 4.4 |
| DFO | Project will require approvals/authorizations from DFO. | Yellowknife | 4.2 |
| YKDFN | Concerned about safety of people using road. | Dettah | 6.2.2, 6.2.3 |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | Ensure enforcement capability is present on road. | Yellowknife | - |
| YKDFN | YKDFN needs funding to participate in SGP TC process. | Dettah | - |
| NSMA | Road should begin as soon as possible. | Yellowknife | - |
| NSMA | Should build cabins with outhouses for hunters and travelers. | Yellowknife | - |
| NSMA | Several small 1 or 2 man gold mines should be opened (about 100 tons) – could be milled at Treminco or Giant – Lots of these sites at Tibbett, Pensive, Dome, Gordon, Beaulieu River. | Yellowknife | - |
| NSMA | Road could go to good garden places in the bush. | Yellowknife | - |
| NSMA | Must protect water – USA is watching for water ownership possibilities. | Yellowknife | - |
| NSMA | Develop road before Inuit develop deep water port | Yellowknife | - |
| NSMA | Should be developed faster and better than Mackenzie highway, chip seal right away. | Yellowknife | - |
| Public | Curious as to whether the Dene is conducting a survey of area close to Yellowknife because any information gathered is important and useful when contemplating a project of this size. | Kugluktuk | - |
| Public | Not very happy with where the boundaries (Nunavut/NWT) are at all because where the two territories are splits my lake, Pellet lake, in half. Long ago this whole lake and surrounding area was populated by Inuit only and not the Indians. | Kugluktuk | - |

| Party | Issue | Where issue raised | Where issue Addressed in Report |
|---|---|---|---|
| Public | If GNWT acquires authority from the federal government, will they use resource revenues from Mining to fund development of Transportation Corridor? | Lutsel K'e | - |
| YKDFN | Who will pay for ongoing monitoring? | Dettah | - |
| | A road is ok as long as there are no pipelines or fuel spills with it. | Kugluktuk | - |
| NSMA | Land use plan for non-aboriginal use in area should be developed and adjusted as required. | Yellowknife | 7.2 |

# 6 EXISTING CONDITIONS, DATA GAPS AND FUTURE STUDY REQUIREMENTS

## 6.1 Introduction

Existing available biophysical and socio-economic data and information relevant to a future environmental assessment of the proposed Slave Geological Province Transportation Corridor (SGP TC) were compiled for the study area shown in Figure 6.1. This section of the Report presents the results of this data and information review exercise, and is organized by distinct environmental (including both biophysical and socio-economic) subject areas, to facilitate the retrieval of information to support future environmental assessment.

For each biophysical and socio-economic subject area, the following sections: summarize the existing (biophysical and socio-economic) environmental conditions; identify potential project-environment interactions that may cause adverse or positive environmental effects; list key issues and concerns; provide a preliminary listing of Valued Environmental Components (VECs) and Valued Socio-Economic Components (VSCs)[2] upon which a future environmental assessment should be focused; indicate likely assessment boundaries for the VECs and VSCs; identify important data gaps; and recommend future studies to address the identified data gaps to support future environmental assessment. References are provided for documents that are cited in the text, as well as other existing literature that may be useful for future assessment work.

The information contained in these sections represents the information typically generated through the initial steps of an environmental assessment. Thus, the information will support, and help to focus, future environmental assessment of the proposed SGP TC.

## 6.2 Terrain, Geology, and Soils

In addition to the preliminary environmental studies documented in this report, the development of DOT's highway strategy with respect to the SGP TC includes an analysis of routing options. Constraints to highway routing and construction posed by terrain and geological features in the SGP are described in the interim report to DOT regarding preliminary route identification (Geowest 1998). Existing geologic, topographic, and geomorphic conditions and processes are also described in the interim report. As the geographic scope of the potential transportation corridor is refined, more detailed geologic, topographic, and geomorphic data pertinent to various routing options will be presented in future reports to DOT, based on ongoing mapping and route analysis by Geowest. The reader is referred to the routing studies for more detailed information.

[2] Valued Environmental Components and Valued Socio-Economic Components are components of the natural (biophysical) and human (socio-economic, socio-cultural) environments that are valued by society and upon which an effects assessment should be focused. Issues scoping and identification of VECs/VSCs is integral to current environmental assessment practice in Canada, and ensures that the assessment is focused on project – environment interactions that are important to society. The use of VECs and VSCs to focus the assessment also facilitates effective use of study resources.

regarding terrain and geology. The following sections summarize information pertinent to the identification of potential project – environment interactions and likely issues of concern, and the future evaluation of potential environmental effects.

### *6.2.1 Existing Conditions*

#### 6.2.1.1 Geology

The SGP TC lies entirely within the Slave Geological Province of the Precambrian Shield, a physiographic region generally characterized by low relief (60 – 70 m above sea level). The bedrock of the SGP ranges in age from early Archaean (*ca.* 3.2 billion years ago) to mid Devonian (370 million years ago), and is overlain by unconsolidated Quaternary (*i.e.*, last 2 million years) sediments.

**Archaean Bedrock**

Three Archaean subdivisions occur within the SGP: pre-Yellowknife Supergroup; Yellowknife Supergroup; and Archaean-aged igneous intrusives.

The oldest bedrock exposed at the surface within the SGP comprises the *Pre-Yellowknife Supergroup, ca.* 3.2 to 2.7 billion years in age. This subdivision is the most limited in outcrop extent in the SGP (*ca.* one percent), and consists of gneissic and plutonic (*e.g.*, massive, coarse-grained, crystalline) rocks that outcrop in the southeastern portion of the study area, as well as west of the Yellowknife River and north of Duckbill Lake.

The *Yellowknife Supergroup* supracrustal strata (*ca.* 3.1 to 2.5 billion years in age) occupy approximately 30 percent of the SGP, primarily in the central portion, and comprise extensive lavas and intrusions associated with a thick suite of turbidites and mudstones (Nisbet 1987).

The *Igneous Intrusive* subdivision occupies approximately 45 percent of the SGP and is widely dispersed, outcropping east of Bathurst Inlet, along the western margin of the SGP, and north from McLeod Bay to Contwoyto Lake. The subdivision is typified by massive, coarse-grained plutonic intrusions *ca.* 2.5 to 2 billion years in age.

**Early Proterozoic and Phanerozoic Bedrock**

Early Proterozoic and Phanerozoic strata occupy about 14 percent of the SGP. These rocks outcrop north of Great Slave Lake, and in three wide zones: from Bathurst Inlet to western Contwoyto Lake; the western margin of the SGP; and in the Great Slave Lake area. Lowermost rocks of this subdivision (2.1 billion years in age) comprise intruded mafic volcanics, which grade upwards to granitic

intrusions, overlain by marine clastic and carbonate rocks (1.8 billion to 370 million years in age). The lower layers of these shallow marine sedimentary rocks are regularly intruded.

**Quaternary Sediments**

Low relief ground moraine of sandy till, deposited during the Wisconsin glaciation, blankets the study area. The Wisconsinan ice sheet locally retreated as recently as 9,500 to 9,000 years ago (Dyke and Prest 1987). Generally, till cover is discontinuous and thin (< 2 m), although greater accumulations occur in pre-glacial valleys and along scarps, and erosion-resistant dykes and outcrops. Glaciofluvial deposits (*e.g.*, eskers, kames) are common, but widely dispersed throughout the SGP. Thin glaciolacustrine deposits occur throughout the study area, a result of glacial and deglacial lakes and ice-dammed ponds.

Widespread permafrost and shallow bedrock, combined with low topographic relief, limit water percolation and drainage, and promote the accumulation of organic material. Consequently, bogs and fens occur extensively throughout the study area.

### 6.2.1.2 Soils

Soils in the area of the proposed SGP TC comprise two dominant groups (Agriculture Canada 1977; Agriculture and Agri-Food 1996) (Figure 6.2). Dystric Brunisols are dominant in the southwest portion of the corridor, north and northeast of Great Slave Lake. Dystric Brunisols are characterized by organic surface horizons overlying acidic B horizons and parent materials. They may be imperfectly drained, and in the study area occur with significant stony and rocky phases. Soil map units encompassing the study area show that Rockland (25 to 90 percent rock outcrop) occurs in more than 20 percent of the map unit area classified as Dystric Brunisols, and that Orthic Gray Luvisols (mineral soil with accumulation of slowly decomposing organic litter) and Orthic Eutric Brunisols (formed on basic parent materials) are significant inclusions, occupying 10 to 20 percent of the map unit area.

Soils in the central and northeast portion of the corridor are classified as Cryic Regosols, comprising predominantly Cryic Orthic Regosols (>40 percent of map unit area) with Rockland and Cryic Gleysols as subdominant subgroups (>20 percent of map unit area) (These units are classified as Orthic Turbic Cryosols and Regosolic Static Cryosols in Figure 6.2). (Cryic) Regosols are characterized by weak profile development, and often reflect the characteristics of the parent materials. Cryic Regosols may occur over a variety of parent materials. In these soils, weak profile development is attributable to periglacial processes. In poorly drained areas, Cryic Regosols may grade into Cryic Gleysols. In the study area, these soils occur with significant stony phases.

Along the northeast shore of Great Slave Lake, Rockland dominates, with stony-phase Orthic Gleysols (poorly drained soils) occurring as a subdominant subgroup (>20 percent of map unit area). To the northwest of Great Slave Lake, Cryic Fibrisols (frozen organic soils; organic cryosols) are dominant, with subdominant components of poorly drained Orthic Gleysols and significant inclusions of Orthic Eutric Brunisols.

Depending on the routing of the SGP TC, only a small portion of the highway would intersect either of these soil units.

#### 6.2.1.3 Permafrost

Permafrost refers to soil or rock that remains at or below 0°C for at least two years (NRCC 1988). Permafrost underlies approximately 50 percent of Canada's land area. The southwest portion of the SGP TC is located within the zone of widespread discontinuous permafrost, in which 30 to 80 percent of the land surface is underlain by permafrost (Figure 6.3). The thickness and extent of permafrost increases to the north, grading into the zone of continuous permafrost. Permafrost thickness varies from approximately 100 m at the southern limit of continuous permafrost to over 1,000 m in the extreme north (French and Slaymaker 1993). In the discontinuous permafrost zone, permafrost preferentially occurs in exposed, well-drained rock and sediments of light colour and little snow cover, and in organic deposits with good insulative properties (*e.g.*, peat). Permafrost typically is absent under lakes and rivers.

Permafrost conditions are influenced by geology, sediment and soil type, vegetation, groundwater and surface water flow, moisture content, ambient air temperature, degree and aspect of slope, and snow cover. Thus, permafrost conditions show a high degree of spatial variability, particularly in the discontinuous permafrost zone.

Permafrost may or may not contain ice, depending on rock and sediment type. Rock and coarse-grained, well-drained sediments (*e.g.*, cobbles, gravels) may be free of interstitial ice, whereas fine-grained sediments (*e.g.*, clay, silt) and organic materials may contain significant amounts of disseminated ice. Massive ground ice (*i.e.*, lenses, veins, wedges) may occur in both coarse- and fine-grained sediments.

In areas underlain by permafrost, the top layer of the ground is subject to annual thawing and freezing; this layer is referred to as the active layer. The thickness of the active layer varies from year to year, and is contingent on a variety of factors listed above. The thickness of the active layer increases further south, ranging from less than 15 cm in the High Arctic to more than one metre at the southern limit of continuous permafrost (NRCC 1988). Thus, the active layer likely will be thicker in the southwest portion of the SGP TC, generally thinning to the northeast.

Icings are another feature of cold climates, and are more common in, but are not limited to, permafrost areas. Icings comprise sheet-like masses of layered ice formed on the ground surface, or on river or lake ice, by freezing of successive flows of water from groundwater seepage, springs, or rivers. Icings may persist over the summer season, and may recur in the same location in successive years. The SGP TC may encounter existing recurrent icings or may induce icings by altering groundwater or surface water flow.

The terrain to be traversed by the SGP TC is also subject to a wide range of geomorphic processes characteristic of cold climates and permafrost areas. These include cryoturbation (*i.e.*, soil movements due to frost action), solifluction and gelifluction, frost shattering, frost heave, active layer failures, thaw slumping, thermokarst, and development of seasonal frost mounds.

The SGP TC will encounter highly variable permafrost conditions, likely ranging from dry, ice-free rock and coarse-grained sediments to ice-rich, thaw-sensitive fine-grained sediments and buried massive ice bodies. Moreover, the suite of active periglacial processes will show a high degree of spatial variability. Specific conditions associated with permafrost and frost-related processes that will be encountered by the SGP TC will be determined in greater detail as the corridor is refined and the actual route selected.

### *6.2.2 Potential Project-Environment Interactions*

Development of the road and ancillary facilities will involve the disturbance of rock, sediment, and soil. Such disturbance will include blasting and excavation of rock, placement of fill, extraction of aggregate for fill and roadbed construction, grading, and removal of soils and organic material unsuitable for construction.

The geology, terrain, and permafrost conditions encountered by the SGP TC will pose technical and engineering challenges to construction and operation of the road and ancillary facilities. Selection of the route and road design will consider such factors as terrain stability (*i.e.*, slopes, organic materials, permafrost, and erodibility), topography, availability of aggregate, constructability, and cost.

The integrity of engineered works constructed on or near slopes that are subject to periglacial processes, such as solifluction, gelifluction, active layer failures, and thaw slumping, may be compromised. Also, the integrity of engineered works constructed over frost-susceptible sediments, buried massive ground ice, and across transitional areas between frozen and unfrozen terrain may be adversely affected by differential freeze-thaw, frost heaving and jacking, and thermokarst. A loss of structural integrity would be of concern with respect to user safety and ongoing maintenance costs.

Frost heaving and thaw settlement could lead to pavement cracking and development of an uneven pavement surface. Thaw and water infiltration from the surface may saturate the subgrade and cause loss of strength and bearing capacity. Frost heave may also cause loss of compaction and loosening of fill in the subgrade, further reducing strength and bearing capacity. Frost heaving of drainage

structures may disrupt cross-drainage and lead to icing and saturation of the subgrade. This may reduce strength and bearing capacity, and promote further heave and settlement. Maintenance activities, such as plowing of snow from the road onto the shoulders, may alter the ground thermal regime, promoting thaw under the embankment side slopes. This may result in settlement, cracking of pavement, and ponding of drainage below the roadbed.

Permafrost often exists in delicate equilibrium with local conditions. Surface disturbance may upset this equilibrium and trigger either the aggradation or degradation of permafrost that may adversely affect the integrity of engineered works, as well as result in adverse effects on valued environmental components, such as downstream surface water bodies that provide habitat for fish.

In addition to these effects of the environment on the project, disturbance of rock, sediment, and soils will result in the alteration of physiographic features that may provide wildlife habitat, support sensitive animal and plant species, or that may be associated with cultural resources. For example, eskers, which are a valuable source of aggregate for construction, provide important wildlife habitat, and have high potential for archaeological sites. The potential effects of the project on biophysical and socio-cultural components of the environment are addressed elsewhere in this report.

The SGP TC may encounter deposits of serpentinite, argillite, and soapstone suitable for carving purposes. The Nunavut Land Claims Agreement assigns rights to the Inuit to obtain exclusive quarrying leases or to acquire title to lands with significant deposits of carving stone within Nunavut.

### *6.2.3 Likely Issues of Concern*

Key issues that likely will require further consideration should the SGP TC proceed to the assessment stage include:

- The integrity of engineered works on and near periglacially active slopes;
- Disturbance of ground thermal regime and consequent effects on highway integrity; and
- Identification and management of significant deposits of carving stone.

### *6.2.4 VECs and VEC Boundaries*

#### 6.2.4.1 Terrain Stability (Sensitive Permafrost Terrain, Periglacially Active Slopes)

Concern with respect to permafrost stability and slope stability relates primarily to the potential effects of a change in stability on human uses of the land and biophysical and socio-cultural resources (rather than some intrinsic value of the permafrost itself). Potential effects of terrain disturbance on biophysical and socio-cultural components (*e.g.*, wildlife, fish habitat, archaeology) are addressed elsewhere in this report, and in future assessment, would be considered in the context of the selected

VECs and VSCs. Also, engineering constraints posed by geology and terrain will be considered through route selection and road design.

Federal environmental assessment legislation requires the assessment of potential effects of the environment on the project. Also, the Nunavut environmental assessment process involves the examination of "physical effects" which include effects on permafrost. A future environmental assessment should consider the effects of terrain stability, specifically of sensitive permafrost terrain and periglacially active slopes, on the project. The boundaries of the assessment would encompass those areas along the proposed SGP TC underlain by permafrost sensitive to disturbance (*e.g.*, fine-grained, frost-susceptible sediments, buried massive ground ice, organic sediments, transitional areas) or on or near periglacially active slopes.

#### 6.2.4.2 Carving Stone

Carving stone (*utkuhighak* and *hananguagahaq*) is valued by the Inuit as a cultural resource. The Nunavut Land Claims Agreement assigns rights to the Inuit to obtain exclusive quarrying leases or to acquire title to lands with significant deposits of carving stone. The SGP TC may encounter deposits of serpentinite, argillite, and soapstone suitable for carving purposes. Although the spatial extent of carving stone deposits that may be encountered by the SGP TC likely would be limited, the potential users of this resource may be distributed across a wide area of Nunavut. Future assessment of the potential effect of the project on this resource would consider this cultural boundary.

### *6.2.5 Data Gaps and Future Study Needs*

Ongoing route selection and refinement, and future road design, will consider such factors as terrain stability (*i.e.*, slopes, organic materials, permafrost, and erodibility), availability of aggregate, constructability, and cost. More detailed analysis of locations and volumes of granular materials will be undertaken (see also Geowest 1998).

Future route selection studies must identify slopes on or near the route that are subject to periglacial processes, such as solifluction, gelifluction, active layer failures, and thaw slumping, and areas potentially underlain by frost-susceptible sediments, buried massive ground ice, and transitional areas between frozen and unfrozen terrain. Interpretation of existing surficial mapping and aerial photography of the route should be carried out to identify such constraints, followed up with ground-truthing (in test sections) by detailed surficial mapping, non-intrusive geophysical techniques, and coring.

Where the route may traverse organic deposits, detailed mapping of permafrost distribution within the organic materials will be required, using similar techniques.

Detailed geotechnical investigations and lab testing (*e.g.*, compressibility, thaw strain, settlement potential) will be required to determine permafrost and sediment characteristics to support final route selection and design. Long-term monitoring of ground temperature and stability likely will be required. However, such detail likely would not be required for the assessment of environmental effects.

Once the route has been selected, additional geologic mapping should be reviewed and ground-truthed as necessary to identify any significant deposits of carving stone. Should such deposits be identified on Crown Lands, the Designated Inuit Organization must be notified to enable the disposition of the carving stone to be determined.

### *6.2.6 Bibliography*


Agriculture Canada. 1977. Soils of Canada. Volume 1: Soil Report, Volume 2: Inventory, and maps. Research Branch, Canada Department of Agriculture.

Anderson, D.M., P.J. Williams, G.L. Guyman, and D.L. Kane. 1984. In *Frost Action and Its Control*. R.L. Berg and E.A. Wright, (eds.). Technical Council on Cold Regions Engineering Monograph. American Society of Civil Engineers. New York. 1-21.

Berg, R.L. and G.N. Aitken. 1973. Some passive methods of controlling geocryological conditions on roadway construction. In *North American Contribution to the Second International Conference on Permafrost, 13-28 July, 1973 Yakutsk, U.S.S.R.* National Academy of Sciences. Washington, D.C. 581-586.

Canalog (a Division of CANAC Consultants Limited), and Canadian Pacific Consulting Services Limited. 1980. Northeast Mackenzie District Transportation Study Phase II. A study of transportation options for the movement of mineral concentrates from the Contwoyto Lake area (NWT) to markets in Canada and Europe. Prepared for Department of Indian and Northern Affairs.

Crory, F.E., R.M. Isaacs, E. Penner, F.J. Sanger, and J.F. Shook, 1984. Designing for frost heave conditions. In *Frost Action and Its Control*. R.L. Berg, and E.A. Wright, (eds.). Technical Council on Cold Regions Engineering Monograph. American Society of Civil Engineers. New York. 22-24.

Department of Indian Affairs and Northern Development. 1968. Roads North of the Yellowknife Area: Assessment of Alternatives. Submission to the Interdepartmental Advisory Committee on Northern Roads.

Department of Indian Affairs and Northern Development. 1979. Northeast Mackenzie District Transportation Study Phase I. Prepared by L. Dubose, Transportation and Communications Section, Economic Analysis Division.

Department of Transportation. 1993. Highway Maintenance Manual. Highway Operations Division, Government of Northwest Territories, Yellowknife.

Department of Transportation. 1998a. Department of Transportation Lupin Winter Road Initiative. Draft prepared by Highways and Engineering Division, Government of the Northwest Territories, Yellowknife.

Department of Transportation. 1998b. Reconstruction of Yellowknife Highway Frank Channel km 242 to Yellowknife km 333. Prepared by Highways and Engineering Division, Government of the Northwest Territories, Yellowknife.

Dyke, A.S. and V.K. Prest. 1987. The Late Wisconsinan and Holocene History of the Laurentide Ice Sheet. *Geographie physique et Quaternaire* 41:237-263.

Esch, D.C. 1990. 20 year performance history of first insulated roadway on permafrost in Alaska. In *Permafrost-Canada, Proceedings of the Fifth Canadian Permafrost Conference*. Collection Nordicana, No. 54. Centre d'études nordiques de l'Université Laval, Québec. 403-408.

Esch, D.C. 1978. Road embankment design alternatives over permafrost. In *Proceedings of the Conference on Applied Techniques for Cold Environments, vol. 1 Cold Regions Specialty Conference, May 17-19, 1978, Anchorage, Alaska*. American Society of Civil Engineers. 159-170.

Fookes, P.G., M. Sweeney, C.N.D. Manby and R.P. Martin. 1985. Geological and geotechnical engineering aspects of low-cost roads in mountainous terrain. *Engineering Geology*. 21: 1-152.

French, H.M. 1993. Cold-Climate Processes and Landforms. In *Canada*:*s Cold Environments*. Hugh M. French and Olav Slaymaker (eds.). McGill Queens University Press. 143-170.

French, H.M. and O. Slaymaker (eds.). 1993. Canada's Cold Environments. McGill Queens University Press.

Gaskin, D.A. and L.E. Stanley. 1973. Control of culvert icing. In *North American Contribution to the Second International Conference on Permafrost, July 13-28, 1973, Yakutsk, U.S.S.R.* National Academy of Sciences. Washington, D.C. 629-636.

Geowest Environmental Consultants Ltd. 1998. Draft Report: Multi-level Mapping and Route Analysis Slave Geological Province Transportation Corridor. September. Prepared for Highways and Engineering Division, Department of Transportation, Government of Northwest Territories. Roll of 18 1: 250,000 maps appended, with route options.

Hearn, G. and D.K.C. Jones. 1987. Geomorphology and mountain highway design; some lessons from the Dharan-Dhankuta Highway, East Nepal. In *International Geomorphology 1986, Part 1*. V. Gardiner, (ed.). John Wiley & Sons Ltd. 203-219.

Huculak, N.A., J.W. Twach, R.S. Thomson, and R.D. Cook. 1978. Development of the Dempster Highway North of the Arctic Circle. In T*hird International Conference on Permafrost vol.1 July 10-13, 1978 Edmonton, Alberta*. National Research Council of Canada. Ottawa, Ontario. 798-805.

Johnson, T.C., E.C. McRoberts, and J.F. Nixon. 1984. Design implications of subsoil thawing. In *Frost Action and Its Control*. Berg, R.L. and E.A. Wright (eds.). Technical Council on Cold Regions Engineering Monograph. American Society of Civil Engineers. New York. 45-104.

Jones, D.K.C., D. Brunsden, and A.S. Goudie. 1983. A preliminary geomorphological assessment of part of the Karakoram Highway. *Quarterly Journal of Engineering Geology* 16: 331-355.

Jones, W.V. and A. Stilley. 1986. Geotechnical design considerations for road construction on an active talus slope. In *Proceedings of the 37th Annual Highway Geology Symposium, Geotechnical Aspects of Construction in Mountainous Terrain, August 20-22, 1986, Helena, Montana*. Montana Department of Highways and Federal Highway Administration, Montana Division. 11-26.

Klohn-Crippen Consultants Ltd. 1993. Izok Project: Environmental Evaluation Submission to the Regional Environmental Review Committee. Prepared for Metall Mining Corporation, Richmond.

LGL Limited. 1979. Assessment of Impacts of a Road to Izok Lake: A review of existing information and recommendations for research on selected species of wildlife. Prepared by G.F. Searing and W.G. Alliston for Northwest Territories Fish and Wildlife Service, Yellowknife.

Lalji, D.S. and R.C. Pathak. 1988. Study of some geotechnical aspects effecting [sic] construction in glacial regions of Himalayas. In *Proceedings of the Permafrost, Fifth International Conference vol. 2, August 2-5, 1988, Trondheim, Norway*. Tapir Publishers, Trondheim. 1271-1276.

Linell, K.A and G.H. Johnston. 1973. Engineering design and construction in permafrost regions: a review. In *North American Contribution to the Second International Conference on Permafrost, July 13-28, 1973, Yakutsk, U.S.S.R.*. National Academy of Sciences, Washington, DC. 553-575.

Livingston, H. and E. Johnson. 1978. Insulated roadway subdrains in the subarctic for the prevention of spring icing. In *Proceedings of the Conference on Applied Techniques for Cold Environments, vol. 1 Cold Regions Specialty Conference, May 17-19, 1978, Anchorage, Alaska*. American Society of Civil Engineers. 513-521.

McHattie, R. and D.C. Esch. 1988. Embankment failure from creep of permafrost foundation soils: a case history. In *Proceedings of the Permafrost, Fifth International Conference, vol. 2, August 2-5, 1988, Trondheim, Norway*. Tapir Publishers, Trondheim. 1292-1297.

Mollard, J.D. 1997. Office airphoto and map pre-feasibility study of a road route from Ingraham Trail Terminus to Exeter Lake, Northwest territories. Report prepared for Expedite North Ltd.

NRCC (National Research Council of Canada). 1988. Glossary of Permafrost and Related Ground-Ice Terms. Permafrost Subcommittee, Associate Committee on Geotechnical Research, National Research Council of Canada. Technical Memorandum No. 142.

Nichols, D.R. and L.A. Yehle. 1961. Highway construction and maintenance problems in permafrost regions. In *Proceedings of the 12th Annual Symposium on Geology as Applied to Highway Engineering.* Engineering Experiment Station, University of Tennessee. Bulletin No. 24. 19-29.

Nisbet, E.G. 1987. The Young Earth: An Introduction to Archaean Geology. Allen & Unwin Inc. Boston.

Nunavut Planning Commission. 1998. West Kitikmeot Regional Land Use Plan. Draft produced in June 1998, for informal public hearing, Akaluktutiak (Cambridge Bay), Northwest Territories.

Quong, J.Y.C. 1971. Highway construction and permafrost with special reference to the active layer. In *Proceedings of a Seminar on the Permafrost Active Layer, May 4-5, 1971*. R.J.E. Brown (ed.). National Research Council of Canada, Associate Committee on Geotechnical Research, Technical Memorandum No. 103. Ottawa, Ontario. 50-53.

Tobiasson, W. 1978. Construction on permafrost at Longyearbyen, Spitsbergen. In *Third International Conference on Permafrost, Proceedings, vol. 1, July 10-13, 1978, Edmonton, Alberta*. National Research Council of Canada. Ottawa, Ontario. 884-890.

Wang, Q., J. Wu, and J. Liu. 1988. Application of lime stabilization on highway permafrost region, Qinghai-Xizang plateau. In *Proceedings of the Permafrost, Fifth International Conference, vol. 2, August 2-5, 1988, Trondheim, Norway*. Tapir Publishers, Trondheim. 1511-1514.

## 6.3 Climate

### *6.3.1 Existing Conditions*

The SGP generally experiences long cold winters and short cool summers. Climatic conditions vary considerably from the boreal forest of the southern SGP to the barren tundra and Arctic coast at the northern terminus of the SGP. Meteorological records are currently collected at two sites within the SGP, Yellowknife in the south and Lupin Mine in the north. Prior to the station opening at Lupin Mine in 1981, a meteorological station was operated on the southeast side of Contwoyto Lake; however, with the opening of the mine this station was closed. Records from Yellowknife indicate that the daily mean temperature ranged from a minimum of –27.9°C in January to 16.5°C in July for the period between 1961-1990 (Cirrus Consultants 1998). Combining records from the Lupin and Contwoyto Lake stations for the period of 1956-1995, the mean daily temperature at Contwoyto Lake in January was –31.2°C and 10.2°C in July. Extreme temperatures recorded at both locations result in a maximum recorded temperature range of –51.2°C to 32.5°C within the SGP. Temperatures within the SGP generally decrease with increasing latitude. Meteorological stations have recently been established at the Izok Lake mineral property (Klohn-Crippen 1993), Ekati Diamond Mine (BHP 1995), and at the Diavik Diamond site on Lac de Gras (Cirrus Consultants 1998) within the SGP. These stations are privately operated and do not have a long period of record.

Precipitation ranges from approximately 300 mm in the southern part of the SGP to 200 mm in the north (Environment Canada 1986). Approximately half of the precipitation falls as snow. Ice cover is generally present on water bodies in the SGP from October to June. Bathurst Inlet and the Coronation Gulf are ice-covered from October to July.

Hours of sunlight vary considerably throughout the SGP, with Yellowknife receiving approximately 20 hours daily in June and July, declining to about six hours daily in January. Areas north of the Arctic Circle ( 66°30'N) experience 24 hours of sunlight during June and July; however, there is a period of time each winter when the sun does not rise above the horizon (Outcrop 1990). Winds in Yellowknife are most frequently from the east at an average speed of 15 km/hour throughout the year (Cirrus Consultants 1998). At Lupin, winds occur most frequently from the north at an average speed of approximately 17 km/hour (Cirrus 1998). During the winter months, blowing snow can reduce visibility and result in significant accumulations of snow in some locations. Smoke from forest fires during the summer can also reduce visibility within the SGP. Fog can occur throughout the SGP, but can be expected to be more prevalent closer to the Arctic coast.

The extent and impact of climate change has received considerable attention recently. The Mackenzie Basin Impact Study examined the potential impact of climate change in the Mackenzie River Basin, west of the SGP. This study concluded that the Mackenzie Basin has experienced a warming trend of 1.5° C this century (Cohen 1997). The Atmospheric Environment Service indicates that 1998 was the warmest year in Canada on record (AES 1999). Records for December 1998 to February 1999, inclusive, indicate temperatures in the Arctic Tundra are 3.6°C above normal and 4.3°C above normal in the Mackenzie Valley area (AES 1999). The SGP is within both of these regions. The Government

of the NWT recently completed its first Greenhouse Gas Emission forecast for Nunavut and the NWT in support of discussions on global change (Ferguson Simek Clark 1998).

Air quality in the SGP is not subject to regional monitoring. Hazra and Prokopuk (1977) undertook an air quality study in the City of Yellowknife, concluding that total suspended particulate levels exceeded National Air Quality Objectives approximately 10 % of the time. In response to concerns over emissions, the Department of Renewable Resources (1993) conducted a study of atmospheric emissions from Royal Oak Mines' Giant Yellowknife Mine in the City of Yellowknife. Ambient air quality is monitored periodically at certain developments within the SGP; however, regional data do not exist. Air quality within the SGP is noted to be generally free of anthropogenic contamination (BHP 1996).

### *6.3.2 Potential Project-Environment Interactions*

The project would be developed and operated in an area subject to extreme temperatures and a range of climatic conditions, including extended periods of darkness. Most of the corridor will be located in the zone of continuous permafrost and appropriate design considerations will need to be employed to minimize disturbance to permafrost and associated negative effects on structures. The effect of permafrost on the project and the project on permafrost is discussed in Section 6.2. The design and construction of project facilities would also need to address the extreme temperatures experienced in the SGP. Cold and darkness will affect winter construction and operation of the project, potentially affecting project equipment, productivity, worker and user safety, and the integrity of the project. Road and marine traffic during periods of darkness or poor visibility may increase the potential for accidents and vehicle-wildlife interactions. Shipping in periods of poor visibility with few navigational aids increases the potential for accidents. Snow drifting may also reduce visibility along the road and may result in accidents, stranded vehicles and additional maintenance costs.

Warmer temperatures for the SGP region could have substantial consequences for the corridor project. Changes in the ice-free period may expand the three month shipping season currently proposed. More significant will be the need to understand the effects of warming on permafrost and the surface water regime. Permafrost melting and changes to water levels could have serious effects on the project; current cold regions design and construction practices may need to be amended to address a changing climatic regime.

In addition to the effects of climate on the project, the SGP TC may contribute to climate change through the emission of greenhouse gases from equipment and vehicles during construction and operations and maintenance. Local air quality could be affected by vehicle and equipment emissions and dust generated from road traffic.

### *6.3.3 Likely Issues of Concern*

Key issues that likely will require further consideration should the SGP TC proceed to the assessment stage include:

- Effect of climate change on project components;
- Effect of the project on climate change; and
- Effect of the project on local air quality.

### *6.3.4 VECs and VEC Boundaries*

Vehicle emissions contribute to greenhouse gas build-up in the atmosphere. The project's greenhouse gas emissions, by themselves, are unlikely to be the cause of regional effects but would contribute to the global emissions inventory. The boundaries of an assessment of the project on greenhouse gas emissions and effects of climate change should include an assessment of the project's contribution to the NWT and Nunavut greenhouse gas emission inventory.

Dust emanating from the road may impact surrounding vegetation, water quality and indirectly on species depending on these VECs. The spatial extent of the potential effects would be a function of a number of factors including vehicle speed, road surface material and ambient conditions. Upon definition of some of the controlling design factors (i.e. vehicle speed, surface material, etc.) the boundary of potential effects can be determined and an assessment undertaken.

### *6.3.5 Data Gaps and Future Study Needs*

Microclimate data may be required for a number of locations to facilitate effective design (i.e. mitigate snowdrifting). This information can be acquired by installing meteorological stations and/or approximating conditions from records from public and private meteorological stations within or near the SGP. Long-term climate forecasting would provide a basis for design and assessing the potential effects of climate change on the project.

The extent of greenhouse gases and other pollutants emitted from project sources will need to be included in the NWT and Nunavut inventories. The potential effects of the project on climate change will need to be determined.

### *6.3.6 Bibliography*

AES (Atmospheric Environment Service). 1984. Climate Atlas: Temperature. Canadian Climate Centre.

AES (Atmospheric Environment Service). 1986. Climate Atlas: Precipitation. Canadian Climate Centre.

AES (Atmospheric Environment Service). 1999. Climate Trends and Variations Bulletin for Canada. Climate Research Branch. http://www.mb.ec.gc.ca.

Barrie, M. 1997. Responding to Global Climate Change In Canada's Arctic. Volume II of The Canada Country Study: Climate Impacts and Adaptation. Environmental Adaptation Research Group, Atmospheric Environment Service, Environment Canada.

(BHP) Broken Hill Proprietry.1995. NWT Diamonds Project, Environmental Setting. Vol II, Environmental Impact Statement.

Brotton, J. and G. Wall . 1997 Climate change and the Bathurst Caribou Herd in the Northwest Territories, Canada. *Climate Change 35, No 1*.

Cirrus Consultants. 1998. Environmental Effects Report, Climate and Air Quality. Prepared for Diavik Diamond Mines.

Cohen, S. (ed.) 1997. Mackenzie Basin Impact Study. Report prepared for Atmospheric Environment Service, Environment Canada.

Department of Renewable Resources. 1993. An investigation of atmospheric emissions from the Royal Oak Giant Yellowknife Mine. Department of Renewable Resources, Government of the Northwest Territories.

EARG (Environmental Adaptation Research Group). 1997. The impact of climate change on permafrost: an assessment guide for engineers, policy makers and environmentalists. Draft Report # 4, Atmospheric Environment Service.

Environment Canada. 1989. Ecoclimatic Regions of Canada, First Approximation. Report prepared for Canadian Committee on Ecological Land Classification.

Environment Canada, 1986. Canada Climate Atlas – Precipitation. Atmospheric Environment Service, Environment Canada.

Etkin, D.A. 1990. Greenhouse Warming: consequences for Arctic climate. *J. Cold Regions Engineering 4, No 1*.

Ferguson Simek Clark. 1998. Greenhouse Gas Emission Forecast for the Northwest Territories. Prepared for the Environmental Protection Service, Government of the Northwest Territories.

French, H.M.(ed.) 1986a. Impact of Climate Change on the Canadian Arctic. Proceedings of a Workshop, March 1986.

French, H.M.(ed.) 1986b. Impact of Climate Change on the Canadian Arctic. Summary and Recommendations of a Workshop, March 1986.

Gerwick, B.C. Jr. 1990. Effect of Global Warming on Arctic Coastal and offshore engineering. *J. Cold Regions Engineering 4, No1*.

Hazra, A.K. and R. Prokopuk. 1977. A report on air quality in Yellowknife, Northwest Territories. Environmental Protection Service, Environment Canada.

Hazra,A.K., Prokopuk, R., and M.J. Hardin. 1977. Chemical characteristics of snow in the Yellowknife area, NWT, 1975. Environmental Protection Service, Environment Canada.

Kane, D.L. , L.D. Hinzman, M.K. Woo and K.R. Everett. 1992. " Arctic Hydrology and climate change" in Chapin, F.S., R.L. Jeffries, J.F. Reynolds, G.R. Shaver and J. Svoboda (eds.), *Arctic Ecosystems in a Changing Climate: An Ecophysiological Perspective.* Academic Press. San Diego.

Klohn-Crippen Consultants Ltd. 1993. Izok Project: Environmental Evaluation Submission to the Regional Environmental Review Committee. Report prepared for Metall Mining Corporation, Edmonton, Alberta.

Maxwell, B. 1994. " Climate of the Canadian Arctic" in Canadian Hydrographic Service, *Sailing Directions*. Vol 1, 4th Edition. Ottawa.

Outcrop. 1990. Northwest Territories Data Book 1990/91.

Prowse,T.D. and C.S.L. Ommanney (eds.). 1990. Northern Hydrology: Canadian Perspectives. National Hydrology Research Institute, Environment Canada.

Reid, B. 1994. Meteorological data collection for site specific evaporation estimates in the Northwest Territories. Mackenzie Basin Impact Study, Interim Report 2: Proceedings of the Sixth Biennial AES/DIAND Meeting on Northern Climate and Study Workshop of the Mackenzie Basin Impact Study: Yellowknife, NWT.

Wall, G. (ed.). 1993. Impacts of Climate Change on Resource Management in the North. Department of Geopgraphy Publication Series, Occasional Paper # 16, University of Waterloo.

Woo, M.K. and S.B. McCann. 1994. Climatic variability, climate change, runoff and suspended sediment regimes in northern Canada. *Physical Geography* 13, No 3.

## 6.4 Marine Environment

The conceptual SGP TC includes the construction of a marine port at tidewater, probably in Bathurst Inlet, which would be capable of handling ocean-going ships. A marine port would allow shipment of supplies into, and products (*i.e.*, ore) out from, mines and communities serviced by all-weather or winter roads. (Nuna Logistics Limited (1998), through a joint venture with Kitikmeot Corporation, has advanced a proposal to construct a marine port in Bathurst Inlet, with connecting roads to existing mines. The proposed port could proceed either independently or as a component of the SGP TC.)

Potential marine transportation routes to Coronation Gulf (on which Bathurst Inlet is situated) have been discussed in the APreliminary Environmental Screening in Relation to Increased Shipping in the Central Arctic@ (Applied Environmental Services 1992). The scope of the following review encompasses only the area of the potential port location in Bathurst Inlet, and a marine shipping route through Bathurst Inlet to intersection with the above-mentioned shipping routes. (The scope of a future environmental assessment would be determined by the regulatory authorities.)

### *6.4.1 Existing Conditions*

The marine species and habitat that exist in the study area of Bathurst Inlet are representative of an Arctic marine environment. The area of Bathurst Inlet is recognized by the Canadian Wildlife Service as an important area for wildlife and is listed as an International Biological Programme site (Draft Arctic Marine Environmental Guide 1996).

It is important to note that the proposed marine shipping season at the proposed port would be limited to the three- to four-month relatively ice-free season from mid-July to mid-October (Nuna Logistics Limited 1998). It is recognized that even during mid-summer, ice and ice edge areas may be present and provide habitat for various marine species.

#### 6.4.1.1 Bering Wolffish (Anarhichas orientalis)

Very little information is available on the abundance of this species except for presence/absence data (Houston and McAllister 1990). The Bering Wolffish has been described as common but not abundant in the northwestern Pacific and Bering Sea, and should be considered vulnerable due to its narrow distribution (Houston and McAllister 1990). However, the Bering Wolffish is not listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (1998) as an endangered, threatened, or vulnerable species in the Canadian Arctic. The species is currently of little or no economic value, but there are indications that it may be a forage species for arctic seals (Houston and McAllister 1990).

The Bering Wolffish has a spotty distribution in the northwest Pacific Ocean and the Bering Sea and has been recorded at one location in the Canadian Arctic: Bathurst Inlet (Houston and

McAllister 1990). The proposed port site (Nuna Logistics Limited 1998) is in the general vicinity of Bathurst Inlet where Bering Wolffish was observed, and the presence or absence of this species at the proposed port site should be verified.

#### 6.4.1.2 Ringed Seal (Phoca hispida)

The ringed seal is the most widespread and numerous marine mammal in Canadian Arctic seas. These seals stay in the Arctic all year. They occur where landfast ice is present year-round, and in spring (March and April) they den and whelp on the ice, under snow cover. They can be present in open water in summer and fall. The ringed seal moults in summer, when it hauls out on ice for extended periods. Population estimates range from 10 to 25 animals per square mile of landfast ice within a mile of shore (Banfield 1974). Densities of adult ringed seals are usually highest in stable fast ice adjacent to coastal areas. As break-up progresses, ringed seals may concentrate in ice-covered coastal bays (Applied Environmental Services 1992). The ringed seal is taken in large numbers by Inuit and Inuvialuit hunters and forms the basis of the economy and food supply in many settlements. Ringed seals are observed and hunted throughout Bathurst Inlet year-round (Draft Arctic Marine Environmental Guide 1996).

#### 6.4.1.3 Bearded Seal (Emignathus barbabtus)

Bearded seals also are year-round residents of the Arctic, occurring in shallow water. In winter, bearded seals are restricted to areas of moving ice, such as landfast ice edges, polynyas, and drifting pack ice. However, bearded seals are solitary and rarely concentrate, except at polynyas (Applied Environmental Services 1992). The Bathurst Inlet population is a subspecies which extends westward to and beyond Bering Strait (Banfield 1974). This species is valued by the Inuit for its large size, meat, and hide.

#### 6.4.1.4 Beluga (Delphinapterus leucas)

Two beluga whales were sighted in Gordon Bay, southeast of Bathurst Inlet, in July, 1989. No previous recorded sighting of a beluga whale in Bathurst Inlet exists (Stewart and Burt 1994). The current population status according to COSEWIC (1998) identifies beluga whales as vulnerable in the eastern high Arctic and Baffin Bay, while the Beaufort Sea/Arctic Ocean population is not considered to be at risk.

Beluga are thought to have a discontinuous distribution in the Canadian Arctic, and typically do not occur in the Central Canadian Arctic (Stewart and Burt 1994). It is generally thought that pack ice separates the Beaufort Sea beluga population from extending further east of the Central Canadian Arctic; however, as noted above, extralimital occurrences have been documented, but are considered rare (Stewart and Burt 1994).

#### 6.4.1.5 Walrus (Odobenus rosmarus)

To date, there have been three documented sightings of walrus in Bathurst Inlet (Stewart and Burt 1994). The current population status according to COSEWIC (1998) indicates that walrus are not considered to be at risk in the Arctic Ocean. Some populations of walrus overwinter in polynyas, and walrus concentrate at haul-out sites (Applied Environmental Services 1992).

Walrus are thought to have a discontinuous distribution in the Canadian Arctic, and typically do not occur in the Central Canadian Arctic (Stewart and Burt 1994). It is generally thought that the geographical barrier limiting walrus distribution in the Central Canadian Arctic is the year-round ice coverage in Queen Maud Gulf, Victoria Strait, M:Clintock Channel, Viscount Melville Sound and M:Clure Strait, all to the east and north of Bathurst Inlet; however, as noted above, three extralimital occurrences of walrus have been documented in the main body of Bathurst Inlet (Stewart and Burt 1994).

#### 6.4.1.6 Baffin Bay Narwhal (*Monodon monoceros*)

To date, most estimates of narwhal stock size have been limited to aerial surveys which only estimate the narwhals at the surface during the time of the survey. Dive data from tagged narwhals indicates that there are at least twice as many narwhals than are seen at the surface during a survey (Fisheries and Oceans Canada 1998). One such survey of eastern Baffin Bay in 1979 estimated 34,700 narwhals at the surface, and there has been no evidence of decline in the populations since (Fisheries and Oceans Canada 1998). The entire stock is thought to be protected from over-exploitation by its widespread distribution (Fisheries and Oceans Canada 1998). The Baffin Bay narwhal is not listed by COSEWIC (1988) to be an endangered, threatened, or vulnerable species in the Canadian Arctic.

The summer range of Baffin Bay narwhals is thought to include most of the waters of the Canadian Arctic Archipelago and northwestern Greenland, while winters are spent in Baffin Bay and Davis Strait (Fisheries and Oceans Canada 1998).

#### 6.4.1.7 Ice as Habitat for Marine Species

Ice edges are recognized as valuable habitats for marine species, such as migrating marine mammals and sea birds waiting for ice break-up. Ice-associated invertebrates and fish, such as Arctic Cod, provide an important food source for marine mammals and seabirds (Applied Environmental Services 1992). A number of species, such as thick-billed murres and black guillemots, use ice edges as preferential feeding areas (Applied Environmental Services 1992).

The centre of Coronation Gulf was observed to contain an area of open water in mid-May 1975, and although this area is not characteristically a landfast-ice edge area, it likely would be important for spring concentrations of waterfowl and sea ducks (Applied Environmental Services 1992).

#### 6.4.1.8 Marine Birds

The northwest Coronation Gulf area is important for waterfowl including black brant, white-fronted geese, common eiders, and king eiders (Applied Environmental Services 1992). Large concentrations of sea ducks (common eider, king eider, and oldsquaw) concentrate in open water areas in the eastern Beaufort Sea and western Canadian Arctic (Applied Environmental Services 1992). The coastal areas of southwestern Kent Peninsula and the adjacent mainland provide very important habitat for nesting brant and white-fronted geese. Several gull colonies are also located on Algak and Ekalulialuk Islands and the small islands off the coast of Arctic Sound (Draft Arctic Marine Environmental Guide 1996).

Marine birds may concentrate during spring and early summer in polynyas and leads, and in fall in areas of open water. While some species, such as king eiders and oldsquaw, are "dispersed" nesters, others, such as the common eider, are colonial nesters and concentrate in good nesting habitats, particularly low-lying coastal islands (Applied Environmental Services 1992).

### *6.4.2 Potential Project-Environment Interactions*

The proposed port site likely would consist of a single berth dock constructed of sheet piling filled with quarry-run rock. Widespread sea ice is not expected to be present during the proposed shipping season, as once the ice has gone out in July, the area remains ice-free until freeze-up in the middle of October (DF Dickens Associates Ltd. 1998).

Potential project-environment interactions that may occur during construction and operation of a proposed marine port include the following.

**Habitat Alteration, Loss, or Degradation**

- Direct alteration or destruction of marine fish and habitat by the construction (infilling) of a wharf in Bathurst Inlet.
- Introduction of sediment into the marine water column through wharf construction and road operation (dust and runoff).
- Degradation of habitat through chronic fuel, hazardous materials, and cargo (assuming the cargo may be ore concentrates) loss during the operation of the port facility.

**Disturbance**

- Disturbance of marine species, specifically marine mammals and marine bird nesting colonies, on the shipping route in Bathurst Inlet and Coronation Gulf by vessel noise and presence, and the cumulative effect of increased traffic over current activities.

- Disturbance by shipping traffic of marine species (fish, phytoplankton, birds, and marine mammals) associated with ice edges, should some amount of sea ice persist throughout the shipping season.

**Accidental Events**

- Oiling of shorelines, birds, and mammals due to accidental spills or loss of fuels and other hazardous materials into the marine environment at the port or along the shipping route.
- Toxicity effects and environmental accumulation of toxins from ore concentrates if accidentally spilled into the marine environment at the port or along the shipping route.

**Direct Mortality**

- Collisions between marine mammals (whales) and vessels could occur along the shipping route.

### *6.4.3 Likely Issues of Concern*

Key issues likely to require further consideration if the SGP TC (or independent port proposal) proceeds, include:

- alteration of the benthic habitat at the proposed wharf site and reconciling this loss in the context of Fisheries and Oceans Canada's policy of Ano net loss@ of fish habitat;
- alteration of benthic habitat, including the water column, by addition of sediments;
- potential disturbance of marine mammal migration routes caused by vessel noise;
- vessel-marine mammal collisions;
- potential alteration of ice edge habitat, should ice be encountered during the shipping season;
- accidental events, such as spills of fuels and other hazardous materials from ships, wrecks, docks, and tanks, resulting in oiling of birds, marine mammals, and shorelines, and chronic toxicity effects;
- response time and capabilities; and
- cumulative effects of increased vessel activity over existing levels.

Other likely issues of concern such as the effect of shipping on use of sea ice by migrating caribou and Aboriginal hunters are discussed in the sections 6.10 and 6.12.

### *6.4.4 VECs and VEC Boundaries*

Based on the identified project-environment interactions, and likely issues of concern, a preliminary list of marine VECs, upon which future work should focus, has been developed. The VECs, in particular specific species that would be assessed, and associated study boundaries would be more refined following collection and review of more detailed data, and future consultation. For example, the geographic extent of shipping activity to be included in the assessment would be determined by the regulator.

#### 6.4.4.1 Benthic Habitat

The benthic habitat will be directly affected by wharf construction and indirectly affected by potential accidental events, such as fuel spills. The spatial boundary for benthic habitat is the most conservative area of distribution of any one life cycle phase of the least mobile component species.

#### 6.4.4.2 Ice as Habitat for Marine Species

Ice, specifically ice edge, provides important habitat for fish, marine birds, and marine mammals. Any potential alteration of the ice edge by shipping could have a potential adverse affect on the ecosystem. The spatial boundary of ice as habitat would encompass ice edge areas which could potentially be disturbed by ship passage or accidental events (*e.g.*, oil spill) that would alter the habitat. Future studies would be required to identify ice edge areas along the shipping route included in the assessment.

#### 6.4.4.3 Marine Mammals

Marine mammals are a top predator in the local ecosystem, are an important food source, and have cultural importance to the people of this area. Marine mammals may be negatively affected by disturbance caused by vessel noise and presence, potential alteration of ice edge habitat, and oiling or toxicity as a result of accidental spills. The spatial boundary for marine mammals would encompass the seasonal range of individuals who have all or a portion of their home range within the study area.

#### 6.4.4.4 Marine Birds

Marine birds use the study area for breeding and summer feeding. Marine birds may be adversely affected by potential alteration of ice edge habitat and oiling as a result of accidental spills. The spatial boundary for marine birds would encompass the seasonal range of habitat used by those individuals occurring at the proposed port site and along the shipping channel.

### *6.4.5 Data Gaps And Future Study Needs*

Once the location of the port site (or sites) is (or are) identified within approximately one kilometre of the final port site location, a marine field program would be warranted. (If there are from two to three probable port sites within a five to seven kilometre radius, it may still be cost-efficient to survey all sites in a one-year program: the major cost of the marine field program is attributable to mobilization, while the survey and transit time between sites would represent only a small percentage of the total cost.)

Assuming the location of the port site(s) is determined to allow work to proceed, the recommended surveys to be carried out as part of the marine field program would include:

- Identification of any ice roads (for human use) in the vicinity of proposed port;
- Identification of any ice leads that may be present in winter, spring, or summer, or landfast ice edges that may be present in summer or fall in the vicinity of the proposed port and along the potential shipping route;
- Description of the ice break-up patterns along the potential shipping route to the proposed port;
- Identification of any seal breathing holes or denning formations on the ice or ice edge in the vicinity of the proposed port;
- Collection of traditional Inuit knowledge of marine environment;
- In the vicinity of the proposed port(s), benthic habitat and species surveys of the proposed wharf footprint or dredged area at least once during the open water season; and
- Identification of fish species or marine mammals that may use the proposed port area as part of any migration route or feeding/rest area during the open water season.

Once the port location and probable shipping route have been confirmed, future studies should also include a more comprehensive search of available data (published and un-published) for information on the presence of marine species at the port site and along the shipping route during the likely shipping season. A follow-up field survey would verify the presence and/or potential for inter-annual variation of species at these locations.

In order to understand, in the context of Bathurst Inlet, the potential effect of wharf construction on benthic habitat, site-specific intertidal/subtidal surveys of the port site should be conducted as soon as possible. This information will be key in determining the degree and extent of mitigative measures and contingency plans required to minimize environmental effects and to obtain the necessary permits under the *Fisheries Act*. The open water season is relatively short and winter freeze-up times are long. Therefore, opportunities to collect data and to carry out follow-up programs are very limited. Should information requirements arrive during the periods of freeze-up, delays may be experienced in obtaining the necessary field data, resulting in delays in obtaining relevant approvals.

### *6.4.6 Bibliography*


Applied Environmental Services. 1992. Preliminary Environmental Screening in Relation to Increased Shipping in the Central Arctic. A draft report prepared for CanArctic Shipping Company Ltd., May 1992

Banfield, A.W.F. 1974. The mammals of Canada. University of Toronto Press.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 1998. *Species List* [Online]. Available: http://www.cosewic.gc.ca

DF Dickins Associates Ltd. 1998. A Study of the Technical Aspects of Deep Draft Shipping to the Western Arctic. Prepared for Planning Division, Department of Transportation, Government of the Northwest Territories.

Canadian Hydrographic Service. 1996. Draft Arctic Marine Environmental Guide.

Fisheries and Oceans Canada. 1998. Baffin Bay Narwhal. DFO Science Central and Arctic Region Stock Status Report E5-43.

Houston, J., and D. E. McAllister. 1990. Status of the Bering Wolffish, *Anarhichas orientalis*, in Canada. *Canadian Field Naturalist* 104(1): 20-23.

Kingsley, M. C. S. 1979. A literature review of the wildlife of Bathurst Inlet, N.W.T. Canadian Wildlife Service. Edmonton, Alberta.

Nuna Logistics Limited. 1998. Port and Road Infrastructure Project, Concept Paper, Bathurst Inlet, Kitikmeot Region, Nunavut.

Nunavut Planning Commission. 1998. West Kitikmeot Regional Land Use Plan. Draft produced June 1998 for informal public hearing, Akaluktutiak (Cambridge Bay), Northwest Territories.

Richard, Pierre R., Anthony R. Martin, and Jack R. Orr. 1997. *Study of fall movements of Beaufort Sea Belugas, using satellite telemetry* [Online]. Available: http://www.ncr.dfo.ca/regions/central/beluga-e.htm.

Smith, T. G. 1977. The Wolffish. *Anarhichas denticulatus*, new to the Amundsen Gulf area, Northwest Territories and probable prey of the Ringed Seal. *Canadian Field Naturalist* 91(3): 288.

Stewart, Barbara E., and Page M. Burt. 1994. Extralimital occurrences of Beluga, *Delphinapterus leucas*, and Walrus, *Odobenus rosmarus*, in Bathurst Inlet, Northwest Territories. *Canadian Field Naturalist* 108(4): 488-490.

## 6.5 Vegetation

### *6.5.1 Existing Conditions*

#### 6.5.1.1 General Plant Community Description and Distributions

The area traversed by the SGP TC falls within two major Canadian ecozones (Government of Canada 1996) (Figure 6.4). The corridor passes through the Taiga Shield Ecozone, extending from the vicinity of Yellowknife towards the southern end of Lac de Gras, and the Southern Arctic Ecozone, extending from the Lac de Gras area to Bathurst Inlet. These two ecozones are characterized by ground moraine and long eskers with bedrock outcrops. Less common glaciomarine and glaciofluvial landforms are outwash aprons of poorly sorted sand and gravel deposits, as well as raised beach ridges. Lakes and ponds are numerous. This glacial and post-glacial history and the region's climate (see Section 5.3) have combined to produce the vegetation present in the study area.

**Taiga Shield Ecozone**

The Taiga Shield Ecozone comprises the broad plant communities listed in Table 6.5.1.

**Table 6.5.1 Plant Communities of the Taiga Shield Ecozone**

| Community Type | Percentage of Ecozone |
|---|---|
| Mixed forest (Forest covers >50% of area, and 26-75% of canopy comprises coniferous or deciduous trees.) | 2% |
| Transitional forest (A mixture of land cover classes in which tree cover is discernible, but forest cover is <50% of the area. Tree density varies from open woodland to scattered stands or linear forest stands in valleys. Understory vegetation includes low erect shrubs, dense lichen mats, and mossy peatland.) | 58% |
| Coniferous forest (Forest cover >50%, and 76-100% of the canopy is coniferous trees.) | 13% |
| Tundra (Treeless arctic and alpine vegetation with nearly continuous plant cover. Includes low, erect, and matted shrub tundra and tussock-cotton grass tundra.) | 27% |
| Barren lands (Plant cover generally sparse,<25%, and not discernible on imagery. Woody plants and herbs dominate vegetated portions of the landscape. Totally unvegetated terrain includes rock and unconsolidated materials.) | 2% |

Two subdivisions of the Taiga Shield Ecozone are present within the SGP TC: the Tazin Lake Upland and Coppermine River Upland Ecoregions (Figure 6.4) (Environment Canada 1997). Collectively, these ecoregions display a sub-humid, high boreal climate with mean annual temperatures of -5°C and -7.5°C, mean summer temperatures of 11°C and 9°C, and mean winter temperatures of -21.5°C and -24°C, respectively. Annual precipitation varies between 200 and 375 mm in the Tazin Lake Ecoregion and between 200 and 300 mm in the Coppermine River Upland Ecoregion. Extensive discontinuous permafrost underlies these regions, with near continuous permafrost underlying the northern portions. The vegetation of the Tazin Lake Upland is characterized by medium to tall, closed stands of trembling

aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), and Alaskan paper birch (*Betula papyrifera* var. *neoalaska*), with white spruce (*Picea glauca*) and black spruce (*Picea mariana*) dominating in later successional stands. Poorly drained fens and bogs show tree growth in the form of low, open stands of larch (*Larix laricina*) and black spruce. Soils are primarily Dystric Brunisols with lesser amounts of Turbic, Static, and Organic Cryosols.

The Coppermine River Upland is part of the tundra and boreal forest transition or transitional forest zone. The dominant vegetation types include open, stunted stands of black spruce and larch, with lesser amounts of white spruce. The shrub or ground cover community in these open forests consists of dwarf birch (*Betula glandulosa*), willow (*Salix* spp.), ericaceous shrubs (*e.g.*, northern Labrador tea (*Ledum decumbens*) and red bearberry (*Arctostaphylos rubra*)), cottongrass (*Eriophorum* spp.), and lichens. Poorly drained areas support tussocks of sedge (*Carex* spp.), cottongrass, and sphagnum moss (*Sphagnum* spp.). Extensive areas of low shrub tundra marked by dwarf birch and willow are also common in this ecoregion.

Jacobson (1979) describes several broad vegetation ecosystems located within these ecoregions that may be crossed by the SGP TC. In the extreme lower southwest of the corridor, the Bog and Forest Ecosystem or wildlife zone is characterized by many shallow lakes, large bogs, and extensive spruce and jack pine (*Pinus banksiana*) forests. Lichens, both terrestrial and arboreal, are common in mature forests, and extensive sedge meadows and willow-sedge communities surround the many shallow lakes.

Also in the southwest portion of the corridor, between Rae and Lac la Martre, lies a small area of Mossy Forest Ecosystem. This zone is characterized by many lakes amid extensive spruce forests, comprising primarily black spruce with some white spruce, and mosses and lichens. Burned areas are common. Much of the area is underlain by gravelly moraine.

North of Great Slave Lake is an area known as the Glacial Lake McConnell Ecosystem. This ecosystem is largely influenced by lacustrine deposits from this former large glacial lake. This area extends north on the shield, across the southern halves of the Yellowknife and Snare rivers, to Faber Lake. On the Canadian Shield, most of the lakes are edged by rock and the spruce forest grows to the margins of the lakes. Areas overlain by Glacial Lake McConnell deposits generally are bordered by willow and sedge-dominated communities. From the Glacial Lake McConnell Ecosystem boundary extending to the southwestern end of Warburton Bay, in the median area of the corridor, lies the Open Forest Ecosystem. This is similar to the previous forest ecosystems, but tree cover is less closed and species are less diverse.

From roughly the southeast end of Warburton Bay up to the northern end of MacKay Lake and southeast end of Lac de Gras, is the Forest-Tundra transition, a 16 to 80 km wide zone where forest and tundra vegetation intermingle, providing habitat for many species commonly found in both forest and tundra. This area is primarily within the Coppermine River Upland Ecoregion. However, along this transition zone, anomalies such as the Thelon River tree oasis, lying to the east of the SGP TC, support forest well beyond normal limits. Conversely, areas of tundra may exist south of the treeline.

Timoney (1995) suggests edaphic conditions exert a stronger control over tree distribution on nutrient-poor, dry sandy soils in forest-tundra transition than on nutrient-rich, moist soils. Within unfavourable soil terrains, trees are found in a patchwork of sites, where moisture, nutrients, and snow cover permit survival and reproduction. Though favourable sites might support trees up to the particular species' climatic limits, much of the area to the south of these tree stands will be treeless tundra.

On such unfavorable soil terrains, the Forest Tundra transition zone would be wider and located further south than the transition zone on moist, nutrient-rich soil terrain. On most nutrient-rich soils, the treeline extends northward to its absolute climatic threshold.

**Southern Arctic Ecozone**

The Southern Arctic Ecozone (Figure 6.4) experiences long cold winters and short cool summers. Its major vegetation zones comprise approximately 58 percent Arctic/Alpine Tundra and 37 percent Barren lands, with a five percent component of transitional forest. Overall, the Southern Arctic Ecozone represents a transition zone between the Taiga Forest of the south and the treeless Arctic Tundra to the north. It is characterized by the presence of dwarf shrubs that decrease in size to the north. Characteristic species include dwarf birch, willow, and heath species, such as northern Labrador tea. These dwarf shrubs are mixed with various herbs, as well as some bryophytes and lichens. Major river valleys, such as the Thelon River and other areas of more nutrient-rich mesic soils, support forests consisting mainly of stunted spruce trees. Within this zone, wetlands are abundant in the low-lying areas, and support mainly sedge-moss communities. Precambrian granitic bedrock underlies this zone mantled by discontinuous moraine; fine-grained marine sediments cover the surface near the coast. Bedrock exposures are common, as are long, winding eskers.

Two ecoregion subdivisions of the Southern Arctic Ecozone are present within the area of the SGP TC. These include the Bathurst Hills Ecoregion and the larger Takijuq Lake Upland Ecoregion (Figure 5.4). Here the mean annual temperature is approximately -10.5°C, with a summer mean of 6°C and a winter mean of -26.5°C. Mean annual precipitation is 200-300 mm. The climate is classed as low arctic ecoclimate. Lakes are abundant in the low land, and Shrub Tundra, characterized by dwarf birch, willows, northern Labrador tea, mountain avens (*Dryas* spp.), bilberry (*V. uliginosum),* and mountain cranberry *(V. vitis-idaea*), is the main vegetation. Wet areas and depressions are dominated by sedge tussock (*Carex* spp.), willows, and sphagnum moss. Scattered stands of spruce occur along the southern boundary of this ecoregion as aspects of transitional forest. Rock outcrops are abundant and support barren lands habitat.

The Bathurst Hills Ecoregion occurs along the portion of the SGP TC located along the shores of Bathurst Inlet. This region is classed as a low arctic ecoclimate. Here the mean annual temperature is approximately -12.5°C, with a summer mean of 4°C and a winter mean of -28°C. Mean annual precipitation is 125-200 mm. The vegetation of this ecoregion is characterized by continuous cover of shrub tundra vegetation, dominated by dwarf birch, willows, and alder (*Alnus* spp.) on warm dry sites. Poorly drained sites are dominated by sphagnum moss and sedge tussocks (*Carex* spp. and

*Eriophorum* spp.). The terrain of this ecoregion is hilly with some peaks reaching 610 m in elevation. Rock outcrops and Turbic and Static Cryosols (developed in the sandy, glacial tills) are predominant in this region. Permafrost is continuous.

Jacobson (1979) characterizes the Takijuq Lake Upland Ecoregion as being within the Sparsely Vegetated Tundra Ecosystem which extends from the area of Lac de Gras north through Contwoyto Lake, and the Burnside River drainage to Bathurst Inlet. Dominant species of this ecosystem includes dwarf birch, red bearberry, mountain cranberry, bilberry, willows, crowberry (*Empetrum nigrum*), sedges, and other forbs, along with lichens and mosses (Zoltai and Pettapiece 1973).

#### 6.5.1.2 Rare Plants

Argus and Pryor (1990) list 48 species of plants considered rare in the Northwest Territories. Cross-referencing with Porsild and Cody (1980) indicates that 11 of these rare species have been recorded within or near the preliminary SGP TC. Table 6.5.2 lists these species and the habitats in which they are typically found. Given the scale of available distribution mapping and the paucity of vegetation surveys in the study area, it is not possible to determine exactly where in the SGP TC these species occur. However, this list indicates which rare species have a high probability of being found in the corridor, and which habitats are likely to harbour rare species.

**Table 6.5.2 Rare Species Recorded Within or Near the Preliminary SGP TC**

| Scientific Name | Common Name | Habitat | Nearest Location |
|---|---|---|---|
| *Braya glabella* | Braya | mineral soil, damp tundra | near Bathurst Inlet area |
| *Carex morrisseyi* | Sedge | minerotrophic *Larix* fens | near the study area and towards Great Bear Lake and Hudson's Bay |
| *Cypripedium guttatum* | Lady Slipper | local in open mossy woods, perhaps restricted to calcareous woods | near Great Slave Lake |
| *Gentiana tendella* | Gentian | local on sandy beaches and gravelly mud flats along the Arctic coast | near Bathurst Inlet |
| *Mertensia drummondi* | Drummond's Lungwort | sandy banks and eskers; not a seashore species | west of Bathurst Inlet near coast |

| Table 6.5.2 Rare Species Recorded Within or Near the Preliminary SGP TC | | | |
|---|---|---|---|
| **Scientific Name** | **Common Name** | **Habitat** | **Nearest Location** |
| *Polygonum caurianum* | Knotweed | wet gravelly pond margins and lake shore | along Great Slave Lake just south of corridor below Rae |
| *Potamogeton porsildiorum* | Pondweed | shallow ponds and lakes | near Yellowknife, north shore |
| *Ranunculus pallasii* | Pallas's Buttercup | wet brackish meadow and slough, *i.e.*, mainly along seacoast and estuaries. | near Bathurst Inlet and to west on coast |
| *Rorippa crystallina* | Yellowcress | sedge grass meadows | site near lower portion of corridor northwest of Great Slave Lake |
| *Scirpus rollandii* | Bulrush | damp marl lake shore, alkaline seepage | site along Yellowknife highway, local in area |
| *Woodsia alpina* | Northern Woodsia Fern | local rock crevices, rock scree, in calcareous or non-acidic areas | site near lower portion of corridor |

### *6.5.2 Project-Environment Interactions*

Potential project-environment interactions that may occur during construction and operation of the SGP TC include the following.

- Plant communities may be lost as a result of construction of the highway and development of borrow pits along the route.
- Road-side vegetation will be affected by dust and vehicle emissions.
- Alteration of drainage patterns associated with highway construction could result in alteration of plant communities, particularly wetland plant communities and terrestrial plant communities fringing wet areas. Drainage alterations may also initiate mass movements which can result in disturbance of plant communities.
- Disturbance of resources traditionally used by Aboriginal groups, including berries, medicinal plants, bark, and other plants and plant parts.
- Sedimentation of watercourses adjacent to the highway or borrow pits may smother aquatic plant communities.
- Alteration of ground temperature regime as a result of construction activities or accidental fires

may initiate mass movements which could disturb plant communities.

- Habitat fragmentation and edge effects may occur adjacent to the highway.
- Accidental events such as fuel or chemical spills may damage terrestrial, wetland, and aquatic plant communities. Accidental fires could destroy terrestrial plant communities.
- Highway development could facilitate the spread of non-native weed species which may displace native species.
- Construction and operation may produce a cumulative effect on plant communities, species, or habitat already affected by development.

### *6.5.3 Likely Issues of Concern*

Key issues likely to require further consideration if the SGP TC proceeds include:

- Possible loss or disturbance of rare plant species and vegetation communities in and adjacent to construction and operation areas as a result of construction activity;
- Length of time for disturbed or replanted vegetation to recover in sub-arctic/arctic environment;
- Construction disturbance of rare plant communities or plant communities having high value for wildlife;
- Effects of accidental events;
- Alteration or destruction of wetland habitat as a result of road construction or alteration of drainage regimes; and
- Cumulative effects of construction and operation on existing levels of disturbance.

### *6.5.4 VECs and VEC Boundaries*

Vegetation is an important component of terrestrial ecosystems. Plants provide food and cover for animal populations, as well as providing food, fuel, and medicinal plants for humans. Plant cover stabilizes soils and influences permafrost conditions by modifying site albedo and producing an insulating layer of organic material. Vegetation contributes to overall biodiversity of the region. Of particular concern, should the SGP TC proceed, would be the presence of rare plant species, rare or particularly sensitive plant communities, and plant communities which are of high value to animal or human populations. Future assessment work should be focused on these VECs within areas of potential surface disturbance associated with road construction and operation (including areas that may be affected by off-site effects).

### *6.5.5 Data Gaps and Future Study Needs*

At the present time, there is little site-specific information available regarding the distributions of plant communities and rare plants within the study area. General information is available regarding vegetation at the ecoregion and ecodistrict level. This information may be of use in identifying broad areas having high value as wildlife habitat.

In addition, there is some detailed site specific information which has been collected for scattered locations within and outside the defined study area. These data sources provide lists of plants and descriptions of plant communities which occur or may occur in the study area; however, they do not provide sufficient information to establish whether rare species or rare or sensitive plant communities may be affected by this project. In order to collect this information, it will be necessary to define more precisely the highway alignment to make it feasible to collect site-specific information regarding rare plants and plant communities.

Ideally, a preliminary routing corridor one to two kilometres in width should be selected within which the road would be established. Aerial photography could be collected along this corridor to provide information on the distribution of plant communities along the corridor. Each plant community identified on the aerial photography would be ground-truthed to determine its species composition. In this way, rare or sensitive plant communities could be identified. Traditional knowledge of valued plant species and locations should be obtained. More detailed vegetation surveys should be conducted in plant communities having high potential to harbour rare species. Once this site-specific information has been collected, the road route can be modified within the corridor as required to avoid rare species or rare or sensitive plant communities, potential effects on vegetation can be evaluated, and mitigation measures and contingency plans for accidental events developed.

### *6.5.6 Bibliography*

Argus, G.W. and K.M. Pryor. 1990. Rare Vascular Plants in Canada: Our Natural Heritage. Canadian Museum of Nature.

Environment Canada. 1997. *A national ecological framework for Canada* [Online]. Available: http://www1.ec.gc.ca [1998, October 19-23].

Government of Canada. 1996. The State of Canada's Environment. Ministry of Public Works and Government Services.

Jacobson, R. 1979. Wildlife and Wildlife Habitat in the Great Slave and Great Bear Lake Regions 1974-1977. Environmental Studies No. 10. Department of Indian and Northern Affairs. Ottawa, ON.

Porsild, A.E. and W.J. Cody. 1980. Vascular Plants of Continental Northwest Territories, Canada. National Museum of Canada.

Timoney, K. 1995. Tree and tundra cover anomalies in the subarctic forest-tundra of Northwestern Canada. *Arctic* 48 (1): 13-21.

Zoltai, S.C. and W.W. Pettapiece. 1973. Studies of Vegetation, Land Form, and Permafrost in the Mackenzie Valley. Environmental-Social Committee, Northern Pipelines, Task Force on Northern Oil Development. Report No. 73-4.

## 6.6 Wildlife and Wildlife Habitat

### *6.6.1 Existing Conditions*

The terrestrial and freshwater ecosystems that exist in the study area are the result of biological colonization, geography, and climatic conditions. Terrestrial wildlife species found within the study area are typical of those that inhabit boreal forest and arctic tundra habitats. Seasonal variation in these habitats can be quite extreme and, as a result, some species have developed adaptations such as hibernation or migration that allow them to thrive in the study area on a seasonal basis. Other species remain active in the study area year-round and have also developed specific adaptations allowing them to survive long, cold winters and successfully reproduce during the short, productive summer period.

The GNWT Department of Renewable Resources, Wildlife and Economic Development (RWED) has legislative authority for the 'preservation of game' in the NWT pursuant to the *Northwest Territories Act* (R.S.C. 1970). Under the *Wildlife Act* (1978), the Commissioner of the Northwest Territories divides the NWT into Wildlife Management Units and may designate other areas within such units for wildlife management purposes. Within the Greater Slave Geological Province, at least four Wildlife Areas of Special Interest to RWED exist: the Bathurst Caribou Herd calving ground (barren ground caribou); Coppermine River (gyrfalcon and peregrine falcon); Melville Sound (gyrfalcon and peregrine falcon); and Horton Plain (musk ox) (Ferguson 1987). With the exception of part of the Bathurst caribou Herd calving ground at Bathurst Inlet, none of these areas occur within the proposed study area.

#### 6.6.1.1 Caribou (Rangifer tarandus)

Caribou throughout northern Canada and indeed, throughout their circumpolar range, are considered as a single widespread species. Subspecies are recognized and may be further grouped according to the woodland or barren ground habitat they occupy, and/or as concentrations of individuals known as herds, usually with a common calving area. Within the study area, caribou are considered part of the Bathurst Herd estimated at 486,000 animals in 1986 (Klohn-Crippen 1993). A more recent estimate by RWED in 1990, estimated the population at 350,000, making it the largest herd in the NWT (Nunavut Planning Commission 1998). The herd is considered healthy, and approximately six percent is harvested annually (A. D'Hont, pers. comm.).

The herd occupies a range of 250,000 $km^2$, with variable calving areas usually (1986-1996) centered around the Bathurst Inlet area (Nunavut Planning Commission 1998). Recent satellite tracking of collared animals from this herd have confirmed that wintering areas have also been variable occupying areas south of the tree line from the Coppermine River to Great Slave Lake and, in some years, as far south as the Saskatchewan border (WKSS 1998). In spring, the animals migrate northeast through the study area towards Victoria Island and, in the fall, move southwest through the study area back to the treeline. Movements of caribou in this herd are somewhat unpredictable and, with few barriers to movement, specific migration corridors have not been documented (Bromley and Buckland 1995).

However, recent WKSS studies examining caribou habitat and migration patterns using remote sensing and intensive interviews with elders and others familiar with caribou, were initiated in 1996, and are currently ongoing to address these questions.

#### 6.6.1.2 Moose (Alces alces)

Moose are at the northern extent of their range in the NWT and densities are low, typically 0.05-0.15/km$^2$ (Graf 1992). Moose in this region, and in Yukon and Alaska have undergone slight population increases between 1960 and 1990 (Karns 1998). Approximately 60 moose were harvested in the West Kitikmeot-Slave Geological Province in 1996-97 (A. D'Hont, pers. comm).

In the study area, moose use a variety of habitats including lakeshores, river valleys, and alder swamps year-round, often moving out into the arctic tundra in summer to use area of lush willow growth (Britton 1983). Alluvial habitats along floodplains and deltas, such as those along the Coppermine River, are particularly important in the provision of a high biomass of forage (Peek 1998). However, given the rocky terrain, predominantly open coniferous forests, and few riparian areas, habitat is of generally low quality (Jacobson 1979). Moose are considered non-migratory, although in the Mackenzie Valley, for example, they are known to occupy large home ranges (40-942 km$^2$) (Stenhouse *et al.* 1995).

#### 6.6.1.3 Musk Ox (Ovibos moschatus)

Since their near extirpation in the last century, musk ox have made a strong recovery and are now common throughout much of the Canadian Arctic (Klohn-Crippen 1993). Musk ox populations are now large enough to sustain both subsistence harvesting and a commercial meat harvest (GNWT 1998b). A survey of the area northeast from Contwoyto Lake to the coast west of Bathurst Inlet in 1991 estimated a population of 1,400 musk oxen (Bromley and Buckland 1995).

Musk ox distribution until the 1970s was described as occurring northeast of a line running from Coppermine through Contwoyto Lake to Artillery Lake in the study area, and as far north as Great Bear Lake to the west of the study area (Searing and Alliston 1979). In recent years, musk oxen have been observed in the Izok Lake area, southwest of Bathurst Inlet during the summer months (Klohn-Crippen 1993), and important musk ox calving grounds have been identified in the Bathurst Inlet area (Nunavut Planning Commission 1998). During surveys in 1991, only a few musk oxen were observed south of Contwoyto Lake (Bromley and Buckland 1995).

#### 6.6.1.4 Grizzly Bear (Ursus arctos horribilis)

Grizzly bear in Canada are estimated at 22,000 individuals (Canadian Museum of Nature 1998), with approximately 4,000-5,000 in the NWT (Peek *et al.* 1987). Grizzly bears inhabit the Mackenzie

Mountains, Sahtu and central barrenlands of the NWT. It is not certain, but the population of barren-ground grizzlies in the NWT, it is thought to be less than 1000 (D.Cluff, pers. comm. 1999). Sightings by people working or travelling in the area suggest that bears occur at low densities throughout the study area (Bromley and Buckland 1995). North American populations are considered healthy (Peek *et al*. 1987).

Grizzly bear occur throughout the barrens of the study area (Banfield 1959; Klohn-Crippen 1993) and in the forested regions near Great Slave Lake (Searing and Alliston 1979). They usually den in southerly exposed, well-drained slopes or banks with sufficient depth to avoid permafrost (Nagy 1983 in Klohn-Crippen 1993). Dens are usually not occupied in successive years; however, successive dens are often found in the same area. Female grizzly territories are 1,350 $km^2$ in the Coppermine area and denning always occurs within their summer territory (Klohn-Crippen 1993). Male territories are generally larger (Craighead and Mitchell 1982 in Klohn-Crippen 1993), reaching an average of 6,320 $km^2$ in the SGP (WKSS 1998).

#### 6.6.1.5 Black Bear (Ursus americanus)

At present in Canada, the black bear occupies about 85% of its former range, having been eliminated from the southern portions of some provinces (Kolenosky and Strathern 1987). In the northern portion of their range, such as the study area, black bear tend to be at lower densities where both the diversity and quality of plant species are lower.

Black bear are found in the southern, forested part of the study area, and only occasionally are observed on the tundra (Bromley and Buckland 1995). In 1996-97, 12 black bears were harvested by residents in the West Kitikmeot-Slave Geological Province, within the study area (A. D'Hont, pers. comm.). In similar habitat to the study area (*i.e.*, forested and barren ground) in Labrador, field studies indicated varied habitat and seasonal use of several forage species (JWEL 1997).

#### 6.6.1.6 Wolf (Canis lupus)

It is estimated that there are about 10,000 wolves in the NWT (GNWT 1998a), with between 1,400 and 3,000 of them living within the Bathurst Caribou Herd range (Bromley and Buckland 1995). Population trends are unknown (Carbyn 1987), although wolves occupy all of their traditional range in the NWT (Heard 1981). Densities are highest on barren ground caribou herd range (Heard 1981).

Wolves range over the study area on a seasonal basis in response to caribou distribution (Searing and Alliston 1979; Klohn-Crippen 1993). As a result, wolves in the study area do not appear to maintain exclusive territories but, instead, follow the migratory Bathurst Caribou Herd (GNWT 1998a). In the past, denning sites have been recorded in eskers near the treeline and along the Hood and Burnside Rivers (Searing and Alliston 1979). A recent study of eskers in the Lac de Gras, Contwoyto Lake, and

Nose Lake area identified 36 active wolf dens (WKSS 1998). Fur auction records for the last 20 years indicate an annual harvest in the NWT of 800 to 1,500 wolves (GNWT 1998a).

#### 6.6.1.7 Wolverine (*Gulo gulo*)

Wolverine are solitary, nomadic animals that range over large areas. The current distribution in Canada is considerably reduced, although viable populations still exist in the NWT (Hash 1987).

Wolverine have been observed in the study area near Izok Lake (Klohn-Crippen 1993). This species tends to follow migrating caribou herds, feeding on the remains of carcasses left by wolves and bears, and therefore may be expected throughout the study area. Home range sizes, determined through radio-telemetry, vary from 59 to 1,905 $km^2$, although some of these are young wolverines appearing to move over much larger areas than adults (WKSS 1998). The results of a harvest study indicate that 137 wolverines were trapped during 1996-97 (WKSS 1998).

#### 6.6.1.8 Other Furbearers

Arctic fox (*Alopex lagopus*) inhabits arctic and alpine tundra zones and ranges throughout the study area, with populations fluctuating dramatically in response to small mammal cycles (Banfield 1974; Garrott and Eberhardt 1987). American marten (*Martes americana*), mink (*Mustela vison*), muskrat (*Odontrata zibethicus*), American beaver (*Castor canadensis*), red fox (*Vulpes vulpes*), otter (*Lontra canadensis*), lynx (*Lynx lynx*), ermine (*Mustela erminea*), and red squirrel (*Tamiasciurus hudsonicus*) inhabit forested portions of the study area (approximately the southern half of the study area) (Banfield 1974; Strickland and Douglas 1987; Eagle and Whitman 1987; Melquist and Dronkert 1987; Quinn and Parker 1987). Northern furbearers produce some of the highest quality fur in the world and commercial trapping provides an important source of income for Aboriginal people in the region (GNWT 1998b). All of these species are taken by trappers in communities in the SGP (A. D'Hont, pers. comm.).

#### 6.6.1.9 Small Mammals

Several small mammal species occur in the study area. Some species, such as the Arctic ground squirrel (*Spermophilus parryi*), brown lemming (*Lemmus sibiricus*), and collared lemming (*Dicrostonyx torquatus*), are found only in the tundra region (Banfield 1974). Brown and collared lemmings exhibit cyclic population fluctuations and remain active year-round. The Arctic ground squirrel is considered an extremely important food source for many Arctic carnivores, even though it hibernates for approximately seven months a year. The deer mouse (*Peromyscus maniculatus*), heather vole (*Phenacomys intermedius*), chestnut-cheeked vole (*Microtus xanthognathus*), and American porcupine (*Erethizon dorsatum*) are found in the southern half of the study area, below the treeline. The northern bog lemming *(Synaptomys borealis*), northern red-backed vole (*Clethrionomys*

*rutilus*), and the meadow vole (*Microtus pennsylvanicus*) are distributed throughout the study area at varying densities (Banfield 1974). These vole species also exhibit cyclic population fluctuations. All small mammal species in the study area are prey for avian and mammalian carnivores.

#### 6.6.1.10 Passerine Birds

Passerine bird species nesting in the study area include several sparrow, swallow, thrush, longspur, redpoll, and warbler species. Many of these species are at the northern extent of their range and their densities may be low. These birds are migratory and only spend the short summer breeding season in the study area. Year-round residents include boreal chickadee (*Parus hudsonicus*), Canada jay (*Perisoreus canadensis*), pine grosbeak (*Pinicola enucleator*), white-winged crossbill (*Loxia leucoptera*), and common raven (*Corvus corax*) (Banfield 1974). The introduced European starling (*Sturnus vulgaris*) is only partly migratory and has been observed in December at Yellowknife (Banfield 1974).

#### 6.6.1.11 Raptors

The study area supports a number of raptor species including golden eagle (*Aquila chrysaetos*), rough-legged hawk (*Buteo lagopus*), peregrine falcon (*Falco peregrinus*), and gyrfalcon (*Falco rusticolus*) breeding in areas with suitable cliff habitat (Godfrey 1986; Klohn-Crippen 1993). The peregrine falcon is listed by COSEWIC as "endangered" (COSEWIC 1979). Golden eagle, peregrine falcon, and gyrfalcon nests have been observed on the coastal cliffs of Bathurst Inlet, nests of all four species have been identified along the winter road route to the Lupin mine site, southwest of Bathurst Inlet (Searing and Alliston 1979), and the endangered *anatum* subspecies of peregrine falcon is known to nest in the Lac de Gras area (P. Latour, pers. comm.). The southern portion of the study area likely represents the northern breeding distribution of tree-nesting species such as bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaeetus*), great horned owl (*Bubo virginianus*), and northern harrier (*Circus cyaneus*) (Godfrey 1986). Numerous bald eagle nests have been identified in the Yellowknife area and along the shores and islands of the east arm of Great Slave Lake (Searing and Alliston 1979). The short-eared owl (*Asio flammeus*) is a ground-nesting bird that may be found throughout the tundra of the study area, and is listed as vulnerable by COSEWIC. The snowy owl (*Nyctea scandiaca)* can be expected to winter in the study area, particularly in years when small mammal numbers are low (Godfrey 1986).

#### 6.6.1.12 Waterfowl

Waterfowl, including geese and dabbling and diving ducks, are found throughout the study area during spring, summer, and early fall. However, few of these species nest widely throughout the study area because of the limited availability of suitable habitat (Searing and Alliston 1979). Within the study area, Bathurst Inlet has been identified as an important spring staging area, and the northwest arm of Great Slave Lake as important nesting habitat (Searing and Alliston 1979). The Queen Maud Gulf

Bird Sanctuary to the northwest of the study area is recognized as a wetland of international importance (a RAMSAR site pursuant to the Convention of the Conservation of Wetlands of International Importance, 1971) (Nunavut Planning Commission 1998). Birds nesting in this wetland are likely staging at Bathurst Inlet in the spring. As well, the Bathurst Inlet area was identified as an area of significance by the International Biological Program (IBP) in the 1970s.

Lesser and greater snow geese (*Anser* sp.) and Ross' goose (*Anser rossii*) nest in large numbers at Queen Maud Gulf and in smaller numbers elsewhere in the central Arctic. The number of these species is currently at record high levels (CWS 1998). The short grass prairie population of Canada geese (*Branta canadensis*), which nest in suitable habitat throughout the study area, was estimated at over 560,000 birds in 1996 (CWS 1998). Spring surveys conducted in the NWT since 1987 do not show any significant increase in the number of Canada geese (CWS 1998). In 1996-97, resident hunters are estimated to have killed 1,400 ducks, 10 geese, and 6,000 gamebirds (A. D'Hont, pers. comm.).

#### 6.6.1.13 Other Endangered Species

The endangered whooping crane (*Grus americana*) nests in Wood Buffalo National Park, approximately 90 km south of the study area. Since 1983, there has been a large increase in the number of juvenile and surviving subadults, and a consequent increase in the breeding population (Kuyt 1993). Many new pairs have begun nesting outside of the traditional nesting areas, some of these on the peripheries of existing breeding range along the Sass and Klewi Rivers in the NWT. However, the majority of pioneering breeding pairs occur farther south within the Alberta portion of Wood Buffalo National Park and expansion is likely to continue in a southerly direction (Kuyt 1993). It is possible that the occasional non-breeding whooping crane may stray into the study area.

The eskimo curlew (*Numenius borealis*) is listed by COSEWIC as "endangered." However, it is possible that the species is extinct. Researchers suggest that excessive hunting pressure and, possibly, climatic factors were responsible for the decline of eskimo curlew (Searing and Alliston 1979). Sightings of the species were reported during three years in the 1970s, but the last confirmed records were in the 1960s (COSEWIC 1979). The study area encompasses the curlew's former range and the possibility that the species still nests in the study area should be considered.

### *6.6.2 Potential Project – Environment Interactions*

Potential project-terrestrial wildlife interactions that may result from construction, operation and accidental events of the SGP TC include the following. Some of these interactions may produce a cumulative effect when combined with other development-related pressures.

#### 6.6.2.1 Habitat Alteration or Loss

- Physical removal or alteration of habitat due to construction of the road and right-of-way (*e.g.*, use of eskers where dens and other wildlife habitat is located as sources of aggregate, potentially affecting all wildlife species using the area);
- Changes in water levels and drainage patterns, resulting in alteration of habitat, may affect nesting waterfowl and shorebirds;
- Avoidance of habitat due to construction activity (*e.g.*, blasting, equipment use) affecting all wildlife species using the area;
- Avoidance of habitat due to disturbance from road operations (including changes in caribou migration patterns, and avoidance by other species such as wolves, wolverine, grizzly bear, and nesting waterfowl and raptors);
- Interruption of caribou migration or travel routes between the mainland and islands as a result of ice-breaker or other vessel travel through sea ice;
- Routine or accidental events introducing contaminants into the environment and becoming transferred through food-webs, leading to decreased productivity and/or other food chain effects; and
- Accidental events, such as fuel or chemical spills which could contaminate water bodies, potentially affecting food supplies for otter or mink, or could cause oiling of waterfowl or shorebirds, and fire, which destroys vegetation, could affect all wildlife species using the area.

#### 6.6.2.2 Disturbance

- Disturbance of wildlife by traffic and other human activities during sensitive periods, such as waterfowl and raptor nesting or caribou calving, may reduce productivity or cause mortality of young.
- Disturbance of wildlife also may lead to temporary or permanent avoidance of preferred habitat leading to increased predation.

#### 6.6.2.3 Direct Mortality or Injury

- Vehicle-wildlife collisions causing serious injury or mortality to wildlife including caribou, moose, musk oxen, wolves, or fox;
- Access provided by the road may increase hunting and trapping pressure on furbearers, waterfowl, and large mammal species; and
- Mortality of bears or wolves that may become nuisance animals at construction camps or maintenance depots.

### *6.6.3 Likely Issues of Concern*

Key issues that likely would require further consideration if the SGP TC were to proceed include ( not ranked in any particular order):

- Alteration of caribou migration routes and calving grounds because of disturbance caused by road construction and operation, and marine vessel traffic, also affecting wolves and wolverine which move with the herd;
- Effects of blasting on wildlife;
- Destruction of wolf and bear den sites as a result of esker quarrying;
- Wildlife-vehicle collisions;
- Disturbance of nesting raptors or waterfowl caused by construction and operation of the proposed road;
- Alteration of terrestrial habitat by accidental forest and tundra fires, spills, emissions, and dust;
- Alteration of wetland habitat for waterfowl due to changes in drainage patterns caused by construction of the road;
- Mortality of nuisance animals (human and bear interactions for example) at construction camps or maintenance depots;
- Wildlife mortality and injury by exposure to road and camp litter;
- Increased hunting and trapping pressure on caribou, musk ox, furbearers, and waterfowl due to enhanced access provided by the road; and
- Cumulative effects on wildlife habitat, wildlife, and wildlife diversity from past and planned future development, including road construction and operation.

### *6.6.4 VECs and VEC Boundaries*

Based on potential project-environment interactions and likely issues of concern, future assessment should be focused on the following VECs, subject to refinement as work proceeds.

#### 6.6.4.1 Caribou

The Bathurst Caribou Herd is an important food source for Aboriginal and non-Aboriginal hunters from West Kitikmeot, several Dene communities around Great Slave Lake, and other communities to the south of Great Slave Lake. Approximately 14,500 to 18,500 animals are harvested annually (Nunavut Planning Commission 1998). Caribou also serve as an important component of the natural system in this area, providing a food source for numerous top-level carnivores including wolves, wolverine, grizzly bear, and other smaller carnivores that scavenge on remains. Caribou may be adversely affected by road construction through disturbance of migration patterns, collisions with vehicles, and increased hunting pressure as a result of enhanced access.

The spatial ecological boundary would encompass the portions of the study area annually occupied by the Bathurst Herd, including winter and summer range, migration corridors, and calving grounds.

However, predictions of environmental effects caused by the road should consider the entire range of the Bathurst Caribou Herd, including areas used outside the SGP TC.

#### 6.6.4.2 Musk Ox

Musk oxen are currently managed to provide subsistence and commercial hunting opportunities. The 1996-97 musk ox quota in the SGP was 124 animals, approximately three percent of the estimated musk ox population in the area (A. D'Hont, pers. comm.). There are physiological and behavioural characteristics that make musk oxen vulnerable to disturbance or over-harvesting. These characteristics include a low reproductive rate, sedentary nature, a general lack of wariness, and a tendency to stand their ground if closely pressed (Burch 1974). Therefore, careful management of this species is important and any adverse effects of the new road on musk ox require examination.
The spatial boundary for musk ox would encompass the home ranges of individuals who have all or a portion of their home range within the SGP TC.

#### 6.6.4.3 Grizzly Bear

This species is wide-ranging and associated with undisturbed landscapes. As well, it is listed as "vulnerable" by COSEWIC. Because of their late maturity and small litter sizes, grizzlies recover very slowly from any factor that decreases their numbers (World Wildlife Fund 1998). In 1997, 19 grizzly bears were killed in the West Kitikmeot-Slave Geological Province area, eight under quota and 11 in defense of life or property (A. D'Hont, pers. comm.). The quota of bears for the two management zones in the West Kitikmeot-Slave Geological Province was ten; however, almost twice as many bears were killed. This vulnerability and the potential for human-grizzly conflicts as a result of road construction and operation emphasize the importance of evaluating the effects of the road on the grizzly bear population in the SGP TC. There is a strong likelihood that the potential increased mortality associated with increased development would exceed the population's capability and a population decline may ensue (D. Cluff, pers. comm. 1999).

The spatial boundary for grizzly bear would encompass the home ranges of individuals who have all or a portion of their home range within the study area.

#### 6.6.4.4 Wolf

Road development may affect wolves by altering their distribution and densities through avoidance of the road, destruction of den sites during quarrying activities, collisions with vehicles, and increased hunting and trapping mortality. Wolves are an integral part of the predator-prey hierarchy in this region and it is important to determine the effects of human disturbance and increased access on this species.

Though wolves that inhabit the study area tend to be migratory in nature, during the summer months they are restricted to denning areas that may be vulnerable to disturbance. The spatial boundary for wolves would encompass the range within the project area used during the denning period.

#### 6.6.4.5 Wolverine

Wolverine live and breed in large areas of undisturbed land. Because wolverine may be sensitive to human disturbance and susceptible to over-trapping, it is important to assess the effects of a road on this species. The spatial boundary for wolverine would encompass the home ranges of individuals who have all or a portion of their home range within the SGP TC.

#### 6.6.4.6 Other Furbearers

Furbearers experience natural population cycles, independent of harvesting activity, and must be carefully monitored to ensure over-harvesting does not occur when populations are low. It will also be important to understand and/or predict declines to be able to separate natural from potential project-induced effects. An increase in accessibility created by road construction may increase trapping pressure on furbearer species.

The spatial boundary for furbearers would encompass the home ranges of individuals who have all or a portion of their home range within the SGP TC.

#### 6.6.4.7 Raptors

Raptors are top-level predators that occur at naturally low densities. Their presence is a reflection of the abundance and status of the various species beneath them in the food chain. Peregrines have also been shown to be sensitive to human disturbance. For these reasons, they are often chosen to be indicators of environmental health. As well, the peregrine falcon, which is known to nest in the study area, is listed as "endangered" by COSEWIC.

Raptor species generally have widespread distribution patterns and only a small proportion of their population is confined at any time within the area influenced by the proposed road. The spatial boundary for raptors would be defined as the range of habitat used by those individuals occurring within a 2 km corridor centered on the highway right-of-way.

#### 6.6.4.8 Waterfowl

Waterfowl concentrated in staging, nesting, or moulting areas may be vulnerable to disturbance or over-harvesting as a result of increased access provided by the road. The spatial boundary for waterfowl would be defined as the range of habitat used by those individuals occurring within a 2 km corridor centered on the highway right-of-way.

### *6.6.5 Data Gaps and Future Study Needs*

A number of studies currently funded by the West Kitikmeot/Slave Study Society (WKSS) address data gaps related to several of the proposed VEC species (WKSS 1998):

- Factors affecting Bathurst Caribou calving ground location (initiated 1998);
- Seasonal movements of the Bathurst Caribou Herd (initiated 1996);
- Summer behaviour of caribou at mine sites (completed 1997);
- Wolverine ecology, distribution, and productivity in the SGP (initiated 1996);
- Population ecology of grizzly bears in the SGP (initiated 1996); and
- Esker habitat studies in the SGP (includes mapping of wolf dens and radio tracking of individuals) (initiated 1996).

Annual spring waterfowl surveys are conducted by the Canadian Wildlife Service in important waterfowl breeding habitat adjacent to the SGP (CWS 1998); however, nothing definitive is known about the distribution or activities of any waterfowl species in the SGP, particularly the central region (Bromley and Buckland 1995).

Furbearer populations are monitored through collection of information from trapper returns. This often results in data gaps because of inconsistencies related to returns from trappers (A. D'Hont, pers. comm.). With the exception of the wolverine and wolf studies, there is currently no research being conducted on other furbearer populations in the study area.

There is little detailed information on the distribution and movements of raptors in the study area. Systematic surveys have been conducted only along the arctic coast and for the most part, records of raptor nests in the SGP are dependent on incidental reports from people working or travelling in the area (Bromley and Buckland 1995).

At some point in the future, the selected road route may be challenged on two aspects relating to scale. The detailed level would consider local site-specific issues such as avoiding raptor nest sites, local bear dens, or perhaps erosion-sensitive habitats. Such information would be required to identify the need for possible local adjustments to mitigate adverse effects. Such resources should be identified once the study area is narrowed down to a 1 km corridor, or if appropriate, within a 10 km corridor.

The other level of justification required will be an evaluation of regional differences vis-a-vis environmental concerns. Examples of issues at this level would include wetland habitat productivity and/or relative density, overlap with ranges of caribou or other large-ranging animals, or perhaps overlap with sensitive river valleys. This regional understanding of wildlife resources would occur at an ecoregion/ecodistrict scale. Data collection requirements to address such issues should be tailored to provide a regional but less detailed, constraints evaluation. The following studies are recommended to support this evaluation, and should be carried in the early stages of corridor refinement. Future studies should incorporate traditional knowledge.

#### 6.6.5.1 Literature Review

A thorough review of the data collected in studies completed by the WKSS should be conducted to determine if there are further studies required to address gaps related to proposed VEC species and project interactions. Again the focus could occur at the ecoregion/ecodistrict scale, and it is not proposed to embark on these studies necessarily in 1999.

#### 6.6.5.2 Waterfowl

An aerial breeding waterfowl survey should be conducted in the SGP as soon as possible. It is suggested that a stratified block survey methodology be adopted to examine relative differences in waterfowl production over large areas. All potential breeding habitat (peatland, marsh, rivers-brooks, and open water) within a particular block would be surveyed. Data to be collected would include species, numbers, and social structure (pairs, lone males, females, unknown sex). A power analysis would be completed to identify minimum sample sizes required to detect required differences in productivity.

Once the study area corridor is more refined (*i.e.*, 1 km or less), a detailed characterization of the waterfowl habitat along the route should be developed (not proposed for 1999). This would allow for a quantified estimate of habitat that may be lost or altered as a result of the project.

#### 6.6.5.3 Raptors

As with waterfowl above, blocks of suitable raptor habitat could be surveyed to determine relative differences in species densities and composition. Active nests per ecodistrict/ecoregion (focusing on potential suitable habitat for cliff nesting and tree nesting species) would be the density parameter to be used in such a comparison. This aerial survey of active raptor nests could be completed in 1999 in the SGP.

### *6.6.6 Bibliography*

#### *Personal Communications*

A. D'Hont. Wildlife Biologist, Department of Resources, Wildlife and Economic Development, Government of Northwest Territories, Yellowknife, NT. 1998.

P. Latour. Wildlife Biologist, Canadian Wildlife Services, Environmental Conservation Branch, Environment Canada, Yellowknife, NT (consultation interview, January 25, 1999).

D. Cluff. Regional Biologist – North Slave Region, Department of Resources, Wildlife and Economic Development, Government of the NWT. Yellowknife, NT. 1999.

#### *Existing Information*

Anthony, R.M. 1996. Den use by Arctic foxes (*Alopex lagopus)* in a subarctic region of western Alaska. *Canadian Journal of Zoology*. 74: 627-631.

Banfield, A.W.F. 1974. The Mammals of Canada. University of Toronto Press and the National Museum of Natural Sciences, Ottawa, Ontario.

Bergerud, A.T. 1974. The role of the environment in the aggregation, movement and disturbance behaviour of caribou. In *The behavior of ungulates and its relation to management.* V. Geist and F. Walters (eds.). IUCN. 552-584.

Bighorn Environmental Design Ltd. 1996. Cumulative effects and environmental assessment of the proposed Cheviot Mine Development: ungulates, small mammals, avifauna, amphibians. Prepared for Cardinal River Coals Ltd., Hinton, AB.

Britton, B. 1983. Moose of the Northwest Territories. Arctic Wild. Sketches, Department of Renewable Resources, Government of Northwest Territories.

Bromley, M. and L. Buckland. 1995. Biological Information for the Slave Geological Province Report No. 83. Prepared for the Department of Renewable Resources, Government of Northwest Territories.

Burch, E.S. 1974. Muskox and man in the central Canadian subarctic 1689-1974.

Cade, T.J., J.H. Enderson, C.G. Thelander and C.M. White (eds.). 1988. Peregrine Falcon Populations: Their management and recovery. The Peregrine Fund, Inc. Boise, Idaho.

Canadian Museum of Nature. 1998. *Species at risk in Canada: Grizzly bear* [Online]. Available: http://www.nature.calenglish/atrisk.htm.

Carbyn, L.N. 1987. Gray wolf and red wolf. In *Wild Furbearer Management and Conservation in North America*. M. Novak, J.A. Baker, M.E. Obbard and B. Malloch (eds.). Ministry of Natural Resources, Ontario. 359-376.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 1979. Endangered Canadian Wildlife Fact Sheet: Eskimo Curlew. Prepared by the Council on the Status of Endangered Wildlife in Canada. Ottawa, Ontario.

Court, G.S., C.C. Gates and D.A. Boad. 1988. Natural history of the peregrine falcon in the Keewatin District of the Northwest Territories. *Arctic* 41(1):17-30.

Craighead, J.J. and J.A. Mitchell. 1982. Grizzly Bear. In *Wild Mammals of North America: Biology, Management and Economics*. J.A. Chapman and G.A. Feldhamer (eds.). John Hopkins University Press. Baltimore, Maryland.

CWS (Canadian Wildlife Service). 1998. *Distribution of goose populations in Canada* [Online]. Available: www.ec.gc.ca/cws.scf/canbird/goose/.

Dufour, P. 1980. Effects of Noise on Wildlife and Other Animals: Review of research since 1971. United States Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C. No. 550/9-80-100

Dzubin, A. 1984. A Partially Annotated Bibliography of Disturbance, Noise and Harassment Effects on Birds. Ecological Assessment Section, Canadian Wildlife Service, Prairie Migratory Bird Research Centre, Saskatoon, Saskatchewan.

Eagle, T.C. and J.S. Whitman. 1987. Mink. In *Wild Furbearer Management and Conservation in North America*. M. Novak, J.A. Baker, M.E. Obbard and B. Malloch (eds.). Ministry of Natural Resources, Ontario. 614-625.

Ferguson, R.S. 1987. Wildlife areas of special interest to the Department of Natural Resources. Wildlife. Management Division, Department of Renewable Resources, Government of the Northwest Territories.

Ferguson, S., W.E. Mercer and S. Oosenbrug. 1989. The relationship between hunter accessibility and moose condition in Newfoundland. Internal report prepared for Wildlife Division, Department of Environment and Lands, Province of Newfoundland, St. John's.

Fleck, S. 1981. Birds of prey of the Northwest Territories. Arctic Wildlife Series, Renewable Resources Wildlife Service, Government of the Northwest Territories, Yellowknife.

Follmann, E.H., R.A. Dieterich and J.L. Hechtel. 1980. Recommended carnivore control program for the Northwest Alaskan Pipeline Project: including a review of human-carnivore encounter problems and animal deterrent methodology. Final report prepared for Northwest Alaskan Pipeline Company, Fairbanks, Alaska.

Follman, E.H. and J.L. Hechtel. 1990. Bears and pipeline construction in Alaska. *Arctic* 43(2):103-109.

Garrott, R.A. and L.E. Eberhardt. 1987. Arctic fox. In *Wild Furbearer Management and Conservation in North America*. M. Novak, J.A. Baker, M.E. Obbard and B. Malloch (eds.). Ministry of Natural Resources, Ontario. 394-406.

GNWT (Government of Northwest Territories). 1998a. *Facts about wolf harvesting in the Northwest Territories* [Online]. Available: http://www.gov.nt.ca/RWED/wf/wolf.html.

GNWT (Government of Northwest Territories). 1998b. Economic Framework: *Wildlife Sector* [Online]. Available: http://www.gov.nt.ca/RWED/ced/fram…/body_ingredients_for_success. html.

Godfrey, W.E. 1986. The Birds of Canada. National Museum of Natural Sciences, Ottawa, Ontario.

Graf, R.P. 1992. Status and management of moose in the Northwest Territories, Canada. *Alces Suppl* 1: 22-28.

Gunn, W.W.H. and J.A. Livingston (eds.). 1974. Disturbance to birds by gas compressor noise simulators, aircraft and human activity in the Mackenzie Valley and the North Slope, 1972. *Arctic Gas Biological Report Series* 14(4): 153-201.

Hash, H. 1987. Wolverine. In *Wild Furbearer Management and Conservation in North America*. M. Novak, J.A. Baker, M.E. Obbard and B. Malloch (eds.). Ministry of Natural Resources, Ontario. 575-585.

Heard, D.C. 1981. Historical and present status of wolves in the Northwest Territories. In *Wolves in Canada and Alaska*. Carbyn, L.N. (ed.). Canadian Wildlife Service. Report Series No. 45. 44-47.

Heard, D.C. and T.M. Williams. 1992. Distribution of wolf dens in migratory caribou ranges in the Northwest Territories, Canada. *Canadian Journal of Zoology*. *Rev. Can. Zool*. 70:1504-1510.

Jacobson, R. 1979. Wildlife and Wildlife Habitat in the Great Slave and Great Bear Lake Regions, 1974-1977. Environmental Studies No. 10, Northern Affairs Program. Department of Indian Affairs and Northern Development.

Jalkotzy, M.G., P.I. Ross and M.D. Nasserden. 1997. The effects of linear developments on wildlife: A review of selected scientific literature. Prepared for Canadian Association of Petroleum Producers. Arc Wildlife Services Ltd. Calgary, Alberta.

Johnson, D.R. and M.C. Todd. 1977. Summer use of a highway crossing by mountain caribou. *Canadian Field Naturalist* 91(3):312-314.

JWEL (Jacques Whitford Environment Limited). 1997. Voisey's Bay 1996 Environmental Baseline Technical Data Report: Black Bear. Prepared for Voisey's Bay Nickel Company Limited, St. John's, Newfoundland.

Karns, P. D. 1998. Population distribution, density and trends. In *Ecology and Management of the North American Moose*. A.W. Franzmann, and C.C. Schwartz (eds.). Smithsonian Institution Press, Washington. 125-139.

Kelsall, J.P., E.S. Telfer and T.D. Wright. 1977. The effects of fire on the ecology of the Boreal Forest, with particular reference to the Canadian North: a review and selected bibliography. Canadian Wildlife Service.

Klohn Crippen Consultants Inc. 1993. Izok Project: Environmental Evluation. Submission to the Regional Environmental Review Committee. Report Prepared for Metall Mining Corporation. Edmonton, Alberta.

Kolenosky, G.B. and S.M. Strathearn. 1987. Black bear. In *Wild Furbearer Management and Conservation in North America*. M. Novak, J.A. Baker, M.E. Obbard and B. Malloch (eds.). Ministry of Natural Resources, Ontario. 442-455.

Kuyt, E. 1993. Whooping crane, *Grus americana*, home range and breeding range expansion in Wood Buffalo National Park, 1970-1991. *Canadian Field Naturalist* 107(1): 1-12.

LGL Alaska Research Associates, Inc. 1994. Mitigation of the effects of oil field development and transportation corridors on caribou. Report prepared for Alaska Caribou Steering Committee.

Melquist, W.E. and A.E. Dronkert. 1987. River otter. In *Wild Furbearer Management and Conservation in North America*. M. Novak, J.A. Baker, M.E. Obbard and B. Malloch (eds.). Ministry of Natural Resources, Ontario. 626-641.

Murphy, S.M. and J.A. Curatolo. 1987. Activity budgets and movement rates of caribou encountering pipelines, roads and traffic in northern Alaska. *Canadian Journal of Zoology*. 65:2483-2490.

Nelson, R.W. 1979. An assessment of the impact of Northern activities upon certain raptors. Prepared for Foothills Pipe Lines (Yukon) Ltd.

Novak, M., J.A. Baker, M.E. Obbard and B. Mallock (eds.). 1987. Wild Furbearer Management and conservation in North America. Ministry of Natural Resources, Ontario.

Nunavut Planning Commission. 1998. West Kitikmeot Regional Land Use Plan. Draft produced in June 1998 for informal public hearing. Akaluktutiak (Cambridge Bay), Northwest Territories.

Peek, J.M. 1998. Habitat relationships. In *Ecology and Management of the North American Moose*. A.W. Franzmann, and C.C. Schwartz (eds.). Smithsonian Institution Press, Washington. 351-375.

Peek, J.M., M.R. Pelton, H.D. Picton, J.W. Schoen and P. Zager. 1987. Grizzly bear conservation and management: a review. *Wildlife Society Bulletin*. 15(2): 160-169.

Poole, K.G. and R.G. Bromley. 1988. Natural history of the gyrfalcon in the central Canadian Arctic. *Arctic* 41(1): 31-38.

Quinn, N.W.S and G.R. Parker. 1987. Lynx. In *Wild Furbearer Management and Conservation in North America*. M. Novak, J.A. Baker, M.E. Obbard and B. Malloch (eds.). Ministry of Natural Resources, Ontario. 682-694.

Reijnen, R., R. Foppen, C. TerBraak and J. Thissen. 1995. The effects of car traffic on breeding bird populations in woodlands, III. Reduction of density in relation to the proximity of major roads. *Journal of Applied Ecology* 32:187-202.

RRCS (Renewable Resources Consulting Services Ltd.). 1994. A review of the literature pertaining to the effects of noise and other disturbance on wildlife. Technical Report 7. In *EIS: Military flight training. An environmental impact statement on military flying activities in Labrador and Quebec*. Department of National Defence (DND).

Ritchie, R.J. 1987. Response of adult peregrine falcons to experimental and other disturbances along the Trans-Alaska Pipeline System, Sagavanirktok River, Alaska, 1985, 1986. Prepared for Alyeska Pipeline Service Company by Alaska Biological Research.

Roseneau, D.G., C.E. Tull and R.W. Nelson. 1981. Protection strategies for peregrine falcon and other raptors along the proposed Northwest Alaskan gas pipeline route. Final report prepared for Northwest Alaskan Pipeline Company by LGL Alaska Research Associates, Inc.

Roby, B.A. 1978. Behavioral patterns of barren-ground caribou of the Central Arctic Herd adjacent to the Trans-Alaska Oil Pipeline. M.Sc. thesis. University of Alaska. Fairbanks, Alaska.

Rowe, J.S. and G.W. Scotter. 1973. Fire in the boreal forest. *Quarternary Resources* 3(3):444-464.

Searing, G.F. and W.G. Alliston. 1979. Assessment of Impacts of a Road to Izok Lake: A Review of Existing Information and Recommendations for Research on Selected Species of Wildlife. Prepared for Fish and Wildlife Service, Government of the Northwest Territories.

Shideler, R.T. 1986. Impacts of human developments and land use on caribou: A literature review. Vols. I and II, Technical Report No. 86-3. Habitat Division, Alaska Department of Fish and Game. Fairbanks, Alaska.

Shideler, R.T., M.H. Robus, J.F. Winters and M. Kuwada. 1986. Impacts on human developments and land use on caribou: A literature review. Vol I: Technical Report 86-2. A worldwide perspective. Alaska Department of Fish and Game. Juneau, Alaska.

Sopuck, L.G., C.E. Tull, J.E. Green and R.E. Salter. 1979. Impacts of development on wildlife: A review from the perspective of the Cold Lake Project. Vols. I and II. Report prepared for Esso Resources Canada Ltd., by L.G.L. Ltd. Edmonton, Alberta.

Sopuck, L.G. and D.J. Vernam. 1986. Distribution and movements of moose (*Alces)* in relation to the Trans Alaska Oil Pipeline. *Arctic* 39(2): 138-144.

Stenhouse, G.B., P.B. Latour, L. Kutny, N. MacLean and G. Glover. 1995. Productivity, survival, and movements of female moose in a low density population, Northwest Territories, Canada. *Arctic* 48: 57-62.

Strickland, M.A. and C.W. Douglas. 1987. Marten. In *Wild Furbearer Management and Conservation in North America*. M. Novak., J.A. Baker, M.E. Obbard and B. Malloch (eds.). Ministry of Natural Resources, Ontario. 530-547.

WKSS (West Kitikmeot/Slave Study Society). 1998. *Funded Projects Summary* [Online]. Available: http://www.wkss.nt.ca/html/funded_projects_summary.html#pro9.

World Wildlife Fund. 1998. *WWF Canada Factsheets: Grizzly bear* [Online]. Available: http://198.53.192.127/facts/grizzly.html.

## 6.7 Fisheries and Aquatic Habitat

### *6.7.1 Existing Conditions*

The SGP TC crosses through numerous watersheds including thousands of streams, rivers, lakes, and marshes in boreal forest and arctic tundra ecosystems that provide habitat for various species of fish. To the south of the proposed corridor lies Great Slave Lake, and to the north of the corridor lies Bathurst Inlet. Therefore, both freshwater and anadromous fish species could be affected by the proposed project, as anadromous species will migrate into the interior lakes and streams to spawn. Marine species and habitat are reviewed in Section 6.4, Marine Environment.

Several fish species in the Slave Geological Province provide commercial, subsistence, domestic, and recreational fishing opportunities. Several databases and reports exist that document studies on fish and fish habitat in the Slave Geological Province in the Northwest Territories. However, many watersheds remain unexplored.

The most abundant and economically important species that likely occur in the watercourses crossed by the SGP TC are lake whitefish (*Coregonus clupeaformis),* Arctic char (*Salvelinus alpinus*), northern pike (*Esox lucius*), lake trout (*Salvelinus namaycush*), Arctic grayling (*Thymallus arcticus*), inconnu (*Stenodus leucichthys*), and walleye (*Stizostedion vitreum*).

The Northwest Territories also hosts five species of fish that are listed as species of special status by COSEWIC (Table 6.7.1).

**Table 6.7.1 Fish Species of Special Status in the NWT**

| Species | COSEWIC Listing |
|---|---|
| darktail lamprey (*Lethenteron alaskense*) | intermediate |
| shortjaw cisco (*Coregonus zenthicus*) | uncertain in the NWT |
| deepwater sculpin (*myoxocephalus thomsoni*) | threatened |
| fourhorn sculpin (*myoxocephalus quadricornis*) | freshwater form vulnerable |
| spoonhead sculpin (*Cottus ricei*) | not at risk |

Currently, a large portion of interior lakes and rivers along the proposed SGP TC are used for subsistence, domestic, and recreational fishing. Although lake trout and other fish species have slow growth in northern lakes, there do not appear to be fishery resource problems in the interior lakes, and most lakes are under-utilized. One noted exception is in the area of Ingraham Trail where many lakes can be accessed regularly due to the all-weather road and may be subject to greater fishing pressure (G. Low, pers. comm.).

Data on fish species in the Slave Geological Province are primarily from commercial, subsistence, and recreational catch statistics and from data gathered to assess the effects of resource developments. In most cases, therefore, data are limited to waterbodies affected by humans.

Most economically important fish species are widely distributed throughout streams, rivers, and lakes in the Northwest Territories. The following is a breakdown of species and preferred habitats during different life stages in the area of the SGP TC, as well as a description of the fish species listed by COSEWIC as species of special status.

#### 6.7.1.1 Lake Whitefish

Lake whitefish is the most economically valuable species in the Northwest Territories (Fisheries and Oceans Canada 1983), important for both commercial and sport fishing. Lake whitefish are distributed throughout interior lakes and rivers in the Slave Geological Province and within the proposed corridor (G. Low, pers. comm.). Lake Whitefish spawn in the fall, but the exact date varies from year to year. This species prefers to spawn in shallow water over a hard, stone or sand substrate at depths less than 7.6 metres. The eggs incubate over the winter and hatch in April or May (Scott *et al.* 1973).

#### 6.7.1.2 Arctic Char

Arctic char has a more northerly distribution than other freshwater fish in the Northwest Territories, and is the dominant species of the Arctic coast. Arctic char is shown statistically to be the second most valuable fish species in the Northwest Territories. Historically, they are an important food resource for the Inuit, and are currently fished both commercially and recreationally in the Northwest Territories. Their distribution is widespread in freshwater rivers and lakes and in salt water north of the Nunavut border. Their distribution within the SGP TC north of the Nunavut border varies dramatically with life stage, time of year, and stock (G. Low, pers. comm.). Arctic char are found in coastal rivers and lakes and seldom travel far inland. Some char never leave freshwater, as they migrate from lakes to streams, while others are anadromous and spend part of their lives in salt water (Fisheries and Oceans Canada 1983). Arctic char spawn in the autumn either in lakes or in slow moving pools in rivers. They prefer to spawn in lakes with gravel substrates or rocky shoals at depths between 0.9 and 4.6 metres. The eggs incubate over the winter and hatch around April; however, fry emergence does not occur until ice break-up (Scott *et al.* 1973).

#### 6.7.1.3 Northern Pike

Northern pike, often referred to as jackfish, is the third most economically valuable fish species in the Northwest Territories (Fisheries and Oceans Canada 1983). Northern pike, distributed throughout lakes and rivers in the Northwest Territories, are important for both commercial and recreational fisheries (Fisheries and Oceans Canada 1983). Northern pike spawn in the spring after the ice melts.

They prefer to spawn in daylight hours in heavily vegetated river floodplains, marshes, and bays of large lakes. The eggs incubate and hatch within period of 12 to 14 days, after which time the young remain inactive and often attach themselves to vegetation for another six to ten days until they have absorbed their yolk sac (Scott *et al*. 1973).

#### 6.7.1.4 Lake Trout

Lake trout form an important part of the commercial, sport, and subsistence fisheries in the Northwest Territories (Fisheries and Oceans Canada 1983). Lake trout are widely distributed throughout the Northwest Territories, and usually inhabit shallow tundra lakes and rivers. Lake trout spawn in the autumn, although the exact date varies depending on factors including, temperature, weather, and the size of the lake. This species typically spawns over large boulders or rubble substrates in depths less than 12.2 metres. Eggs generally hatch after an incubation period of 15 to 21 weeks. After spawning, adult trout disperse and may travel to lakes up to 160 km away (Scott *et al*. 1973).

#### 6.7.1.5 Arctic Grayling

Arctic grayling were historically fished by Aboriginal people for dog food and occasionally for human consumption when whitefish and lake trout were scarce. There is currently a market for recreational fly-fishing of this beautiful fish in the Northwest Territories. Arctic grayling are distributed in lakes and rivers throughout the Northwest Territories. This species generally inhabits large rivers, rocky creeks, and lakes with cold, clear water. During ice break-up (usually between April and June), adults move from ice-covered lakes and large rivers to spawn in smaller tributaries with gravel or rock substrates. When such habitats are not available, adults will spawn in large rivers with similar substrates. Eggs hatch after a short incubation period of 13 to 18 days (Scott *et al*. 1973).

#### 6.7.1.6 Inconnu

Inconnu belong to the whitefish family and are important for commercial, subsistence, and recreational fishing in the Northwest Territories. Inconnu are distributed throughout lakes and rivers in the Northwest Territories. This species is anadromous in coastal rivers and lakes, and landlocked in interior lakes and streams. Inconnu most frequently inhabit large muddy streams and lakes (Fisheries and Oceans Canada 1983). Inconnu migrate up tributary rivers in the summer to spawn, and return to lakes in the fall to overwinter. Anadromous fish of this species enter freshwater rivers and streams from the ocean to spawn.

#### 6.7.1.7 Walleye

Walleye are fished both commercially and recreationally in the Northwest Territories. This species is distributed throughout lakes and rivers in the southern region (up to Great Bear Lake). Walleye are tolerant to a wide range of conditions, but typically prefer large, shallow, turbid lakes or clear lakes and rivers that provide enough depth for protection from the sun. This habitat requirement for turbid or deep water is necessary because walleye have sensitive eyes during daylight hours (Fisheries and Oceans Canada 1983). Walleye spawn in the spring or early summer, except in years with unfavourable temperatures when they may not spawn at all. This species prefers to spawn in rocky areas in white water below falls and dams in rivers, or in bouldery or coarse gravel shoal areas of lakes. Eggs hatch after a short incubation period of 12 to 18 days (Scott *et al*. 1973).

#### 6.7.1.8 Darktail Lamprey

Darktail lamprey are limited to northwestern Canada and Alaska. This species has no documented commercial, subsistence, or recreational value in the Northwest Territories. In fact, the only known sighting in the Northwest Territories occurred in the Martin River, a tributary of the Mackenzie River (Vladykov *et al*. 1980); the species is therefore considered rare. It is unlikely that this species is present in the waterbodies in the area of the proposed highway corridor; however, should its presence be observed, its assigned "intermediate" status by COSEWIC will be evaluated (Houston 1990).

The habitat preferences of the darktail lamprey are not known at present; however, the species is non-parasitic and restricted to freshwater.

#### 6.7.1.9 Shortjaw Cisco

Shortjaw cisco have been reported in Great Slave Lake in the Northwest Territories (Scott *et al*. 1973). This species has no documented commercial, subsistence, or recreational value in the Northwest Territories. Shortjaw cisco are considered threatened with extinction in Lake Superior, and have been extirpated from Lakes Michigan and Huron due to fishing pressure and habitat destruction. Although this species is not abundant in the Northwest Territories, its status there is uncertain. Shortjaw cisco are usually found in lakes at depths between 55 and 144 m. They move to shallower water for spawning. Available spawning and lifecycle data are specific to the Great Lakes, and are therefore not applicable to Great Slave Lake in the Northwest Territories.

#### 6.7.1.10 Deepwater Sculpin

Deepwater sculpin are considered a glacial relic and are believed to be confined to Canadian waters, with the exception of Torch Lake, and the Great Lakes. This species has no documented commercial, subsistence, or recreational use in the Northwest Territories where it has been found in Great Bear

Lake and Great Slave Lake areas. Deepwater sculpin are believed to be extirpated from Lake Ontario and populations are considered threatened in the Great Lakes; however, it has been suggested that deepwater sculpin are common in Great Bear Lake and possibly other lakes in the Northwest Territories (McPhail *et al*. 1970). Deepwater sculpin inhabit deep water in lakes, but have been documented at all depths in northern lakes. Lakes inhabited by this species are generally cold and deep and it is believed that the species may associate with a mud substrate (McPhail *et al*. 1970). Spawning habitats have not yet been identified but it is assumed that spawning also takes place in deep water. This species in general is not considered by COSEWIC to be of special status, except in the Great Lakes; therefore, its status in the Northwest Territories is not considered threatened (Parker 1987).

#### 6.7.1.11 Fourhorn Sculpin

Fourhorn sculpin are a predominantly marine species that are widely distributed and abundant in the Canadian Arctic. This species has no documented commercial, subsistence, or recreational value in the Northwest Territories. Fourhorn sculpin are usually found in marine or brackish water, but have also occasionally been identified in rivers up to 150 km from the sea and as relict landlocked forms in some lakes (McAllister 1980). In Canada, fourhorn sculpin have been identified along the Arctic coast from Alaska to Labrador, including Bathurst Inlet. Adult fourhorn sculpin are benthic, while larvae are pelagic. Juveniles and adults move to near-shore brackish waters during open water season to find habitat with their preferred salinity and temperature. Fourhorn sculpin are believed to overwinter in bays and inlets along the Arctic coast in areas free of ice. The spawning behaviour of this species is not known; however, it is suspected that they spawn under the ice in the winter, with eggs hatching in May to June. As the fourhorn sculpin is common in Arctic coastal waters, its status in the Northwest Territories is considered not at risk" (Houston 1989a).

#### 6.7.1.12 Spoonhead Sculpin

Spoonhead sculpin are believed to be restricted to Canadian waters. This species has no documented commercial, subsistence, or recreational value in the Northwest Territories. Spoonhead sculpin have been identified in the upper and lower Mackenzie River and in the Thelon River system in the Northwest Territories; however, there are limited data available to characterize their habitat preferences and biology. Most data available simply identify species presence. The species is not considered at risk by COSEWIC, and it is unlikely that it occurs in the area of the proposed corridor (Houston 1989b).

### *6.7.2 Potential Project - Environment Interactions*

There are several potential project – environment interactions associated with each phase (construction, operation, and maintenance) of the proposed highway project, as well as in the unlikely event of accidents and malfunctions during these phases.

Surveying the proposed route and clearing the right-of-way (ROW) will require that watercourses be crossed by boat, fording, or helicopter. Fording over spawning gravel or rearing habitat can have harmful effects on eggs and juvenile fish by either killing them directly or causing sedimentation that suffocates eggs. Grubbing and debris disposal during ROW clearing can destabilize banks, cause sedimentation and erosion, and introduce debris into watercourses.

Construction activities that occur at or adjacent to watercourses can have negative effects on fish and their aquatic habitat. Construction activities adjacent to a watercourse can cause bank destabilization, sedimentation, and alteration or destruction of riparian vegetation. Construction activities within a watercourse can have more direct effects on fish populations through destruction or alteration of habitat, destruction of fish eggs or juveniles in the substrate, displacement, and sedimentation in the water column. Water crossing structures (culverts and bridges) may cause velocity or physical barriers to fish migration.

Improper disposal of camp garbage, sewage, wastewater, and cleaners, or material wastes during highway construction can have adverse effects on waterbodies (or groundwater which may eventually move into watercourses) such as nutrient loading, contamination, and habitat destruction.

Concrete and aggregate production will require water withdrawal from nearby watercourses at the production site. This can cause a decrease in water levels that can stress fish. The discharge of wastewater or washing water from batch plant sites may lead to water contamination. Liquid concrete residues have a high pH and can be toxic to fish and other aquatic species.

Acid generating rock that may be encountered in rock-cuts or borrow areas and the drainage from these areas may alter the pH of nearby water sources. Reduction in pH can lead to habitat avoidance or physiological distress in some fish species.

During road operation, dust, surface runoff, shoulder grading, ditch cleaning, gravel surfacing repairs, grade repairs, culvert replacements or repairs, and sand application (for ice control) can cause the introduction of fine material and road gravel into fish-bearing watercourses. This increase in sediment can lead to changes in water quality and have negative effects on fish, fish egg survival, fish behaviour, and the abundance of food present in the water column.

Other operation and maintenance techniques that may alter water quality include chemical contamination from chemical ice control, dust control, and vegetation control.

The operation of the highway will increase recreational access to many watercourses. This may lead to increased fishing pressure, as well as increase the potential for litter that may negatively affect fish populations and their habitats.

If dedicated service depots are developed in conjunction with the SGP TC, various hazardous materials such as fuels, lubricants, solvents, and antifreeze may be stored and handled on site. As well, each

depot would have waste handling facilities. Improper waste disposal could result in the introduction of hazardous materials to watercourses.

Accidents and malfunctions could occur during all phases of the project. Physical accidents or malfunction like fires, bridge or culvert collapse or road washout, accidental encroachment on a watercourse, or destruction of riparian habitat can destroy or alter fish habitat. Accidents or malfunctions can also result in water contamination through leaks or spills from machinery (fuels, oils, and lubricants), camp operations (sewage, food waste, solvents, cleaners, bleaches, concentrates, and purifiers), and from signage preparation (paints, lacquers, solvents, and thinners). Hazardous materials may also be transported to sites during construction and normal operation of the highway. Accidental spills or accidents may occur during transportation (project operation) that could also lead to water contamination. Any materials that spill into a watercourse can have detrimental or lethal effects on fish, plants, and other aquatic organisms.

Accidental fires, especially in forested areas, caused during construction activities, camp operations, road maintenance, or vehicle accidents along the highway can result in degradation or loss of fish habitat. Fires can destroy riparian vegetation around watercourses, exposing slopes that can erode and lead to sedimentation of watercourses, and altering of pH values.

### *6.7.3 Likely Issues of Concern*

Key issues of concern likely to require further assessment should the SGP TC proceed include the effects of road, watercourse crossing and port construction and operation on water quality and water quantity, fish migration, and fish and fish habitat.

Specific concerns include:

- Potential effects on water quality of acid generating rock encountered in rock cuts or borrow areas;
- Effects on groundwater quality, and influence on streams and lakes:
- Effects on fish populations of increased recreational access to many watercourses, leading to increased fish harvests and potential poaching;
- Cumulative effects of this project with others such as mineral exploration and mine operations, existing roads and trails, and recreational and tourism related activities;
- Effects on nearby watercourses of leisure activities (*e.g.*, fishing and swimming) of construction personnel;
- Effects of dust from highway construction and operation;
- Effects of highway maintenance on fish, fish habitat, and water quality;
- Potential effects of accidental events; and
- Potential effects of water use and waste disposal from temporary and permanent camps.

### *6.7.4 VECs and VEC Boundaries*

Freshwater fish and aquatic habitats are valuable resources for commercial, subsistence, and recreational fishing activities, and are protected under provincial and federal government regulations. For assessment, fish species with similar habitat requirements could be grouped and evaluated together. Also, fish species of special conservation status likely would be evaluated as a single category.

The SGP TC will pass through many watersheds between Great Slave Lake and Bathurst Inlet in Slave Geological Province. Boundaries for freshwater and anadromous fish and fish habitats can be defined as ecological, project, and temporal boundaries. Ecological boundaries for fish species found in the various watersheds, intersected by the proposed corridor would be based on the spatial and temporal distribution of the fish species present, as well as natural features that limit watercourse productivity. The project boundary for freshwater fish and fish habitat would encompass an area upstream and downstream of each crossing location and also include an area around watercourses adjacent to any laydown areas, camps, or maintenance areas. This area will be determined in the project description. The date and duration of each project phase would define the temporal project boundaries.

### *6.7.5 Data Gaps and Future Study Needs*

Once the highway corridor is defined, it is recommended that a detailed literature review be conducted to ensure that all available sources of information on fish and fish habitat in water bodies within the proposed corridor are identified and reviewed. Sources will include published information, grey literature (such as agency reports and reports generated by proponents for other projects and activities in relevant areas), and open files at agencies such as Fisheries and Oceans Canada and the territorial government. A thorough review should also be conducted on the environmental effects of linear developments in northern regions.

When the corridor is refined to a 10 km width, the water bodies that potentially will be affected by the proposed SPG TC can be identified and delineated on topographic maps. At that time, a detailed review of existing data for the water bodies present within, adjacent to, or downstream of the corridor should be conducted. Existing data, including traditional knowledge, should be further evaluated to confirm data gaps.

As the corridor is refined to a 1 km width, a mapping exercise involving interpretation of maps and aerial photographs to classify fish habitat and identify potentially critical habitat should be conducted. A field reconnaissance program should then be initiated to ground-truth such areas and to identify/confirm sensitive or critical habitat (such as spawning or rearing habitat) that should be avoided during the final right-of-way selection. (Section 35(2) of the *Fisheries Act* requires an Authorization in cases where a harmful alteration, disruption, or destruction (HADD) of fish habitat will occur. A HADD may require the proponent to provide compensation to conform to Fisheries and Oceans Canada's guiding "no net loss" principle for habitat protection and conservation.)

When the project description defines a 30 to 50 m ROW, comprehensive surveys of all watercourse crossings should be conducted using Fisheries and Oceans Canada's Stream Habitat Survey Form or other approved form. These surveys would include the proposed crossing location, as well as some distance upstream and downstream depending on the stream type and species present. As required, water quality parameters such as temperature, pH, suspended solids, and dissolved oxygen can also be analyzed at this stage. Based on the information thus gathered regarding species occurrence, and habitat presence and type, potential effects can be evaluated and mitigation (including watercourse crossing, scheduling and techniques) and contingency plans for accidental events developed.

Where broader watershed data are lacking or inadequate to determine potential effects beyond the highway corridor, it may be necessary to direct studies to address specific issues not covered by existing information or compliance monitoring results.

### *6.7.6 Bibliography*


Ash, G.R., S. Harbicht, and F. Hnytka. 1991. Fisheries Investigations at the Lupin Gold Mine, Contwoyto Lake, Northwest Territories. Report prepared for Echo Bay Mines, Edmonton, Alberta.

Beak Consultants Ltd., and Mary Collins Consultants Ltd. 1980. Initial Environmental Evaluation for the Lupin Gold Project, Contwoyto Lake, Northwest Territories. Calgary, Alberta.

BHP Diamonds Inc. and DIA MET Minerals Ltd. 1995. NWT Diamonds Project environmental impact statement: Volume II – Appendices. Vancouver, British Columbia.

Bromley, M. and L. Buckland. 1995. Biological Information for the Slave Geological Province. Prepared for the Department of Renewable Resources, Government of the Northwest Territories, Yellowknife.

Department of Transportation. 1998. Reconstruction of Yellowknife Highway Frank Channel km 242 to Yellowknife km 333. Department of Transportation, Yellowknife, Northwest Territories.

Falk, M.R. 1979. Biological and Limnological Data of Ten Lakes Surveyed in the Northwest Territories, 1971-72. Fisheries and Marine Service Data Report No. 129. Western Region, Fisheries and Marine Service, Department of Fisheries and the Environment, Winnipeg, Manitoba.

Fisheries and Oceans Canada. 1983. Underwater World: Selected Freshwater Fish of the Prairie Provinces and the Northwest Territories. Department of Fisheries and Oceans, Communications Branch. Ottawa, Ontario.

Hatfield Consultants. 1972. Initial Environmental Evaluation for Giant Yellowknife Mines Limited, Salmita Project. Report prepared for Giant Yellowknife Mines. Vancouver, British Columbia.

Houston, J.J.P. 1987. Status Report on the Shortjaw Cisco (*Coregonus zenithicus*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario.

Houston, J. 1989a. Status Report on the Fourhorn Sculpin (*Myoxocephalus quadricornis*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario.

Houston, J. 1989b. Status Report on the Spoonhead Sculpin (*Cottus ricei*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario.

Houston, J. 1990. Status Report on the Darktail Lamprey (*Lethenteron alaskense*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario.

Indian and Northern Affairs. 1995. Project reports, 1994-95: Arctic Environmental Strategy Northwest Territories Water Component. Northern Affairs Program, Water Resources Division, Indian and Northern Affairs. Yellowknife, Northwest Territories.

Johnson, L. 1976. Ecology of Arctic Populations of Lake Trout, *Salvelinus namaycush*, Lake whitefish, *Coregonus clupeaformis*, Arctic Char, *S.alpinus*, and Associated Species in Unexploited Lakes of the Canadian Northwest Territories. Fisheries Research Board of Canada 1976: F00769. Freshwater Institute, Research Directorate, Fisheries and Marine Service, Department of the Environment. Winnipeg, Manitoba.

Klohn-Crippen Consultants Ltd. 1993. Izok Project: Environmental Evaluation Submission to the Regional Environmental Review Committee. Report prepared for Metall Mining Corporation, Edmonton, Alberta.

MacDonald, G. and R. Fudge. 1979. Arctic land use research program 1978: a survey of the fisheries resources of the Kazan Upland (southeastern District of Mackenzie, southern District of Keewatin, Northwest Territories). Environmental Studies – Canada Department of Indian Affairs and Northern Development, Land Use Information Series, no. 11.

McAllister, D.E. 1980. *Myoxocephalus guadricornis* (Linnaeus) Fourhorn Sculpin. In *Atlas of North American freshwater fishes*. North Carolina State Museum of Natural History Biological Survey Publication No.12.

McKinnon, G.A., and F.N. Hnytka. 1988. Effect of winter pipeline construction on the fishes and fish habitat of Hodgson Creek, Northwest Territories. Canadian Technical Report of Fisheries and Aquatic Sciences No. 1598. Department of Fisheries and Oceans, Winnipeg, Manitoba.

McPhail, J. and C. Lindsay. 1970. Freshwater fishes of northwestern Canada and Alaska. Fisheries Resources Board of Canada Bulletin: 173.

Moshenko, R.W. 1980. Biological Data on the Major Fish Species from Fifty-Nine Inland Lakes in the Northwest Territories, 1959-68. Canadian Data Report of Fisheries and Aquatic Sciences No. 175. Western Region, Department of Fisheries and Oceans. Winnipeg, Manitoba.

Norecol Environmental Consultants Ltd. 1987. Tundra Gold Project Environmental Studies. Norecol Environmental Consultants Ltd. and Noranda Exploration Co. Ltd. Vancouver, British Columbia.

Parker, B. 1987. Status Report of the Deepwater Sculpin (*Myoxocephalus thompsoni*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario.

Peddle, J. and D. McKenna. 1995. Project Reports 1994-95: Arctic Environmental Strategy NWT Water Component, Northern Affairs Program. Water Resources Division, Indian and Northern Affairs. Yellowknife, Northwest Territories.

Peddle J. and A. Wilson. 1994. Activity Reports 1993-94: Arctic Environmental Strategy NWT Water Component, Northern Affairs Program. Water Resources Division, Indian and Northern Affairs. Yellowknife, Northwest Territories.

Reid Crowther & Partners Ltd., and RL&L Environmental Services Ltd. 1985. Echo Bay Mines Ltd.: Lupin Mine: Report on Aquatic Studies Program. Reid Crowther & Partners Ltd. Edmonton, Alberta.

RL&L Environmental Services. 1992. 1992 fisheries investigation of Long Lake near Lupin Gold Mine, Contwoyto Lake, NWT: final report. Report prepared by Echo Bay Mines [Sponsor]. RL&L Environmental Services Ltd., Edmonton, Alberta.

RL&L Environmental Services. 1993. 1992 South Basin fishery inventory study: final report. Report prepared by Echo Bay Mines Ltd. [Sponsor]. RL&L Environmental Services Ltd., Edmonton, Alberta.

Roberge, M.M., L. Dahlke, and J.B. Dunn. 1986. Biological Investigation of Contwoyto Lake, Northwest Territories, 1981-82. Canadian Data Report of Fisheries and Aquatic Sciences No. 605. Central and Arctic Region, Department of Fisheries and Oceans. Winnipeg, Manitoba.

Roberge, M.M., J.B. Dunn, and M.R. Falk. 1990. Catch, Effort and Biological Data of Fish, in particular Lake Trout (*Salvelinus namaycush*), from Prelude and Prosperous Lakes, Northwest Territories, 1973 and 1979. Canadian Data Report of Fisheries and Aquatic Sciences No. 817. Central and Arctic Region, Department of Fisheries and Oceans. Winnipeg, Manitoba.

Roberge, M.M., and D.V. Gillman. 1984. Limnological and Biological Data from 41 Lakes Along the Ingraham Trail, Northwest Territories, 1979-80. Canadian Data Report of Fisheries and Aquatic Sciences No. 473. Western Region, Department of Fisheries and Oceans. Winnipeg, Manitoba.

Science Institute of the Northwest Territories. 1994. 1992-1993 compendium of research in the Northwest Territories. Science Institute of the Northwest Territories, Yellowknife, Northwest Territories.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. *Fisheries Research Board of Canada Bulletin*: 184.

Searing, G.F. and W.G Alliston. 1979. Assessment of impacts of a road to Izok Lake: A Review of Existing Information and Recommendation for Research on Selected Species of Wildlife. Prepared for the Fish & Wildlife Service, Government of Northwest Territories.

Stewart, D.B., and G. MacDonald. 1978. Arctic Land Use Program 1977: A Survey of the Fisheries Resources of the Central Northwest Territories. Environmental Studies No. 8. Fisheries and Marine Service, Department of Fisheries and Environment.

Stewart, D.B. 1997. A review of the Status and Harvests of Fish Stocks in the North Slave Area, Northwest Territories. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2393. Central and Arctic Region, Department of Fisheries and Oceans. Winnipeg, Manitoba.

Tallman, R.F. 1996. Migration of Inconnu (*Stenodus leucichthys*) and Burbot (*Lota lota*), Slave River and Great Slave Lake, June 1994 to July 1995. Northern River Basins Study Project Report No. 117. Edmonton, Alberta.

Vladykov, V.D., E. Kott, and D.E McAllister. 1980. *Lampetra alaskense* (Vladykov and Kott) Darktail lamprey. In *Atlas of North American freshwater fishes*. North Carolina State Museum of Natural History, Biological Survey Publication No. 12.

#### 6.7.6.1 Personal Communications

G. Low. Fisheries Officer, Fisheries Management, Department of Fisheries and Oceans, Hay River, Northwest Territories.

## 6.8 Surface Water

### *6.8.1 Existing Conditions*

The Slave Geological Province, like much of the arctic, is often referred to as a polar desert because of the low levels of precipitation. Much of the precipitation occurs as snow which accumulates during the winter and melts during the spring freshet, resulting in significant surface runoff during this brief period. In general, ice on lakes within the SGP breaks up in early to mid June and lakes freeze again by late September (Puznicki 1996). Lakes within the southerly areas of the SGP tend to have a longer open water season than lakes in the northern part of the region. Peak discharge on most rivers occurs during the spring breakup in June and July. Low flows occur during the winter when groundwater recharge is minimal and large quantities of water are converted to ice. Some lakes and streams within the SGP freeze to the bottom while others maintain a limited flow. Mean annual basin yield increases from the southern part of the SGP to the north and appears to reflect the regional distribution of permafrost: lower basin yields are observed in the zone of discontinuous permafrost and higher yields are observed in the permanent permafrost zone (HBT AGRA 1993).

Limited water quality information is available for freshwater resources in the SGP. Prowse (1990) states that the limited data available indicate the natural condition of these waters are characterized by low nutrient concentrations, generally low organic carbon, and low concentrations of dissolved ions, as well as little iron and zinc. Wedel *et a.l* (1998) prepared an overview study of the Coppermine River Basin which presented a summary of water resource information available at the time. A similar study was completed for the Yellowknife River Basin in 1990 (Wedel *et al*. 1990). Both reports rely on existing data collected by the Water Survey of Canada and conclude that each basin was largely unaffected by development (Wedel *et al*. 1988, 1990). A 1993 study funded by DIAND (HBT AGRA 1993) includes several references for water quality studies completed at mineral development sites in the SGP.

Recognizing the limited amount of water quality data for the region, Puznicki (1996,1997) conducted a program of lake water quality and sediment quality sampling and analysis in the SGP during the summers of 1993 and 1994. Lakes selected for analysis were based on areas of current or past human activity (excepting large developments such as Lupin Mine, where a company sponsored monitoring program was in effect) and randomly selected lakes throughout the region. Waters were sampled and analyzed for major ions, metals, and bacteriological and physical parameters, whereas sediment samples were analyzed for trace and heavy metals. Puznicki (1996) concluded that, in general, most of the physical parameters and major ions in the water samples analyzed were within the Canadian Water Quality Guidelines (CCREM 1987) or were characteristic of most Canadian surface freshwaters. However, results indicated some locations where concentrations of some parameters were uncharacteristic of typical regional conditions. Half of the lakes sampled for total coliform exceeded Canadian Water Quality Guidelines; all of these lakes had facilities providing a service to the public (Puznicki 1996). Sediment quality analysis involved the testing of concentrations of 68 metals; however, only seven of these metals had Ontario and interim Canadian guidelines specifying allowable

levels. National and Ontario guidelines were exceeded for arsenic, copper, lead, nickel, and zinc. The applicability of the guidelines to the SGP and the potential effects as a result of exceeding the guidelines is not known.

The proposed SGP TC (Figure 6.1) currently under consideration is approximately 100 km in width in the north, expanding to two 100 km wide corridors south of Lac de Gras. There are several major watersheds located within or partially within the SGP. Largest and most known is the Coppermine River Basin, whose source is Lac de Gras. The Coppermine River flows approximately 845 km before emptying into the Arctic Ocean near the community of Kugluktuk. Other major river systems within the SGP include the Snare, Yellowknife, Beaulieu, and Lockhart Rivers draining into Great Slave Lake and the Burnside, Back, Mara, Tree, and Hood Rivers which drain to the Arctic Ocean. Large lakes within the SGP include Great Slave Lake on the southern border of the SGP, Lac de Gras, Point Lake, Contwoyto Lake, and Napaktulik Lake. The Water Survey of Canada (WSC) has established a number of monitoring stations in the area; however, many of these stations are no longer operating. Table 6.8.1 illustrates the stations established by the WSC, duration of record, and type of information collected. The locations of these stations are illustrated in Figure 6.5**.** Water quality data are archived in the NAQUADAT data base, while hydrometric data is available in the HYDAT database. Both of these databases are available through the Water Survey of Canada.

**Table 6.8.1 Water Survey of Canada Monitoring Stations in area of Proposed Slave Geological Province Transportation Corridor**

| # | Site Name | Year Established | Last Date of Record | Hydrologic Data | Water Quality Data |
|---|---|---|---|---|---|
| 1 | Macrea River outlet at Duncan Lake | 1988 | 1988 | Flow | No |
| 2 | Thonokied River near the mouth | 1980 | 1990 | Flow | Yes |
| 3 | Thonokied River below Alfridi Lake | 1994 | 1996 | Flow | Yes |
| 4 | Burnside River at outlet of Contwoyto Lake | 1993 | | Flow | Yes |
| 5 | Burnside River near mouth | 1976 | | Flow | No |
| 6 | Contwoyto Lake at Lupin Mine | 1991 | | Level | No |
| 7 | Coppermine River below Destafanny Lake | 1994 | | Flow | Yes |
| 8 | Coppermine River at outlet of Point Lake | 1964 | | Flow | Yes |
| 9 | Duncan Lake near Yellowknife | 1975 | | Level | No |
| 10 | Fairy Lake River near outlet of Napaktulik Lake | 1993 | | Flow | No |

Additional monitoring stations are operated in the SGP either by individual operators or by the WSC under contract to the operators. WSC operates two such stations for the NWT Power Corporation on the Snare River system and is in the process of installing a third station. Information from these privately funded sites may be available from the owners.

Water has played an essential role in traditional and current use of the SGP. Surface waters within the SGP have been and continue to be used by local residents for travel, recreation, and domestic water supply, and habitat for fish, which is an important food source. Industrial use of water within the SGP occurs for hydro-electric power generation and mineral processing. Tourism operators also depend on current water quantity and quality within the SGP to sustain their operations. Additionally, water in its solid form, ice, provides essential travel routes between communities, outpost camps, and industrial developments.

### *6.8.2 Potential Project- Environment Interactions*

There are several potential project – environment interactions associated with each phase (construction, operation, and maintenance) of the proposed highway project, as well as in the unlikely event of accidents and malfunctions during these phases. Many of these potential project-environment interactions have been identified in section 6.7.2 and are summarized below. The reader is referred to section 6.7.2 for a full discussion.

Potential project-environment interactions include:

- Disturbance of the banks of watercourses during construction, resulting in sedimentation;
- Sedimentation of watercourses as a result of road dust, surface runoff, grading, grade and surface repairs, culvert maintenance, and sand application (for ice control);
- Blockages or diversions of water during construction of river crossing structures;
- Flood and/or ice movement interacting with crossing structures;
- Water uses for construction and camp operations;
- Disposal of construction and camp wastes into waterbodies;
- Runoff from acid generating rock exposed during construction and quarrying; and
- Accidental release of hazardous materials into waterbodies.

### *6.8.3 Likely Issues of Concern:*

Key issues that have been identified to date and would require further consideration should the SGP TC proceed to the assessment stage include:

- Release of sediments to waterbodies during construction and operation and effects on water quality, fish, and fish habitat;
- Potential effects on water quality of acid generating rock encountered in rock cuts or borrow areas;
- Effects on groundwater quality, and influence on streams and lakes;

- Cumulative effects of this project with others such as mineral exploration and mine operations, existing roads and trails, and recreational and tourism related activities;
- Effects on nearby watercourses of leisure activities (*e.g.*, fishing and swimming) of construction personnel;
- Effects of dust from highway construction and operation;
- Effects of highway maintenance on water quality;
- Potential effects of water use and waste disposal from temporary and permanent camps;
- Potential contamination from hazardous materials during their transportation, storage, and use;
- Alteration or blockage of watercourses during construction and operation;
- Water use requirements at camps and construction sites;
- Deposition of construction and domestic waste in water bodies; and
- Design of structures to accommodate significant flood events.

Concern with respect to sedimentation of waterways relates primarily to potential effects of increased turbidity and resultant effects on potable water quality, fish, benthic organisms and fish habitat. Physical blockage or alteration of channels is a concern because of the potential effects on fish passage, increased sedimentation, and the integrity of crossing structures.

### *6.8.4 VECs and VEC Boundaries*

Water quality is a VEC which may be impacted by the SGP TC. The quality of water in the SGP can affect potable water supplies, fish, aquatic and terrestrial wildlife and habitat. Water quantity could also be considered a VEC as it can affect habitat for fish and aquatic wildlife.

Disposal of waste and accidental releases of hazardous substances into the aquatic environment has the potential to alter water quality and aquatic habitat. Water will be required at several sites for potable water supply and construction activities. Local supplies must be identified and potential effects evaluated.

The boundaries of an assessment of potential effects on water quality and quantity would include areas immediately upstream and downstream of all water crossings potentially affected by sediment release and/or blockage of fish passage. Assessment of the effects of point source water use and discharges would be bounded by the waterbodies directly affected by the water use or waste discharge. The boundaries of the assessment of waste disposal may need to be altered depending on the treatment process to be used.

### *6.8.5 Data Gaps and Future Study Needs*

Water quantity and quality data are limited for the proposed SGP TC area. The WSC maintains some monitoring stations within the SGP; however, it is uncertain if data from these stations will be applicable to assisting with project design and environmental assessment. Data are also presently being collected by operators in the SGP such as the NWT Power Corporation and several mining companies, but until the location of the potential road right-of-way and ancillary facilities is determined, it is difficult to tell if this information will be applicable. At a minimum, existing information may provide a context from which site-specific data can be interpreted.

Once a route has been identified for further analysis, the collection of water level and flow data, ice conditions, water quality data, and other parameters will be required at major crossing sites. Installation of monitoring stations would likely be required in some locations. Reconnaissance inspections to observe evidence of past flows and ice events should be coordinated with the collection of terrain information at crossing sites.

Water quality and fish sampling will be required to assess conditions at sites for proposed water supply and waste disposal facilities. This will only be possible after locations for site facilities have been identified.

### *6.8.6 Bibliography*

CCREM. 1987. Canadian Water Quality Guidelines. Prepared by the Task Force on Water Quality Guidelines of the Canadian Council of Resource and Environment Ministers. Environment Canada, Water Quality Branch, Ottawa, Canada.

Fee, E.J., M. P. Stainton, and H. J. Kling. 1985. Primary production and related limnological data for some lakes of the Yellowknife, NWT area. Department of Fisheries and Oceans.

GeoNorth Ltd and North/South Consultants Inc. 1997. Guidance for Northern Aquatic Effects Monitoring. Prepared for Water Resources Division, Department of Indian Affairs and Northern Development.

Geowest Environmental Consultants Inc. 1998. Multi-Level Mapping and Route Analysis, Slave Geological Province Transportation Corridor: Phase 2, 1:60,000 Route Evaluation, Routes G,I,J,K and L. Prepared for the Department of Transportation, Government of the Northwest Territories.

Gibson, J.J. and T.W.D. Edwards. 1995. Evaporation rates at mine sites in the Northwest Territories determined by an isotopic method. Water Resources Division. Department of Indian and Northern Affairs.

Gibson, J.J, J.A. Whidden and T.W.D. Edwards. 1994. Evaporation studies at the Lupin Mine site using stable isotopes IV: 1993 progress report. Echo Bay Mines Ltd.

Gibson, J.J., T.W.D. Edwards, J.A. Whidden and T.D. Prowse. n.d. Isotope hydrology of natural and artificial reservoirs in Arctic climates. International Atomic Energy Agency Symposium, IAEASM-329-25P)

Hazra,A.K., Prokopuk, R., and M.J. Hardin. 1977. Chemical characteristics of snow in the Yellowknife area, NWT, 1975. Environmental Protection Service, Environment Canada.

HBT AGRA Ltd. 1993. Water quality in the Slave Structural Province. Department of Indian Affairs and Northern Development.

Healey, M.C. and W.L. Woodall. 1973. Limnological surveys of seven lakes near Yellowknife, Northwest Terrirtories. Freshwater Institute, Fisheries Research Board of Canada.

Healey, M.C. and R.R. Wallace, eds. 1987. Canadian Aquatic Resources. Department of Fisheries and Oceans.

Kane, D.L. 1993. Northern hydrology and water resources in a changing environment: in Wall, G. (ed.) *Impacts of Climate Change on Resources Management in the North*. University of Waterloo, Dept. of Geography Occasional Paper # 16.

Klohn-Crippen Ltd. 1994. Izok Project Water Management Report. Metall Mining Corporation.

Moore, J.W. 1978. Biological and Water quality surveys at potential mines in the Northwest Territories. II Inco gold property, Contwoyto Lake. Environmental Protection Service, Environment Canada.

Moore, J.W. 1978. Biological and Water quality surveys at potential mines in the Northwest Territories. IV The Texasgulf copper-zinc property, Itchen Lake. Environmental Protection Service, Environment Canada.

Moore, J.W., Hardin, M.J. and J.E. McComiskey. 1978. Biological and water quality surveys at potential mines in the Northwest Territories. I .Camlaren gold property, Gordon Lake. Environmental Protection Service, Environment Canada.

Moore, J.W., D.J. Sutherland, S.J. Wheeler and V.A. Beaubien. 1978. The effects of abandoned metal mines on aquatic ecosystems in the Northwest Territories, I Discovery Mine. Environmental Protection Service, Environment Canada.

Moore, J.W., S.J. Wheeler and D.J. Sutherland. 1978. The effects of abandoned metal mines on aquatic ecosystems in the Northwest Territories, II Giant Yellowknife Mines Ltd. Environmental Protection Service, Environment Canada.

Pattenden, R., M. Dunnigan, J. Patalas and G.R. Ash. 1993. Izok Project aquatic studies, 1993. Metall Mining Corporation.

Prowse ,T.D., 1990. Northern Hydrology: An Overview. In *Northern Hydrology - Canadian Perspectives*, T.D. Prowse and C.S.L. Ommanney, (eds.) National Hydrology Research Institute, Environment Canada. pp.1-36.

Puznicki, W.S. 1996. An Overview of Lake Water Quality in the Slave Structural Province Area, Northwest Territories. Prepared for the Department of Indian and Northern Affairs.

Puznicki, W.S. 1997. An Overview of Lake Bottom Sediment Quality in the Slave Structural Province Area, Northwest Territories. Prepared for the Department of Indian and Northern Affairs.

Reid, B. n.d. Evaporation studies at mine tailings ponds in the Northwest Territories, Canada. Water Resources Division, Department of Indian Affairs and Northern Development.

Reid, B. 1994. Meteorological data collection for site specific evaporation estimates in the Northwest Territories. Mackenzie Basin Impact Study, Interim Report 2: Proceedings of the Sixth Biennial AES/DIAND Meeting on Northern Climate and Study Workshop of the Mackenzie Basin Impact Study: Yellowknife, NWT.

Wedel, J.H., B.J. Olding and M. Palmer. 1988. Overview of the Coppermine River Basin, NWT. Inland Water Directorate, Environment Canada

Wedel, J.H., A. Smart and P. Squires. 1990. An Overview Study of the Yellowknife River Basin, NWT. Inland Water Directorate, Environment Canada

## 6.9 Archaeological and Heritage Resources

### *6.9.1 Existing Conditions*

#### 6.9.1.1 Historical Land Use

The study area is characterized by both biophysical homogeneity and cultural stability, with the former undoubtedly influencing the latter. The myriad lakes and rivers provide means of travel and communication, both in summer by canoe and in winter over hard-packed, windblown snow on thick ice, and also sources of food, including large numbers of caribou at lake and river crossings, fish, and waterfowl. Caribou are ubiquitous, but concentrate in greater numbers at certain places and times of the year, and historically represented the largest and most vital source of food and materials for Aboriginal peoples. The limitations of climate and physiography inhibited incursions of people and ideas from outside the area, thus maintaining cultural stability both across the region and through time. Available evidence strongly suggests that the people encountered at the time of European contact followed a way of life that had not changed significantly for more than 7,000 years (Wright 1981).

Shortly after deglaciation and revegetation of the Barren Grounds, approximately 7,000 or 8,000 years ago, Palaeo-Indian people moved north from the Plains and established a pattern of seasonal exploitation of big game. By about 6,000 years ago, the Palaeo-Indian culture, represented on the Barren Grounds by the Northern Plano tradition, had evolved into what archaeologists refer to as the Shield Archaic period. The Shield Archaic period continued unbroken for several thousand years until climatic deterioration resulted in a drastic southward movement of the treeline and the inability of Archaic people to reach the full extent of their Barren Grounds range and return to the shelter of the boreal forest within the annual round. Archaic populations were replaced by southward moving Palaeo-Eskimo people from the Arctic coast between about 3,300 and 2,600 years ago. The final pre-contact groups to occupy the Barren Grounds, from 2,500 to the time of European contact, include people of the Taltheilei Shale tradition, a group ancestral to the northern Athapaskan Dene of today (Wright 1981; Noble 1981; Sly *et al.* 1998), and the Copper Inuit (Gordon 1988).

In the last two centuries, subsistence-related land use on the Barren Grounds has declined, while trapping, exploration, recreation, tourism, and industrial development have increased. Each of these more recent activities is leaving its own traces which, as time goes on, become the archaeological sites of the future.

Gordon (1996), based on his investigations of over 1,000 archaeological sites on the Barren Grounds, concluded that almost all of the peoples who are represented by those sites followed the caribou on their annual migrations from the boreal forest out onto the tundra calving and feeding grounds and back to the treeline for winter. Major sites with multiple occupations, sometimes by several successive cultural groups, are present at important river and lake crossings where large numbers of caribou could be taken. Smaller sites represent exploitation of dispersed subgroups of caribou, and other resources such as fish, waterfowl, and berries.

#### 6.9.1.2 Identified Sites

Archaeological investigation in the SGP has resulted in the discovery of approximately 860 sites, with 702 of those appearing on 1: 250,000 NTS maps crossed by the study area (L. Johanis, pers. comm.). For the most part, sites have been found as a result of development-associated assessments, although several surveys and excavation projects have also been undertaken for academic reasons. The distribution of recorded sites within the study area indicates a strong association with lake and river systems, with major clusters of sites appearing where mineral exploration and development has been, or is, most active. Among the sites within the study area are clusters at the head of the North Arm of Great Slave Lake, Wekweti-Winter Lake, Lac de Gras, Contwoyto Lake, Burnside River, and Bathurst Inlet.

During a recent multi-year field and community research project on a traditional Dogrib trail of over 490 km length between Great Slave Lake and Great Bear Lake, nearly 350 traditional Dogrib place names and a total of 282 archaeological sites were recorded. Lithic material was noted at over half of the archaeological sites. Forty burial locations representing 189 individual graves were visited, and four abandoned villages, four lithic quarries, and fourteen sacred sites were recorded (Andrews and Zoe 1997).

Investigations for BHP Diamonds Inc. on the north side of Lac de Gras have resulted in the finding of 117 archaeological sites (Bussey 1998). Most sites are associated with eskers and/or lakes, with eskers associated with rivers and lakes being the areas of greatest potential for archaeological sites.

Fedirchuk (1997c), working on the Diavik property on the mainland and islands at the east end of Lac de Gras, has recorded 195 archaeological sites, including 96 where the mining or quarrying of quartz veins took place, 71 artifact scatters, seven campsites, one burial, one cache site, one stone marker, and one cache of abandoned or stored poles. At the Jericho Mine site at the north end of Contwoyto Lake, and the access road to the Lupin Mine, Fedirchuk found a total of 34 sites. All were exposed on the surface either through wind action and animal use of eskers, or were in bedrock locations. Eleven of the sites represent single artifact finds, seventeen are artifact scatters consisting primarily of flake discards, two are camp sites, and the remaining four are quarries associated with quartz veins on bedrock outcrops.

Gordon (1986) conducted a two-year excavation at the Nadlak site, located on an island in the Burnside River, southwest of Bathurst Inlet. Among the archaeological features were five mounds which, upon excavation, were shown to consist of four to six superimposed floors with associated rings of caribou antler. Gordon interprets the antler rings as the remains of walls and roofs constructed from hundreds of intertwined antlers. The site was occupied during the climatic episode known as the Little Ice Age between 1400-1700 A.D. by Copper Inuit, who had made a full Barren Land adjustment from life on the coast to life in the interior, where caribou became the principle subsistence focus. Musk oxen, birds, and fish were also harvested (Gordon 1988). Morrison (1978) has identified over sixty sites at the south end of Bathurst Inlet, mostly from the recent historic period.

Other investigators working in similar environments within the SGP but outside of the study area have produced similar results. Damkjar (1994) recorded 52 sites in the vicinity of Izok Lake, near Itchen Lake, mostly associated with lakeshores, eskers and esker fans, knolls, and outcrops, as well as at a proposed port site on Coronation Gulf. Prior to his survey, a total of 239 sites had previously been recorded in a study area which extended from the west side of Contwoyto Lake to Rockinghorse Lake, through Itchen Lake and Takiyuak Lake to near Kugluktuk (Coppermine).

Kroker (1996) conducted an archaeological assessment of a new mine site near Ulu Lake, north of the Hood River, and several alternate winter haul road routes between the Hood River and Burnside River. Two pre-contact sites were found near the mine, on the Hood River, including a site with a late Taltheilei component dating to between 100-1000 A.D. and a Dorset Palaeo-Eskimo component dating between 200 B.C and 1000 A.D.. An additional 21 sites were found near the haul road routes, mostly either on a major north-south esker or on the shore of a lake connected to Contwoyto Lake by the Burnside River. Sites included a Northern Plano occupation at least 5,000 years old, and several tent ring sites which probably post-date the establishment of trading posts along the Arctic coast.

A major cluster of sites is attributed to two surveys by Metcalf on the upper Coppermine River from the outflow of Lac de Gras through Point Lake to the west end of Lake Providence (Metcalf 1977), and in the Acasta Lake, west end of Point Lake, and upper Coppermine River area (Metcalf 1978). Metcalf (1977) recorded 74 sites, primarily on river and lake shores, on and beside blowouts, at lake outflows, river narrows, and confluences, on raised beaches and hilltops, and where caribou trails converge on rivers and lakes on his first survey, and another 122 on the second. The major characteristics of the second survey included the presence or proximity of the treeline, esker belts, a caribou migration route, and plateau drainage. The area is an important milling area for caribou before the October rut, and eskers tend to concentrate and orient the movements of the herd. Most sites were found on the forest-tundra fringe, particularly where esker outwashes were present (Metcalf 1978).

Morrison (1982) conducted a survey on the middle Lockhart River, which drains the barrens north of the east end of Great Slave Lake through MacKay, Aylmer, Clinton-Colden, Ptarmigan, and Artillery lakes into the extreme east end of McLeod Bay. Previous surveys in Morrison's study area had resulted in the recording of 22 sites (MacNeish 1951; Noble 1966-1969); Morrison found another 40, most from the late Taltheilei or historic periods. Sites were predominantly found at potential caribou crossing and fishing locations at river narrows between lakes. Thomson (1998) and Fedirchuk (1996a) also found a small cluster of sites in a limited survey around Kennady Lake, southwest of Aylmer Lake. All of the nine sites were associated with eskers or blowouts and all were within a short distance of lakes.

Another class of heritage site which might be expected to be present in the study area, particularly within the boreal forest and its fringes, is the remains of traditional use sites, such as those associated with travel in the open water season. Sites might contain evidence of canoe manufacture and storage, extraction of birch bark, and camps at either ends of particularly long or arduous portages (Andrews and Zoe 1998). Sacred sites at which there may be no extant traces of material which can be attributed to human origin may also be present and, although not technically protected under existing territorial

legislation, may require documentation and recognition pending a decision on some form of mitigation. Such sites could include locations where important events have taken place and/or where travelers feel a need to pay proper respect to some entity. Graves are also considered sacred and powerful places, although they are not protected under existing heritage legislation if they are located outside designated cemeteries. In general, the cultural landscape receives little attention in territorial and federal legislation (Andrews *et al.* 1998b). Knowledge of traditional place names for berry and medicinal plant harvesting areas, trails, and other localities is disappearing as the use of oral tradition declines in modern communities, but still represents a major source of potential information on archaeological sites and sacred sites (Andrews and Zoe 1997).

The state of knowledge of archaeological resources in the study indicates that Gordon's (1996) theory of permanent, year-round association of bands of people with herds of caribou may extend through the study area and through all time periods until the influence of trapping and trade, disease, resettlement, and development caused major changes. Most sites found in the study area to date appear to be associated with rivers, lakes, and eskers, lookout and workshop locations, stone quarries, and other situations where the business of observing, hunting, and processing caribou could be carried out, where travel could be most easily accomplished, and where material could be obtained for the manufacture of stone tools. As described elsewhere, the proposed SPG TC will inevitably intersect with all of these types of locations: eskers, moraines, and other sources of aggregate and sand; bedrock for sources of crushed aggregate and rip-rap; river crossings; and lake shores.

#### 6.9.1.3 Ongoing Investigations

As mineral exploration and development, research for land claims, and other projects continue in the study area, the database on archaeological sites and other heritage resources will expand, providing developers, researchers, and regulators with an enhanced ability to predict site locations and minimize project-environment interactions. Among the multi-year projects described above, which are currently in progress, are the archaeological assessment of exploration activities at Kennady Lake by Monopros Limited (Thomson 1998) and a proposed archaeological survey for Monopros of a winter access route from MacKay Lake to Kennady Lake (S. Pfister, pers. comm.). Traditional use studies have been completed by most Aboriginal groups in the region, or are currently in process.

The Nunavut Planning Commission is maintaining a database of archaeological sites in the West Kitikmeot which includes campsites, trading posts, sacred sites, villages, sites of unknown function, findspots, killsites, lookouts, and workshops classified by time period as Pre-Contact, Post-Contact, European, and Undetermined. As of June 1998, over 700 sites had been mapped from information provided by the Canadian Museum of Civilization (CMC) and Inuit from the West Kitikmeot communities, using criteria provided by the CMC and the Prince of Wales Northern Heritage Centre which consider any relevant cultural or historic feature made before 1950 as an archaeological site (Nunavut Planning Commission 1998).

### *6.9.2 Project-environment Interactions*

There are several areas of potential interactions between project activities and archaeological and traditional use sites, of which there are most likely many hundred more than are currently known within the study area. All aspects of highway construction have the potential for interaction with heritage resources, including: surveying; vegetation clearing and grubbing; excavation of aggregate and quarry materials; construction of the subgrade; watercourse crossings; access roads to development areas; camps; laydown areas; and other associated facilities, as well as rehabilitation activities at work sites. Potential interactions may occur particularly where these activities are located in areas such as:

- Eskers and other elevated glacial deposits, where excavation for construction materials will increase the potential for direct disturbance or destruction of archaeological sites, such as camp sites, hunting blinds, caches, lookouts, workshops, burials, and sources of lithic raw materials on and near these features, especially where they are in close association with lakes and rivers;

- Traditional trail routes, including pedestrian trails, dog-team trails, canoe trails, and portages, which are often subsequently followed by and thus may be disturbed by developments such as winter or all-season highways;

- Lake shores and former lake shores, where potential is high for direct disturbance of recent and pre-contact camp sites, hunting and fishing areas, and other evidence of human land use;

- Areas of traditional use for harvesting berries, medicinal plants, and other resources;

- River crossings at locations that may have been suitable for interception of caribou, fording, fishing, camping, and ending or beginning portages (especially as construction requirements will tend to select locations where the river is at its narrowest and where relief is relatively low); and

- Elevated areas, such as ridges, hill tops, and bedrock outcrops, where people may have watched for approaching game, quarried vein quartz and other lithic material, and manufactured or modified weapons and tools while taking advantage of the aspect or breeze.

In addition, the completion of the new highway will increase access during the operation phase to previously inaccessible areas, possibly resulting in a cumulative increase in inadvertent disturbance of archaeological sites by development activities, or deliberate disturbance of archaeological sites and removal of artifacts. Construction of maintenance depots and continuing use of esker materials for sanding have potential for new disturbance of sites. Construction activities and post-construction accidental events may increase the potential for destruction or contamination of sites by fire, especially in forested areas, or by spills of chemicals and fuels. Other accidental events which have potential for interaction with archaeological resources include the failures of roads or bridges in archaeologically sensitive areas, where sites might be affected by clean-up and reconstruction activities.

### *6.9.3 Likely Issues of Concern*

The main issues of concern for archaeological resources are:

- The archaeological sites database for the study area is far from complete, due to lack of previous research in many parts of the region;
- The potential for interactions between project activities and archaeological and traditional use sites is high; and
- The predilection of highway designers, animals, and human land users to select the same parts of the landscape for their activities limits somewhat the available mitigative options in the event of project-environment interaction.

Archaeological sites represent a finite, and often the only tangible, source of information about human land use in the pre-contact period. Information passed down from generation to generation about past traditions, settlement patterns, and subsistence practices can also be substantial sources of information, to which confirmation and validation (if required) can be contributed by archaeological research. While most sites are found in areas which possess some attribute or set of attributes which indicate a high archaeological potential, others are occasionally found in unexpected locations, the result of some unforeseen event or unpredictable whim on the part of the occupant. Until a survey and inventory is conducted, the ability to predict site locations with complete accuracy, find and record sites, recommend and implement suitable mitigation measures, develop heritage resources contingency plans, and contribute to the knowledge of past land use in the area will be limited.

The loss of information through disturbance or destruction of archaeological sites without controlled data recovery or other mitigative means can limit the ability to reconstruct the past. Aboriginal groups, regulators responsible for site protection, and other interested members of the population have expressed concern that archaeological and other heritage resources are dealt with appropriately. The proposed route will undoubtedly create situations where project activities interact with archaeological and other heritage resources, potentially contributing to a cumulative effect on a non-renewable resource already affected by past and present activities.

The route will inevitably pass, cross, or be built in proximity to lakes, rivers, and eskers because of their relative construction-related attributes or mere presence on the landscape. For example, use of level terraces adjacent to lakes will reduce construction costs; numerous rivers will need to be crossed; and eskers contain abundant sources of aggregate needed for construction. These same environmental features provide wildlife habitat, and were/are exploited, traveled on, and lived on by human users of the land. Eskers, because of the presence of readily available materials, were also used as burial sites.

Concern for archaeological and other heritage resources, and any required mitigation, may introduce conflicts with the most cost-effective construction practices, and may have potential for schedule delays.

### *6.9.4 VECs and VEC Boundaries*

Archaeological sites and other heritage resources are valued by the public and, in the case of archaeological sites, are protected by law. Archaeological sites and artifacts in the Northwest Territories are deemed to be public property and the government takes an active interest in their preservation. Three laws protect archaeological sites in the Northwest Territories:

The *Northwest Territories Archaeological Sites* regulations, which apply throughout the Northwest Territories, state:

> **Section 3**. *No person shall excavate or investigate any archaeological site in the Territories or remove from the Territories or collect any archaeological specimen unless he has obtained a permit to do so.*

The *Territorial Land Use Regulations* apply on Federal Crown Lands. Two sections are relevant to archaeological sites:

> **Section 10(a)**. *No permittee may, unless expressly authorized in writing by an inspector, conduct a land use operation within 30 meters of a known or suspected archaeological site or burial ground;*

> **Section 16**. *Where, in the course of a land use operation, a suspected archaeological site or burial ground is unearthed or otherwise discovered, the permittee shall immediately,*
> *a) suspend the land use operation on the site; and*
> *b) notify the Engineer or an inspector of the location of the site and the nature of any unearthed materials, structures or artifacts.*

The *Historical Resources Ordinance* pertains to Commissioner's Land. Protection of archaeological sites in these areas is provided by:

> **Section 9(1)**. *Whenever, in the opinion of the Commissioner, any prehistoric or historic remains, whether or not designated as an historic place under this ordinance or under the Historic Sites and Monuments Act of Canada, is threatened with destruction by reason of commercial, industrial, mining, mineral, exploration or other activity, the Commissioner may order the persons undertaking the activity to provide for adequate investigation, recording and salvage of prehistoric or historic objects threatened with destruction.*

Under the terms of the Nunavut Land Claims Agreement, every archaeological artifact in the Nunavut portion of the study area is owned jointly by the Inuit Heritage Trust (for the people of Nunavut) and the Government of Canada (for the people of Canada). It is illegal to buy, sell, or remove archaeological specimens. Article 33 of the Nunavut Land Claims Agreement deals exclusively with archaeology and presents guidelines and regulations on the conduct of archaeological research in the

territory. The Inuit Heritage Trust will assume increasing responsibility for supporting, encouraging, and facilitating the conservation, maintenance, restoration, and display of archaeological sites and specimens in the Nunavut Settlement Area. All applications for archaeological research in the Nunavut Settlement Area are reviewed by the Inuit Heritage Trust which, in turn, consults with the communities. The agreement also defines an archaeological site as:

> *a site or work within the Nunavut Settlement Area of archaeological, ethnographical or historical importance, interest or significance or a place where an archaeological specimen is found, and includes explorers' cairns (*Nunavut Land Claims Agreement, Article 33.1.1).

Recent studies by Andrews *et al.* (1998b) and others indicate that a new legislative regime is required in the Northwest Territories which will recognize and protect sacred sites and cultural landscapes, as well as archaeological sites. It is clear that heritage resources constitute a Valued Environmental Component, which requires consideration within future assessment of the SGP TC. Boundaries for this VEC would be set once the locations of archaeological sites and project activities are known. Consultations with First Nations, Inuit, and other groups will also provide information on other heritage sites not currently protected by legislation. As a guideline, under the terms of a Land Use Permit, development activities in the Northwest Territories must leave a 30 m buffer between the activity area and the outer limit of an archaeological site unless clearance has been obtained for other mitigative action. Any future monitoring requirements would be determined following the impact assessment.

### *6.9.5 Data Gaps and Future Study Needs*

The archaeological sites database is incomplete. There are over 700 known and recorded archaeological sites in the study area. Access to this database can only be gained through the Archaeological Survey of Canada, Canadian Museum of Civilization, Hull. Until the route selection has been refined to include a smaller area, it is recommended that access to this database be postponed.

The survey coverage in study area is incomplete. Archaeological surveys in the study area have been limited, for the most part, to locations proposed for development, particularly associated with mineral exploration and mining. Few surveys have been conducted for academic research, to identify sites threatened by natural attrition, or to support land claims. Thus, there are large parts of the study area that have never been surveyed and are unknown, archaeologically.

Access to the archaeological sites database at the Archaeological Survey of Canada will be required to document the 700 or so known sites in the study area. Information required will include location, local environment, size, and cultural affiliation, among other attributes. A more intensive review of associated archaeological reports will also reveal which areas have already been surveyed, and to what extent. Based on these data, the results of currently ongoing informant interviews, and a review of project area maps and aerial photographs, it will be possible to prepare a map of known site distribution, and a preliminary prediction of where additional sites are most likely to be located. This

work can commence in early 1999 for the selected corridor(s), and should form part of the process for selection of the route(s) and other activity areas, *e.g.*, eskers. Review of information on traditional use collected by Aboriginal groups in the region should be undertaken so as to integrate knowledge of more recent sites into the predictive modeling and archaeological survey strategy.

Once the mapping of known sites and predictive modeling is complete, a preliminary field assessment should be conducted to test the predictions and to identify sites in high potential areas which are common to all of the preferred corridors. Once the final 1 km wide corridor selection has been made, the predictive modeling can be refined, and an archaeological field assessment should be conducted of high potential and moderate potential areas, and a selection of low potential areas. When the final ROW is identified, the need for additional field surveys will be assessed, and any sites previously identified which interact with the ROW will be revisited and mitigation options evaluated. Following each assessment stage, a report should be prepared and submitted to the Prince of Wales Northern Heritage Centre and any other relevant regulators, agencies, and affected communities, including an inventory of new sites recorded. The results of the assessments should be presented to affected communities and feedback requested.

### *6.9.6 Bibliography*


Andrews, Thomas D. and John B. Zoe. 1998a. The Dogrib Birchbark Canoe Project. *Arctic* 51(1): 75-84. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Andrews, Thomas D., John Zoe, and Aaron Herter. 1998b. On *Yamqzhah's* Trail: Dogrib Sacred Sites and the Anthropology of Travel. In *On Sacred Lands: Aboriginal World Views, Claims, and Conflicts*. Jill Oakes, Rick Riewe, Kathi Knew and Elaine Mahoney, (eds.). Occasional Publication No. 43: Canadian Circumpolar Institute, University of Alberta. On File, Prince of Wales Northern Heritage Centre, Yellowknife. 305-320.

Andrews, Thomas D. and John B. Zoe. 1997. The *Idaà* Trail: Archaeology and the Dogrib Cultural Landscape, Northwest Territories, Canada. In *At a Crossroads: Archaeology and First Peoples in Canada*. George P. Nicholas and Thomas D. Andrews (eds.). Publication No. 24: Archaeology Press, Simon Fraser University. On File, Prince of Wales Northern Heritage Centre, Yellowknife. 160-177.

Bussey, Jean (Points West Heritage Consulting Ltd.). 1998. Archaeological assessment of the Camsell Lake Property - Snap Lake Project Area, Northwest Territories. Prepared for Winspear Resources Ltd. Vancouver, BC. No permit issued. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Bussey, Jean (Points West Heritage Consulting Ltd.). 1998. Archaeological Investigations for BHP Diamonds Inc. Ekati Diamond Mine, Northwest Territories 1997. Report submitted to Rescan Environmental Services Ltd., Vancouver and BHP Diamonds Inc., Yellowknife. Permits 97-852 and 97-853. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Bussey, Jean. 1997. 1996 Archaeological Investigations for BHP Diamonds Inc. Report submitted to Rescan Environmental Services Ltd., Vancouver. Permit 96-834. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Bussey, Jean. 1997. Draft Archaeological Management Plan for BHP Diamonds Inc. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Bussey, Jean. 1995. 1995 Archaeological Investigations for BHP Diamonds Inc. Report submitted to Rescan Environmental Services Ltd., Vancouver. Permit 95-813. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Bussey, Jean. 1994. Final Report on Archaeological Investigations for the BHP NWT Diamonds Project. Report submitted to Rescan Environmental Services Ltd., Vancouver. Permit 94-768. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Damkjar, Eric. 1994. Heritage Resources Impact Assessment Metall Mining Corporation Proposed Izok Project, District of Mackenzie, Northwest Territories, 1993 Fieldwork. Prepared for Metall Mining Corporation, Edmonton, Alberta. Permit 93-752. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Fedirchuk, Gloria (Fedirchuk McCullough & Associates Ltd.). 1994. Initial Heritage Resource Evaluation Aber-Kennecott Lac de Gras Project. Prepared for Acres International Limited, Calgary, Alberta. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Fedirchuk, Gloria (Fedirchuk McCullough & Associates Ltd.). 1995. Heritage Resources Impact Assessment Kennecott Southwest Diavik Property. Prepared for Acres International Limited, Calgary, Alberta. Permit 95-814. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Fedirchuk, Gloria (Fedirchuk McCullough & Associates Ltd.). 1996a. Heritage Resource Studies: Mountain Province Mining Inc. Kennady Project. Prepared for Canamera Geological Ltd. Permit 96-838. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Fedirchuk, Gloria (Fedirchuk McCullough & Associates Ltd.). 1996b. Heritage Resource Studies: Lytton Minerals Limited Jericho Project. Prepared for Canamera Geological Ltd., Vancouver, British Columbia. Permit 96-836. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Fedirchuk, Gloria (Fedirchuk McCullough & Associates Ltd.). 1997a. Continuing Inventory: Historical Resources Impact Assessment. Report submitted to Diavik Diamond Mines Inc., Yellowknife, Northwest Territories. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Fedirchuk, Gloria (Fedirchuk McCullough & Associates Ltd.). 1997b. Heritage Resources Impact Assessment Kit Resources Northwest Territories Ltd. Goose Lake Project. Permit 97-844. Prepared for Norecol Dames & Moore. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Fedirchuk, Gloria (Fedirchuk McCullough & Associates Ltd.). 1997c. Continuing Inventory: Historical Resources Impact Assessment Diavik Diamond Mines Inc. Diavik Property. Small islands situated off the east island of Lac de Gras. Report submitted to Diavik Diamond Mines Inc. Yellowknife, Northwest Territories. Permit 97-857. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Gillespie, Beryl C. 1981. Yellowknife. Handbook of North American Indians. *Subarctic* 6: 285-290. Smithsonian Institution. Washington, D.C.

Gordon, Bryan C. 1986. Excavation of a late prehistoric Copper Inuit summer-fall antler and stone winter house. Archaeological Survey of Canada, Canadian Museum of Civilization. Hull, Quebec.

Gordon, Bryan C. 1988. Nadlock and its unusual antler dwellings. *Arctic* 41(2): 160-161.

Gordon, Bryan C. 1996. People of Sunlight, People of Starlight: Barrenland Archaeology in the Northwest Territories of Canada. Archaeological Survey of Canada Mercury Series Paper 154. Canadian Museum of Civilization. Hull, Quebec.

Helm, June. 1981. Dogrib. Handbook of North American Indians. *Subarctic* 6: 291-309. Smithsonian Institution. Washington, D.C.

Kroker, Sid. 1996. Ulu mine project archaeological impact assessment: phase II. Report prepared for Quaternary Consultants Limited. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

MacNeish, Richard S. 1951. An Archaeological Reconnaissance in the Northwest Territories. Annual Report for 1949-50. *National Museum of Canada Bulletin* 123: 24-41. Ottawa, Ontario.

Melville, Guy, Bob Goodwin, Dale Russell and John Polson. 1989. Thor Lake Area (Northwest Territories) Environmental Baseline Survey. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Metcalf, Frank. 1977. Coppermine River Archaeological Survey. Permit 77-422. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Metcalf, Frank. 1978. Rawalpindi River Archaeological Survey 1978. Permit 78-437. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Morrison, David. 1978. Archaeological Survey of Southern Bathurst Inlet, Northwest Territories. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Morrison, David. 1981. Archaeological Salvage Surveys: Contwoyto Lake and Repulse Bay, Northwest Territories. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Morrison, David. 1982. Report on an archaeological survey of the Middle Lockhart River System, Northwest Territories. Archaeological Survey of Canada, National Museum of Man. Ottawa, Ontario. Permit 82-514. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Noble, William C. 1966-1969. Archaeological Sites in the Northwest Territories. (Field Notes). Volume 1: Permit 66-261: Survey from Snowdrift to Fort Reliance and Taltheilei Narrows. Volume 2: Permit 67-275: Three surveys between Great Bear and Great Slave lakes. Volume 3: Permit 69-290: Excavations near Artillery Lake and Fort Reliance. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Noble, William C. 1971. Archaeological Surveys and Sequences in Central District of Mackenzie, N.W.T. *Arctic Anthropology* 8(1): 102-135.

Noble, William C. 1974. The Tundra-Taiga Ecotone: Contributions from the Great Slave-Great Bear Lake Region. In *Proceedings of the Fifth International Conference on the Prehistory and Palaeoecology of Western North American Arctic and Subarctic*. Scott Raymond and Peter Schledermann (eds.). Chacmool, University of Calgary. Calgary, Alberta. 153-171.

Noble, William C. 1977. The Taltheilei Shale Tradition: an Update. In *Problems in the Prehistory of the North American Subarctic: the Athapaskan Question*. J.W. Helmer, S. VanDyke, and F.J. Kense (eds.). Chacmool, University of Calgary. Calgary, Alberta. 65-71.

Noble, William C. 1981. Prehistory of the Great Slave Lake and Great Bear Lake Region. Handbook of North American Indians. *Subarctic* 6: 97-106. Smithsonian Institution. Washington, D.C.

Nunavut Planning Commission. 1998. West Kitikmeot Regional Land Use Plan. Draft produced in June 1998 for Informal Public Hearing, Akaluktutiak (Cambridge Bay), Northwest Territories.

NWT Centre for Remote Sensing. (no date). Known archaeological Sites in the Slave Geological Province. Figure on file at the West Kitikmeot/Slave Study Society, Yellowknife.

Prince of Wales Northern Heritage Centre. 1997. Archaeology Reports 1979-November 1997. Alphabetical bibliography listed by permit, author's name, title, year, and repository.

Rogers, Edward S. and James G.E. Smith. 1981. Environment and Culture in the Shield and Mackenzie Borderlands. Handbook of North American Indians. *Subarctic* 6: 130-145. Smithsonian Institution. Washington, D.C.

Sly, P.G., L. Little (Lutra Associates) and E. Hart. 1998. Draft State of Knowledge Report: West Kitikmeot and Slave Geological Province. In progress (January 13, Second Draft). Report on file, Lutsel K'e Dene Band.

Thomson, Callum (Jacques Whitford Environment Limited). 1998. Archaeological Overview Assessment of the Proposed 1998-99 Winter Construction Areas, Kennady Lake, District of Mackenzie, Northwest Territories. Report prepared for Monopros Limited. Permit 98-879. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Unfreed, Wendy J. (Fedirchuk McCullough & Associates Ltd.). 1996. Continuing inventory: historical resources impact assessment Diavik Diamond Mines Inc. Diavik Diamond Project, Lac de Gras, NWT. Permit 96-835. Diavik Diamond Mines Inc., Yellowknife, Northwest Territories. On File, Prince of Wales Northern Heritage Centre, Yellowknife.

Wright, James V. 1981. Prehistory of the Canadian Shield. Handbook of North American Indians. *Subarctic* 6: 86-98. Smithsonian Institution. Washington.

### *6.9.7 Personal Communications*

Luci Johanis, Archaeological Site Database Manager, Archaeological Survey of Canada, Canadian Museum of Civilization, Hull.

Shirley Standafer Pfister, Monopros Limited, Yellowknife.

## 6.10 Land and Marine Use

### *6.10.1 Existing Conditions*

The SGP is an area which has been subject to traditional use by Inuit, Dene, and Metis people for generations as described in the previous section. Aboriginal land use continues in the SGP, primarily focused on the harvesting of renewable resources. Aboriginal land use occurs throughout the year, mainly during the winter and open water seasons.

Inuit use in the project area is focused on the marine environment (Bathurst Inlet, Coronation Gulf, and Peel Sound) and the northern part of the SGP landmass as far south as Lac de Gras (Riewe 1992). Inuit communities within or with land and marine use in the SGP area include Cambridge Bay, Umingmaktok, Bathurst Inlet, and Kugluktuk.

Dene and Metis traditional land use, while not publicly documented, extends from the southern boundary of the SGP into the barren lands as far north as Contwoyto Lake. The Dogrib Treaty 11 Council and the Akaitcho Territory Tribal Council are currently in separate negotiations with the federal government regarding land claim settlements in their traditional territories, which include the SGP. Dene and Metis land use occurs north of the Nunavut border and Inuit land use occurs south of the Nunavut border.

Tourism is also a significant land use within the SGP. Figure 2.3 depicts the tourism establishments in or near the SGP. Several lodges based on fishing and naturalist activities are present, as are a number of caribou hunting camps. In addition, communities within the SGP house a number of tourist facilities. Tourism is said to have a far greater economic impact on communities than the mining or oil and gas industries in the NWT (del Valle, pers. comm., 1999). The economic impact of tourism in the SGP was not determined in this study. Most tourism in the SGP occurs during the summer months; however, an increasing number of visitors are coming to the region during the winter to view the Aurora Borealis.

In addition to tourism, the SGP also provides a number of public recreational opportunities. Residents of the NWT, Canada, and abroad travel to the SGP to hunt, fish, hike, canoe, and enjoy the large expanse of wilderness in the SGP. These activities occur during both the winter and summer seasons. Other significant land uses in the SGP include the hydropower developments on the Snare River system and numerous mineral exploration and development sites.

### *6.10.2 Potential Project-Environment Interactions*

Development of the SGP TC has the potential to cause direct and indirect effects on the environment. The potential for, and degree of, conflict with existing uses will vary depending on the route chosen and levels of activity.

Direct effects of the project on land and marine use may occur when there is a physical conflict between the corridor and an existing land use. Shipping to the proposed port in Bathurst Inlet is expected to occur during the period of open water from August to October. Ship transits have the potential to interact with human use of the marine environment along many sections of the Northwest Passage, Coronation Gulf, and Bathurst Inlet. The port site and road corridor may be located in areas subject to current land use.

The corridor and the activity associated with its construction and use has the potential to cause indirect effects on existing land uses. Shipping may affect the distribution of renewable resources in the marine environment and, ultimately, harvesting success. Should shipping extend into the period of ice cover, disruption of the ice cover may prevent safe on-ice travel by Inuit and decreased harvesting opportunities.

Developing all–weather road access into the SGP raises the potential for increased human use of the area and possible over-harvesting of renewable resources, which currently provide an important source of food and reinforce cultural practices among Aboriginal peoples. In addition to providing access to the resources, activity on the corridor may affect the distribution of wildlife and resulting harvesting opportunities. Redistribution and/or reduction in fish and wildlife populations could have a negative effect on existing tourism operations; however, the road corridor may provide alternative tourism opportunities which could be developed. Recreational use of the area includes hunting, fishing, canoeing, kayaking, hiking, and camping. The wilderness character of the SGP, which draws many recreational users, could be affected by the development of an all-weather transportation corridor, and existing uses could be affected. While the transportation corridor may result in some direct and indirect effects to existing land and marine use, it is the desired result of the SGP TC (increased mineral development) which could result in the most significant effects to land and marine use.

The West Kitikmeot portion of the SGP has been subject to a land use planning exercise under the authority of the Nunavut Planning Commission. The plan sets land use objectives; however, it is not a detailed document prescribing specific land uses. A land use plan or land use planning process is not in place for the NWT portion of the SGP.

### *6.10.3 Likely Issues of Concern*

Key issues that have been identified and would require further consideration should the SGP TC proceed to the assessment stage include:

- Effects of corridor on existing land use in SGP;
- Effects of access on the ability to harvest and the harvesting practices of Aboriginal residents;
- Effects of access on the harvest of renewable resources and the sustainability of the resource;
- Effects of the corridor on tourism in and around the SGP;
- Effects of the corridor on wilderness and recreation;
- Potential for unauthorized land uses along the corridor;
- Effects of shipping on marine use and harvesting by Inuit along entire shipping route; and
- Will legislative or other controls on harvesting activities be required within the corridor.

### *6.10.4 VSCs and VSC Boundaries*

#### 6.10.4.1 Consumptive Resource Use

Harvesting of renewable resources by Aboriginal and non-Aboriginal residents and sport harvesters occurs throughout the marine and terrestrial environment within the SGP TC. The boundaries of an assessment of potential effects to this VSC should include the traditional harvesting areas of Aboriginal communities in the SGP, harvesting areas of non- Aboriginal residents of the SGP, the sport hunting and fishing areas utilized by sport harvesting outfitters. Temporal assessment boundaries would be year round for a long term period.

#### 6.10.4.2 Tourism and Recreation

Tourism and recreational land use is defined as a VSC. The boundaries of an assessment of potential effects on this VSC should include the extent of licenced outfitting areas and tourism use areas, and significant recreational areas within the SGP. Temporal assessment boundaries could be restricted to the summer and fall season when most activity presently occurs; however, the current and future seasons of use should be confirmed with the tourism industry.

#### 6.10.4.3 On Ice Travel

Presently, shipping to a proposed port would occur only during the open-water season. Should a subsequent project definition result in a proposed extended shipping season then an assessment of potential effects on ice-cover and on ice travel should be conducted. Such an assessment should include all areas of the shipping corridor where on ice travel occurs.

### *6.10.5 Data Gaps and Future Study Needs.*

Two important initiatives have been undertaken to document historical and current land use in the region. The Inuit Land Use and Occupancy Project (Freeman 1976) and the Dene Mapping Project were undertaken to demonstrate traditional and current land use by the respective Aboriginal groups in support of the negotiation of comprehensive land claim agreements with the federal government. While the Inuit Land Use and Occupancy Project has been published, the Dene Mapping Project is not presently in the public domain. More recently, the Nunavut Atlas (Riewe 1992) provides additional information on wildlife resources and Inuit land use in Nunavut, and traditional Inuit use areas. Recently, communities and some co-management agencies have taken steps to document traditional knowledge of residents (including land use) of the SGP. These studies are generally under the control of the traditional knowledge holders and are not publicly available. Aboriginal land use and harvesting studies of the proposed transportation corridor and surrounding area will be required to assess project effects on Aboriginal land use and harvesting. Complimentary studies should also be done to facilitate an assessment of potential project effects on non-Aboriginal harvesting.

Existing tourism and mineral operations all require permits and so, will be registered with the federal and territorial governments and Aboriginal organizations as required by law. Documentation of recreational use and sport harvesting activities within the SGP is not readily available and would have to be developed as part of the assessment stage.

A complete documentation of land uses within the SGP will be required to facilitate the environmental assessment of the project.

### *6.10.6 Bibliography*

Freeman, M.M.R. 1976. Inuit Land Use and Occupancy Study. 3 volumes. Department of Indian Affairs and Northern Development.

Riewe, R. (ed). Nunavut Atlas. Tungavik Federation of Nunavut and Canadian Circumpolar Institute.

Nunavut Planning Commission. 1998. West Kitikmeot Regional Land Use Plan. Draft produced in June 1998 for Informal Public Hearing, Akaluktutiak (Cambridge Bay), Northwest Territories.

### *6.10.7 Personal Communications*

Vaughn del Valle, Coordinator Facilities and Assets, Parks and Tourism Division, Department of Resources, Wildlife and Economic Development, GNWT.

## 6.11 Socio-Cultural Environment (People and Communities)

### *6.11.1 Existing Conditions*

#### 6.11.1.1 The Physical Setting of Communities

**Yellowknife** (pop. 17,195) is located on the shores of Great Slave Lake, approximately 960 air km north of Edmonton (Figure 6.6). Yellowknife is accessible by air, water, and all-weather road. Yellowknife is the largest community and the only city in the NWT. The City is also the capital of the Northwest Territories and will remain the capital of the western NWT after the creation of Nunavut in April 1999. Aboriginal groups (in particular the Yellowknives Dene) traditionally used the area around the City for resource harvesting activities and the Yellowknife River to access the barren lands. Non-Aboriginal residency was established in the mid-1930s following the discovery of gold. Yellowknife's economy has well established mining, government, service, and transportation sectors and is the resupply point for mineral exploration camps and operating mines located in the SGP. A variety of Aboriginal organizations, helping agencies, and the Government of the Northwest Territories are headquartered in Yellowknife.

**Dettah** (pop. 190) and **Ndilo** (pop. estimate 209) (NWT Housing Corporation 1996) are close to the City of Yellowknife. Dettah is located on the shores of Yellowknife Bay, approximately 27 km by all-weather road and 6 km by water or ice road from the City. Ndilo is located within City limits at the north end of Latham Island. Dettah and Ndilo have limited infrastructure and access most services through Yellowknife. The communities share an elected band council and community administration.

**Lutsel K'e** (pop. 305) is located on the East Arm of Great Slave Lake, approximately 201 km east of Yellowknife. Lutsel K'e is accessible year-round by air and seasonally by water. Lutsel K'e has limited infrastructure. Residents access many business, health, and education services in Yellowknife, Fort Smith, or Hay River. The community has an elected chief and council.

The twin communities of **Rae-Edzo** (pop. 1655) are the largest communities on Treaty 11 (Monfwi)[3] lands. Rae is located on the south shore of Marion Lake approximately 113 km northwest from Yellowknife. Edzo, located on the east shore of the West Channel (which flows between Marion Lake and Great Slave Lake), is approximately 24 km south of Rae on Highway 3. Rae-Edzo is accessible by all-weather road and water. A private airport facility is under construction in the community. Rae-Edzo is the political, business, administrative, health, and educational centre for communities located on Monfwi lands. Residents also access business, health, and other services from Yellowknife.

[3] Monfwi lands refers to the lands traditionally used by the Dogrib of the Dogrib Treaty 11 Council area. Chief Monfwi described the extent of Dogrib lands in 1921.

**Wha Ti** (pop. 415), **Rae Lakes** (pop. 260), and **Wekweti** (pop. 135) are smaller Treaty 11 (Monfwi) communities. Wha Ti is located on the southeast shore of Lac la Martre, 164 km northwest of Yellowknife. Rae Lakes is situated on Rae Lakes, one of a chain of lakes located between Great Slave Lake and Great Bear Lake. The community is 177 km northwest of Yellowknife. Wha Ti and Rae Lakes are accessible year-round by air and seasonally by winter road. Wekweti is located on the shores of Snare Lake, 195 air km north of Yellowknife and 175 northeast of Rae-Edzo. The community is accessible by air. While the Colomac gold mine was in operation, a winter road connected the mine to the Wha Ti and Rae Lakes winter road. Each year during the mine's operation a winter road would be constructed from the mine's winter road to Wekweti for resupply purposes. On average the road into Wekweti would only be open for a period of 7-10 days or until the operation was complete. The Colomac mine closed in 1997 and a resupply road into Wekweti has not been built since. All three communities have limited infrastructure and access additional services through Rae-Edzo or Yellowknife.

**Cambridge Bay** (pop. 1350), **Kugluktuk** (pop. 120), **Bathurst Inlet** (pop. 18) and **Umingmaktok** (pop. 50) are located in the Kitikmeot Region and will become a part of the new territory of Nunavut as of April 1,1999. Cambridge Bay is located on the southeast coast of Victoria Island, 960 air km northeast of Yellowknife. The community is accessible by air and is supplied by barge during the open water months. Cambridge Bay has an elected mayor and council. As the Government of the Northwest Territories' (GNWT) administrative centre for the Kitikmeot Region, the community has developed administrative, health, business, and service infrastructure.

Kugluktuk is located at the mouth of the Coppermine River on Coronation Gulf. The community is 595 air km north of Yellowknife and 425 km southwest of Cambridge Bay and is accessible by air and water. Barges from Hay River resupply the community. Bathurst Inlet is situated on the southwest side of an inlet of the same name, at the mouth of the Burnside River. The community is approximately 175 air km south of Cambridge Bay and 579 air km northeast of Yellowknife. Umingmaktok is located 121 air km northeast of Bathurst Inlet and 193 air km southwest of Cambridge Bay. Both communities receive scheduled barge service during the summer and are accessible by air year round, although neither have regularly scheduled air service. Government services are provided on an itinerant basis from Cambridge Bay.

#### 6.11.1.2 Community Socio-Political Setting

Over the last three decades, political systems and institutions in the NWT and in the SGP have changed dramatically. In 1967, following a century or more of institutions controlled by the Federal Government, the Roman Catholic and Anglican churches, and/or the Hudson's Bay Company, new resident public and Aboriginal political organizations began to be established north of $60^{o}$. The first was the Government of the NWT (GNWT), formed as a result of a recommendation of the Federal Government's 1966 Carrothers Commission. By the early 1970s, political organizations had been created to serve the particular socio-political interests of the Dene (the Indian Brotherhood of the NWT), Metis (the Metis Association of the NWT), Inuit (the Inuit Tapirisat of Canada), and Inuvialuit

(Committee for Original Peoples Entitlement). Ascertaining Federal Government recognition of Aboriginal rights to land, resources, and governance has long been the impetus for Aboriginal political organizations.

Today, the GNWT functions very much like a provincial government, although fiscally it is responsible to the Federal Government which contributes about 85% of its annual budget. The GNWT has responsibility for a wide range of functions including education, health, housing, forestry, wildlife, justice, and transportation. The GNWT maintains regional, district, and agency offices in the SGP communities of Yellowknife, Rae-Edzo, Kugluktuk, and Cambridge Bay, and works with municipal government structures in others. Regional and/or community-based Aboriginal organizations also exist throughout the SGP. In Kugluktuk, Bathurst Inlet, Umingmaktok, and Cambridge Bay, Inuit organizations generally have been established to implement the Nunavut Land Claim Agreement, legislated in 1994. Other Aboriginal organizations in the SGP, such as the Dogrib Treaty 11 Council and the Akaitcho Territory Tribal Council, are actively involved in land, resource, and self-government negotiations or discussions with the Federal Government. Final agreements recognizing Dene rights and authorities have not yet been achieved. Within parts of the SGP and elsewhere in the NWT, land claim and self-government agreements are reshaping governance and administrative structures and/or are influencing many facets of daily life.

#### 6.11.1.3 Language, Culture, and Values of the People

The ethnic distribution of the population influences perspectives, life styles, and socio-cultural values. SGP communities are representative of the NWT's diverse cultural milieu. Ndilo, Dettah, Lutsel K'e, Rae Lakes, Rae-Edzo, Wekweti, and Wha Ti are predominately Dene communities (Table 6.11.1). The Dene are members of the Athapaskan language group, one of the largest indigenous linguistic groups in North America. Most residents of predominantly Dene communities in the SGP identify a language other than English or French (*i.e.,* a Dene language) as their mother tongue (the language first learned as a child and still understood). Use of a Dene language in the home is most prevalent in Rae Lakes, Wekweti, and Wha Ti, while in other communities English or a combination of English and a Dene language is used more often in the home (Statistics Canada 1996).

Within the predominantly Copper Inuit communities of Bathurst Inlet, Cambridge Bay, Kugluktuk, and Umingmaktok, Inuktitut and Inuinnaqtun are spoken. Use of Inuktitut in the home is greater among individuals in Umingmaktok than in Cambridge Bay and Kugluktuk, where English tends to be the only language spoken in the home.

Twenty percent of Yellowknife's population has Aboriginal ancestry and all of the NWT's Aboriginal languages are spoken in the City. While English is spoken by the majority of the population, languages from around the world are in use in the City.

**Table 6.11.1: SGP Community Populations by Ethnicity, 1996**

| Community | Total | Non-Abor. | Inuit | Dene | Metis | Other Abor. |
|---|---|---|---|---|---|---|
| Yellowknife | 17,195 | 13,780 | 545 | 1,560 | 1,215 | 90 |
| Lutsel K'e | 305 | 25 | 10 | 270 | - | - |
| Dettah | 190 | - | - | 180 | - | - |
| Rae-Edzo | 1655 | 155 | 10 | 1440 | 50 | 10 |
| Wha Ti | 415 | 25 | - | 385 | - | - |
| Rae Lakes | 260 | 10 | - | 240 | - | - |
| Wekweti | 135 | 15 | - | 120 | - | - |
| Cambridge Bay | 1,350 | 320 | 1005 | 10 | 10 | - |
| Kugluktuk | 1,200 | 125 | 1065 | - | - | - |
| Umingmaktok | 50 | - | 50 | - | - | - |
| Bathurst Inlet | n/a | n/a | n/a | n/a | n/a | n/a |

Source: Bureau of Statistics. 1998. **NWT Community Profiles**
Note: To ensure confidentiality, data from the census are independently randomly rounded. As a result, all numbers from the census end in the digit 0 or 5.

The ancestors of modern day Inuit, Dene, and Metis of the SGP were highly mobile hunting and gathering societies. Virtually all aspects of their lives were shaped by the seasonal cycles of the animals upon which they depended. Modern-day Dene, Metis, and Inuit value the land, water, and resources as their ancestors did before them. Today, these resources are dietary staples, and a source of spiritual and cultural well-being. The dynamic nature of the northern environment has placed tremendous pressures on Aboriginal peoples to abandon traditions. Loss of cultural identity and certainty is threatening the health and well-being of some segments of the SGP's population, particularly youth.

### 6.11.1.4 Population Profile

Almost half (49%) of the NWT's population is under the age of 24 years. The youthfulness of the population is reflected in all SGP communities. Youth comprise between 47% and 54% of the population in SGP communities, and 41% of Yellowknife's population.

Between 1991 and 1996, population growth in the NWT was double the national rate (11.7% *vs.* 5.7%). Population growth in the NWT is primarily a factor of high birth and low mortality rates. In 1996, the NWT's birth rate was roughly double the Canadian rate (23.4 *vs*. 12.2 per 1,000), while the

mortality rate was 4.1 compared to 7.1 per 1,000 throughout Canada. In 1996, the average birth rates in SGP communities ranged from 11.6 in Dettah to 30.8 in Rae-Edzo.

### *6.11.2 Potential Project - Environment Interactions*

Traditional harvesting activities and the isolation of once nomadic populations have contributed both to the continuity of Inuit, Dene, and Metis cultures, and the contemporary expression of them. Aboriginal elders and others have long been concerned about the encroachment of mainstream society and the impacts to Aboriginal languages and cultures, and to the well-being of future generations. Aboriginal people are concerned that young people are not practicing age-old customs or reflecting traditional beliefs/values in their day-to-day lives. The development of a transportation corridor in the SGP and the opportunity for more influences from the south and mainstream cultures may add to these fears.

Inuit, Dene, and Metis people continue to state that a healthy socio-cultural environment is contingent on:

- Continued access to traditional lands and the good condition and plentiful supply of natural resources;
- The resolve and the means to nurture individual and group identity, place, and belonging;
- The participation of all generations, and particularly the elders, in matters related to the social, cultural, and natural environment; and
- Aboriginal control over decisions respecting the use of lands and resources.

### *6.11.3 Likely Issues of Concern*

Key issues that likely will require further consideration should the SGP TC proceed to the assessment stage are as follows.

- Many people, particularly those of Aboriginal ancestry, depend on caribou for food, and for cultural and economic survival. There is concern that the productivity and sustainability of the species may be threatened by a road/transportation corridor. Communities throughout the SGP stress the requirement to maintain the integrity of this resource now and in the future: for domestic harvesting, tourism, and recreation purposes; for the central place that caribou play in the culture of Aboriginal people; and the central place that caribou play as an expression of the wilderness values of the SGP.

- Change is a fact of life for some residents of the SGP. Changes in past decades have been both positive and negative. During the community scoping sessions, residents of small communities, particularly Bathurst Inlet and Umingmaktok indicated that they do not want their communities to become like the larger centres in their regions. They envision that their communities will be very much the same in 30 years. Achieving this vision would be challenged by the proposed SGP TC.

- Industrial developments in the SGP have had benefits and costs. Yellowknife, Rae-Edzo, Cambridge Bay, and Kugluktuk have enjoyed economic benefits from recent mining activities. Small communities such as Bathurst Inlet have also seen increases in community income as a result of mining activities. The costs have been to the natural environment and to the way of life to Aboriginal peoples. Residents want to manage change by influencing or controlling the decisions that will affect the lives of people now and in the future. They recognize that good decision making requires traditional and scientific knowledge.

- Aboriginal elders stress that it is their role, as stewards of the land and resources, to ensure that decisions to achieve much desired job and business benefits from the SGP TC and other industrial developments do not have long term costs to the environment, particularly to the land, water, caribou and fish. They say that decision making for a transportation corridor must look at the long term costs to the entire ecosystem of the SGP.

- Community members see that winter roads in the SGP are already providing greater human access to, and use of resources in the region. Winter roads have also lowered living costs in some SGP communities due to the access they provide to cheaper goods. All-weather roads in the SGP have led to restrictions on land use and harvesting. The SGP TC coming from the south may increase access to big game; increase hunting pressures; and change relationships among local and resident hunters. Monitoring harvests and the condition of resources would be necessary. A SGP TC linking the region to the south may result in more benefits to the south than to the north; this is a particular concern in Kugluktuk. People in Kugluktuk are concerned about southern residents coming in to harvest resources and contributing nothing to the people of the North. Rae-Edzo residents share these concerns but suggest that a northern port and road facility would diminish opportunities for the Dogrib to benefit from cost of living reductions and economic opportunities associated with a road from their region.

### *6.11.4 VSCs and VSC Boundaries*

The remote and isolated communities in the SGP TC have predominantly Aboriginal populations who take pride in, and seek the continuance of, their traditions and socio-cultural and economic practices. All communities in the SGP are anxious to stimulate employment and income for the large numbers of people wanting employment. Some groups see greater support for the mining industry as a way of achieving these ends. Others see more diversified economic development as the preferred approach. Achieving often conflicting socio-economic objectives while maintaining the integrity of the natural environment continues to challenge regional residents and organizations. A transportation corridor offers the potential to assist and to hinder the region's efforts to achieve continuance of traditional practices as well as generate new job and income opportunities.

Residents throughout the SGP seek to benefit from new socio-economic activities that are taking place around them. Aboriginal people want to ensure that benefits to them accrue, particularly from those

developments occurring on their traditional lands. Balancing the costs and benefits of industrial development now and to future generations is dividing SGP communities, and is a reason for divisiveness among local populations. Many fear that the SGP TC is exacerbating these divisions. Some participants in public meetings felt that the competition for the transportation corridor may be causing people to lose sight of the natural environment.

Spatial boundaries should encompass communities and residents in and adjacent to the SGP, and areas occupied by the Bathurst Caribou Herd including the winter range and migration corridors. Community participants have indicated that temporal boundaries should extend beyond the construction and operations of the SGP TC to include planning, closure, and post-closure phases of a future project. Community participants want to be involved in meaningful and continuing consultations during all project phases and they want to know what would happen to the corridor and to the communities which have come to depend on industrial employment, when mines in the SGP cease operations.

### *6.11.5 Data Gaps and Future Study Needs*

Research has been undertaken in response to industrial resource development activities in the SGP. Traditional knowledge and multi-disciplinary scientific research completed for environmental impact statements for proposed mine developments (BHP Diamonds Inc. and Dia Met Minerals Ltd. 1995 and UMA and Associates 1998) have contributed to a better understanding of the socio-cultural environment in the SGP. Other research is underway.

- Community-based research initiated by the Tuktu and Nogak Caribou Management Board in 1997 will document Inuit knowledge about caribou in the Bathurst Inlet area and possibly, will include the Lac de Gras area.
- Recent research undertaken by the Dogrib Treaty 11 Tribal Council (Renewable Resource Committee 1997) adds to information about the distribution of hunting activity by Aboriginal people in the Lac de Gras area.
- The Dogrib Treaty 11 Tribal Council is also documenting traditional knowledge about place names relative to caribou habitat in the Lac de Gras area as indicators of important bio-geographical features.

Since 1996, the West Kitikmeot Slave Study Society has been sponsoring research to broaden the information base and understanding of the SGP ecosystem. These efforts have mainly focused on the biophysical environment. There is a need to pursue research into:

- Recent subsistence hunting, trapping, and fishing activity trends in the SGP;
- The effect of industrial work activities on the family unit and other social structures within non-industrialized communities; and
- The short and longer term effects of an increasingly industrialized economy and participation in this economy, to Aboriginal peoples, for example, in terms of harvesting patterns, country food consumption, diet, lifestyles, emotional/physical well-being and continuity/strength of culture/language.

## 6.12 Economy, Income, and Employment

The NWT has a "mixed economy" which blends wage employment, renewable resource harvesting, and subsidies/transfer payments. In each community, the relative importance of each component of the mixed economy differs with the size and demographics of the community, as well as the economic history and opportunities available. For example, subsistence hunting and seasonal wage employment are the basis of Bathurst Inlet's economy; in Rae-Edzo, transfer payments, domestic harvesting, and wage employment all play a key role in the economy; and in Yellowknife, wage employment is the dominant force in the economy.

### *6.12.1 Existing Conditions*

#### 6.12.1.1 Economic Activity by Sector

The pattern of labour force activity (individuals who were either employed or unemployed) in the NWT is reflected in the SGP overall but differs among communities in the region. About 39% of the NWT's labour force works in the public sector in government, education, or health services, making this sector the largest employer in the north and in the SGP. Similar to governments throughout Canada, the NWT's public sector is experiencing a period of fiscal restraint. Federal Government transfer payments to the GNWT, for example, have been frozen at 1995 levels, resulting in a $167 million reduction in payments over the three year period 1996/97 - 1998/99.

In 1996, about one-quarter of the labour force in the SGP was employed in the retail, business service or tourism sectors. Between 1992 and 1995, the value of retail sales in the NWT grew from just over $390 million to approximately $450 million (Norecon Ltd. 1997). The retail and service sectors have been growing mainly due to expenditures by mineral companies engaged in exploration and development work in the SGP. In recent years, growth in the tourism sector has been sluggish.

The transportation and communications sectors employ approximately 11.8% of the labour force in the SGP. Growth in the transportation sector is a factor of activity in other economic sectors. Activity in the mining sector has significantly bolstered the revenues of transportation businesses.

The communications sector is evolving at a rapid rate, due in part to technological advances (*e.g.*, satellite communications and the Internet) and industry deregulation (*e.g.*, long distance telephone). The introduction of new, economically feasible modes of communication have changed the way northern communities communicate. A recent survey conducted by the Federation of Independent Business found that businesses in the NWT and Yukon were the highest users of the Internet in Canada (Resources, Wildlife and Economic Development 1997). Communications infrastructure and employment opportunities in the SGP are concentrated in Yellowknife.

The mining and manufacturing sectors employ 9.6% of the labour force in SGP communities. The opening of Canada=s first diamond mine, BHP=s Ekati Mine in October 1998, and the proposed Diavik Diamond Mines Project scheduled to go into operation in 2002, together with ancillary/value added diamond sorting and cutting facilities, will undoubtedly increase employment in these sectors. New mines and ancillary businesses may offset losses in employment resulting from the closure of the Lupin and the Colomac mines in the SGP.

In 1996, total public and private sector capital expenditures on construction in NWT decreased by 34% from the previous year (Norecon Ltd. 1997). Reduced capital spending has diminished the labour force and the number of northern businesses involved in the industry.

#### 6.12.1.2 Resource Harvesting

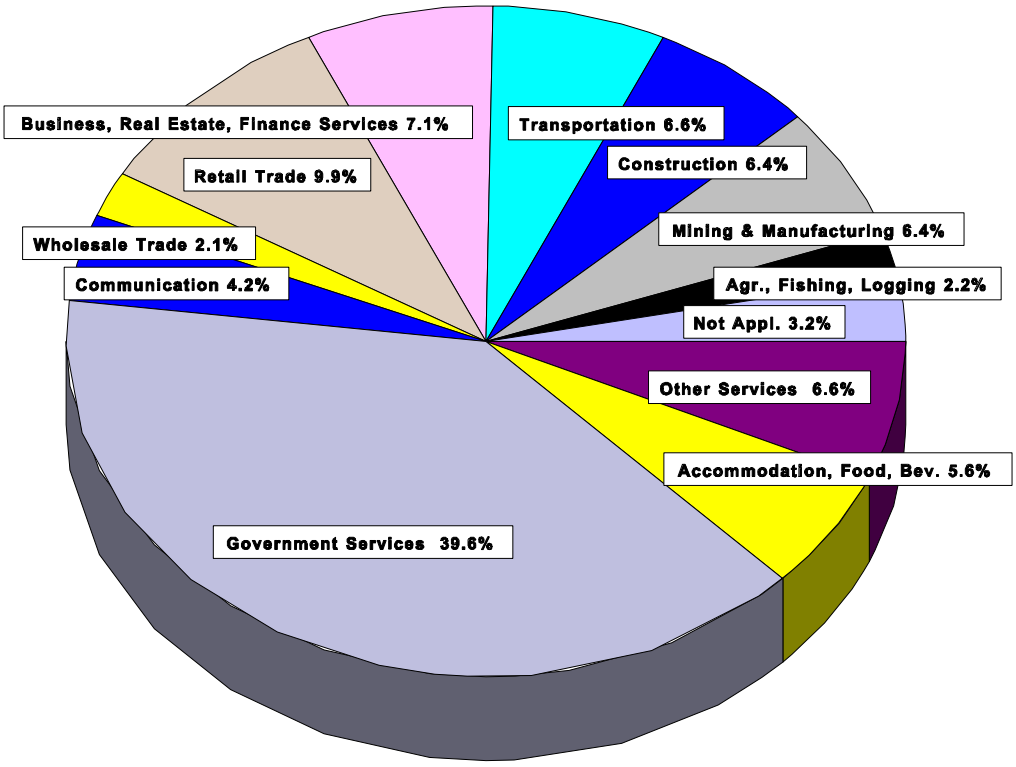
It is estimated that more than 90% of Aboriginal households in the NWT consume country foods, approximately 70% hunt or fish, and nearly 25% trap (Resources, Wildlife and Economic Development 1997). The replacement value of products obtained by hunting, trapping, and fishing activities is estimated at between $50 and $55 million annually (Resources, Wildlife and Economic Development 1997). SGP communities have a history of harvesting renewable resources for commercial purposes although the focus of commercial activities has shifted in recent decades from trapping of fine furs to country foods (caribou, muskox, and/or fish) processing. Kitikmeot Food Ltd. in Cambridge Bay is an example of an active country foods processing facility.

#### 6.12.1.3 Labour Force Activity

The 1996 Census of Canada provides the most recent information on labour force activity in the NWT. At the time of the Census, 73.4% of the NWT's population 15 years or older were either employed or temporarily unemployed but seeking work (also referred to as potential labour force). This percentage was virtually unchanged from 1991 (73.2%). The participation rate in SGP communities is skewed by

Yellowknife, where 85.4% of the population 15 years or older participates in the labour force. Without Yellowknife, the participation rate in SGP communities drops to 60.6% (Table 6.12. 1).

**Figure 6.12.1: NWT Labour Force by Industry and Percentage, 1996**




Source: 1996 Census of Canada

Official unemployment rates do not provide a complete picture of activity among people of working age. Individuals not actively seeking employment because of a perceived lack of jobs are not included in unemployment rates. In 1996, the unemployment rate in the NWT was 12.9% (compared to 13.3% in 1991). Unemployment rates in study communities range from a low of 6.4% in Yellowknife to a high of 38.9% in Rae Lakes.

Another indicator of employment opportunities (or lack thereof) is the employment to population ratio (percent of population 15 years of age and over with a job). In 1996, the employment ratio in the NWT was 64.0% compared to 59.4% in 1991. In the five years between the 1991 and 1996 Canada Census, the employment ratio increased for individuals over 30 years of age and decreased for persons 15 to 29 years of age. Lack of job opportunities for young people and increased participation in educational programs may account for decreases attributed to this age group. The employment to population ratio in SGP communities ranges from a low of 33% in Rae Lakes to a high of 80% in Yellowknife.

The 1996 Census of Canada provides information on the occupations of working aged people in the labour force (individuals either employed or unemployed). Most individuals in the SGP worked in sales and/or service or trades/transportation occupations.

**Table 6.12.1: Population 15 Years & Over, by Labour Force Activity, 1996 and 1991**

| Community | Pop. 15 & Older | In Labour Force | Employed | Unem-ployed | Part. Rate | Unempl. Rate | Employment to Pop. Rate |
|---|---|---|---|---|---|---|---|
| Yellowknife | | | | | | | |
| -1996 | 12,700 | 10,845 | 10,155 | 690 | 85.4 | 6.4 | 80.0 |
| -1991 | 11,140 | 9,730 | 9,235 | 500 | 87.3 | 5.1 | 82.9 |
| Dettah | | | | | | | |
| -1996 | 120 | 70 | 55 | 15 | 58.3 | 21.4 | 45.8 |
| -1991 | 100 | 55 | 40 | 20 | 55.0 | 36.4 | 40.0 |
| Lutsel K'e | | | | | | | |
| -1996 | 210 | 115 | 95 | 15 | 54.8 | 13.0 | 45.2 |
| -1991 | 185 | 115 | 80 | 30 | 62.2 | 26.1 | 43.2 |
| Rae Lakes | | | | | | | |
| -1996 | 165 | 90 | 55 | 35 | 54.5 | 38.9 | 33.3 |
| -1991 | 160 | 90 | 70 | 20 | 56.3 | 22.2 | 43.8 |
| Rae-Edzo | | | | | | | |
| -1996 | 1,070 | 540 | 365 | 175 | 50.5 | 32.4 | 34.1 |
| -1991 | 975 | 540 | 350 | 190 | 55.4 | 35.2 | 35.9 |
| Wekweti | | | | | | | |
| -1996 | 90 | 55 | 40 | 15 | 61.1 | 27.3 | 44.4 |
| -1991 | 80 | 45 | 40 | 10 | 56.3 | 22.2 | 50.0 |
| Wha Ti | | | | | | | |
| -1996 | 280 | 175 | 130 | 50 | 62.5 | 28.6 | 46.4 |
| -1991 | 235 | 145 | 90 | 55 | 61.7 | 37.9 | 38.3 |
| Cambridge Bay | | | | | | | |
| -1996 | 865 | 635 | 580 | 50 | 73.4 | 7.9 | 67.1 |
| -1991 | 705 | 500 | 420 | 80 | 70.9 | 16.0 | 59.6 |
| Kugluktuk | | | | | | | |
| -1996 | 745 | 470 | 395 | 70 | 63.1 | 14.9 | 53.0 |
| -1991 | 655 | 380 | 265 | 110 | 58.0 | 28.9 | 40.5 |
| Bathurst Inlet | | | | | | | |
| -1996 | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| -1991 | n/a | n/a | n/a | n/a | m/a | n/a | n/a |
| Umingmaktok | | | | | | | |
| -1996 | 35 | 20 | 15 | - | 57.1 | - | 42.9 |
| -1991 | 40 | 15 | 10 | 10 | 37.5 | 66.7 | 25.0 |

Source: Bureau of Statistics. May 1998. Labour Force - 1996 Census Results - Northwest Territories. Yellowknife: Government of the NWT.

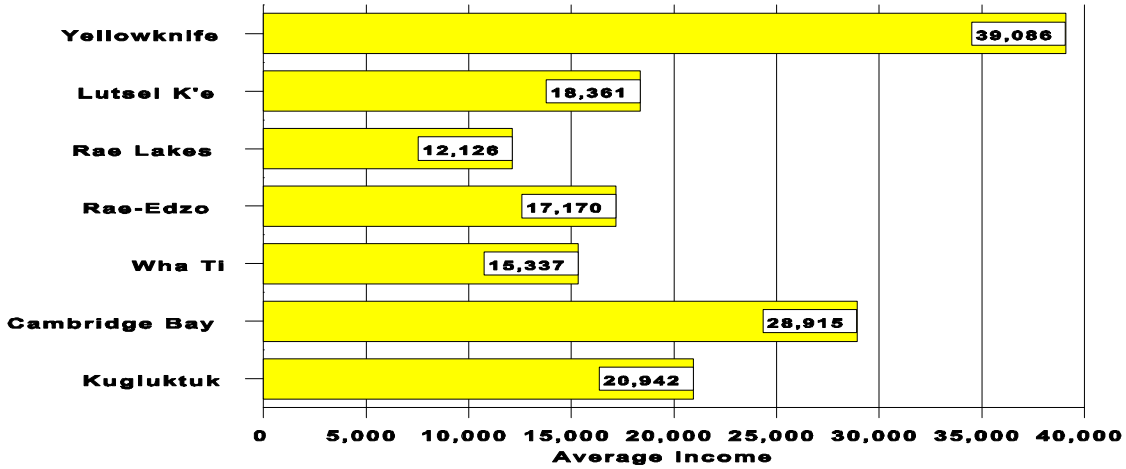
Definitions

Labour Force – all persons 15+ years of age employed and unemployed.
Participation Rate – percentage of population 15+ years of age employed and unemployed.
Unemployment Rate – percentage of total labour force who are unemployed.
Employment to Population Rate – percentage of population 15+ years who are employed.

### 6.12.1.4 Income

In 1996, the average income of persons 15 years of age or older in the NWT was $29,011. There is a wide range in the average incomes (includes persons with income only) in SGP communities, from $12,126 in Rae Lakes to a high of $39,086 Yellowknife (Figure 6.12.2).

**Figure 6.12.2: Average Income in SGP Communities, 1996**




Source: 1996 Census of Canada.
Notes: Data are not available for Dettah, Wekweti, Umingmaktok, or Bathurst Inlet

### 6.12.1.5 Social Assistance

In the mid-1990s, social assistance in the NWT began to change from a passive payment model to an active income support model which linked support to local education, employment, and wellness programs/services. Today, income support is provided to applicants based on a needs test and a requirement to seek productive or wellness choices including employment, training, counselling/treatment, or community service. Changes in assistance have slowed the growth of social assistance expenditures but the time on assistance is increasing (Lutra Associates Ltd. 1998). In 1996/97 over one third of the NWT/Nunavut populations had occasion to receive income support/social assistance. In the same year users of assistance averaged 6.2 months on assistance compared to 5.8 months in 1995/96. Data on social assistance also suggest that dependency on these supports is higher in Nunavut than in the NWT communities. The main reason for seeking income support continues to be a lack of jobs. Overall NWT/Nunavut patterns of social assistance use are reflected in the SGP (Lutra Associates Ltd. 1998).

#### 6.12.1.6 Cost of Living

With the exception of Bathurst Inlet, Umingmaktok, and Wekweti, the cost of living in SGP communities in 1997 ranged from 20% to 80% higher than in Edmonton and food prices were up to 69% higher in communities outside of Yellowknife. The winter ice road contributes to reduce the cost of goods and supplies in Wha Ti, and Rae Lakes while the summer barge service has the same effect in Cambridge Bay, Kugluktuk, Lutsel K'e, Umingmaktok and Bathurst Inlet. Goods and supplies must be flown into Wekweti. The remaining communities are on the all-weather road system and costs are generally consistent year round, although in these and other communities, cost of living is a function of a wide variety of market forces.

**Table 6.12.3: Cost of Living Differential in SGP Communities**

| Community | Living Cost Differential in 1997 Edmonton=100 | Food Price Index in 1997 Yellowknife=100 | Family Weekly Nutritious Basket 1991 |
|---|---|---|---|
| Bathurst Inlet | n/a | n/a | n/a |
| Cambridge Bay | 175-180 | 165 | $273 |
| Dettah | 120-125 | 100 | $163 |
| Kugluktuk | 170-175 | 163 | $259 |
| Lutsel K'e | 150-155 | 169 | $274 |
| Ndilo | 120-125 | 100 | $163 |
| Rae-Edzo | 125-130 | 120 | $168 |
| Rae Lakes | 150-155 | 137 | $225 |
| Wekweti | n/a | 160 | $278 |
| Umingmaktok | n/a | n/a | n/a |
| Wha Ti | 145-150 | 100 | $256 |
| Yellowknife | 120-125 | 100 | $163 |

Source: NWT Bureau of Statistics, 1998b

### *6.12.2 Potential Project - Environment Interactions*

During the construction and operations of transportation infrastructure, the economic, social and cultural environment in the SGP may be directly affected by project spending and other project activities. The very presence of a corridor which connects and promotes access to otherwise remote

areas, may also affect the human environment. A first order or direct project-environment interaction could occur in the economies of selected NWT communities and generally in the SGP due to:

- New employment and income generating opportunities created by the project, and new industrial activities made possible because of the project;
- New demand for goods and services generated by the project, and by new industrial activities made possible because of the project;
- The potential for higher levels of disposable income; and/or
- New and/or different employment conditions.

Transportation infrastructure may stimulate indirect interactions due to:

- Greater access to and within the SGP;
- Greater human movement to and in the previously isolated area; and/or
- Potential changes to the habitat and movement of animals.

Indirect project-environment interactions may also subtly filter through the social, economic, and cultural environments of SGP communities and the region as a whole, particularly related to the economy, income, and employment, in the form of:

- Actions to satisfy the aspirations of northerners to derive employment and labour income benefits from industrial and resource projects occurring on their land;
- Competition for, and availability of, skilled workers to supply the demand associated with $550 million road construction and $50 million port construction activities, as well as associated service and infrastructure demands;
- Labour force demand and income fluctuations associated with varying expenditure patterns over the course of an industrial project (also known as "boom-bust");
- Initiatives to stimulate hiring practices and mitigate barriers to Aboriginal employment and gender equity in the industrial workplace;
- Changes in labour income and spending patterns;
- Population growth due to in-migration to meet excess labour market demand;
- Changes in the nature of employment, education, and training opportunities;
- Changes in the dynamics associated with the mixed economy in SGP communities;
- Changes in wage/industrial employment and hunting/trapping/fishing participation;
- Changes to accessibility and availability of country food, particularly among lower income Aboriginal communities where consumption of country food is an economic necessity;
- Changes in costs of living;
- Changes to harvesting skills, time investment, capitalization/equipment and information;
- Changes to resident recreational and migrant (Aboriginal) harvesting levels and patterns; and
- Changes in access to various resources and related implications to such economic sectors as tourism.

### *6.12.3 Likely Issues of Concern*

Community residents participating in the environmental scoping meetings corroborate concerns documented in recent assessments of industrial projects in remote areas, in proximity to non-industrial populations, and in the SGP.

- SGP communities, and particularly those with predominantly Aboriginal populations, will want project activities and outcomes to provide residents with meaningful and long lasting employment, education/training, and business opportunities. Some community residents have had direct experience with industrial employment and express some scepticism about the extent and duration of opportunities available to them. Many reject the fundamental premise of the SGP TC as support to an industry which is based on depleting resources, rather than a support to northern communities. They are concerned about the effects of mine closures to communities which may come to depend on the jobs and income they create.
- Participants at environmental scoping meetings delivered a strong message that costs and benefits of the SGP TC must be well understood. Experience has shown northern roads have brought benefits but in the case of Dettah, had greater costs. One Dettah resident asked A*will we end up starving because we supported a road*,@. While in Rae-Edzo, a participant stated that *"without the caribou, we cannot afford to live."* Still, the need for wage employment is great among working aged people in SGP communities, and industrial employment is a means to this end. Many community residents are confident that impact benefits agreements and land claims management structures will enable benefits and costs to be managed to the benefit of regional communities.
- If the SGP TC acknowledges the need for northern/local employment and labour income benefits, the less industrialized communities in the region are more likely to feel social, economic, and cultural effects than are larger urban centres such as Yellowknife and Hay River. There is concern that a transportation corridor may threaten socio-cultural and economic activities which are predicated on remoteness/isolation and non-industrialization (*e.g.*, language use, land based cultural sites and activities, wilderness values, eco-tourism). There is also concern about possible social impacts from more alcohol and drug use, and larger populations, and populations which do not understand or share the values of many northern people.
- The SGP TC causes concerns for the people of Bathurst Inlet, who are heavily dependent on the resources of the land. Community residents worry that travel to the nearby community of Umingmaktok to purchase supplies might be hampered by ice-breakers/tanker traffic after freeze-up. Residents of this community and of others throughout the SGP worry about the effects of the project on caribou movements and survival, and the effects of project construction on furbearers upon which people depend for cash income.
- Some SGP communities are beginning to lobby: to become the gateway to the transportation corridor; to have related infrastructure established close to them; and to encourage corridor development in a manner that has as a first priority, improved access for remote communities. Linking communities together and to the south, lowering fuel costs to communities by offshore sourcing of fuel and transhipment of fuel from overseas, and more local economic opportunities are cited as economic benefits. At environmental scoping meetings, members of the public who reside in off-road communities said that anything that can be done to lower the costs of living must be pursued and many suggest they would endorse the SGP TC on this basis. A network of ice-roads to Dogrib Treaty 11 communities is seen as an immediate solution. In some communities, ice roads

were identified as creating less concerns than an all-weather road and/or port facility.

- Residents in the West Kitikmeot identify the potential of the SGP TC to offer a less expensive mode of transportation into the region. Along with this potentially positive benefit, some worry that road travel will increase the cost of air travel and have negative effects on other economic sectors, particularly the tourism industry.
- Some SGP communities are advocating for the development of the SGP TC in order to draw more direct and indirect benefits from mining activities into their region. The settlement of Aboriginal land claims has strengthened the confidence of beneficiaries to more aggressively seek benefits from, and control developments in their settlement regions. In communities with less experience or knowledge of land claims, residents express faith in those implementing the claim to ensure benefits for all beneficiaries.

### *6.12.4 VSCs and VSC Boundaries*

Renewable resource harvesting, tourism, and mineral exploration and extraction are the primary economic activities undertaken in the SGP. In recent years, year-round access to the region has been by aircraft only supplemented by vehicle during the winter via the Lupin Winter Road. The SGP TC may alter existing and/or bring new economic activities in the region. For example, tourism operators may develop products and services to capitalize on improved access to a wilderness/ backcountry experience. Existing wilderness tourism activities may be displaced. Greater use of the area by tourists and/or other recreation users may create new land and resource uses and conflicts.

Economic security is affected by both paid and unpaid human effort or work. In the SGP, economic security in the smaller communities is dependent on a combination of hunting and gathering activities, paid employment, and transfer payments. The success of this mixed economy is contingent on a healthy land, water, and a sustainable resource base for harvesting, as well as opportunities for wage-based employment. Harvesting activities in smaller communities are very much a cornerstone of the mixed economy and are very important to human nutrition/diet, health status, and in some cases, the clothing needs of local residents. The central role of harvesting activities is emphasized by the lower than average incomes and high costs of imported products in communities outside of Yellowknife. Harvesting and transfer payments have sustained those residents in smaller communities who have been unable to participate in wage employment due to lack of opportunities, inadequate education/training, and/or other reasons. The experience of some SGP communities is that few long term benefits are actually accrued from industrial developments and in some cases, these developments have had serious economic costs to residents. These communities worry that the SGP TC may threaten the economic security of current and future generations. Other communities strongly advocate for infrastructure to support mining activity to ensure an economic future and jobs for residents in the western NWT and/or the Kitikmeot region of Nunavut.

Economic activities in the SGP have been influenced to a large degree access. A transportation corridor which would provide year-round access, could significantly alter the nature, extent, and pace of economic activities in the SGP. This may create new land and resource uses and conflicts, and new economic opportunities.

A transportation corridor in the SGP may have significant beneficial and adverse effects on the economy of the region. The economic security of Aboriginal residents may be enhanced by greater access to income earning opportunities but threatened by less opportunities, capacity, and sustainability of harvestable resources/activities. Uncertainty associated with the longevity of wage employment, the availability of transfer payments, and access to natural resources may increase economic stresses within the regional population. Project construction may serve to enhance the quality of community and individual life; however, declining employment after construction and closure, or due to changing supply distribution patterns, may adversely affect the economic security of regional residents in the longer term.

Spatial boundaries of assessment should encompass communities and residents in, and adjacent to the SGP. Community participants have indicated that temporal boundaries should include not only the construction and operations of the SGP but also planning, closure, and post-closure phases of a future project. Participants at environmental scoping sessions emphasized the importance of involving communities in meaningful discussion about sustainable economic alternatives.

### *6.12.5 Data Gaps and Future Study Needs*

Some community participants are sceptical that employment/income benefits from increased mining activities in the SGP are actually flowing to the communities. Although monitoring and ongoing effects mitigation is a condition of the 1996 BHP Diamonds Project-GNWT Socio-Economic Agreement, reporting requirements have not been fulfilled for the first two years of the agreement. In early 1999, the GNWT suggested that modifications were required to the agreed upon wellness indicators in order to fulfill monitoring and reporting requirements. Annual monitoring, mitigation, and reporting of industrial developments in the SGP is necessary for project-specific assessments, as well as cumulative effects assessment.

Issues raised at environmental scoping meetings suggest that new transportation modes and routes should consider the costs and benefits from the perspective of permanent human populations first, and secondly, the needs of industrial/mineral developers. This would require route selection to be predicated by total cost and benefit, including social costs and benefits, and economic feasibility analyses in consideration of the needs of communities and residents in the SGP. Public consultation would be part of these studies, as was suggested by some participants in the environmental scoping meetings.

Most SGP residents want to ensure a balance of environmental protection/sustainability and economic development. They suggest that more research is necessary. Some suggest a need for environmental baseline and modelling studies well in advance of project commencement; recommended baseline studies for VECs are documented in other sections.

Socio-economic literature is weak with respect to documentation of the effects of industrial activities on human populations, in particular:

- The stress effects over a period of time, of rotational industrial wage employment at distant work sites on previously non-industrialized, Aboriginal societies;
- The factors influencing decision making regarding participation in industrial work activities within and among Aboriginal families and communities; and
- The availability of increased wage employment and cash income earning opportunities as ready deterrents to the need for/dependency on income supports and other subsidies.

Issues raised in consultations associated with the environmental scoping of the SGP TC point to a need to better understand the actual benefits and costs associated with winter road access to remote communities.

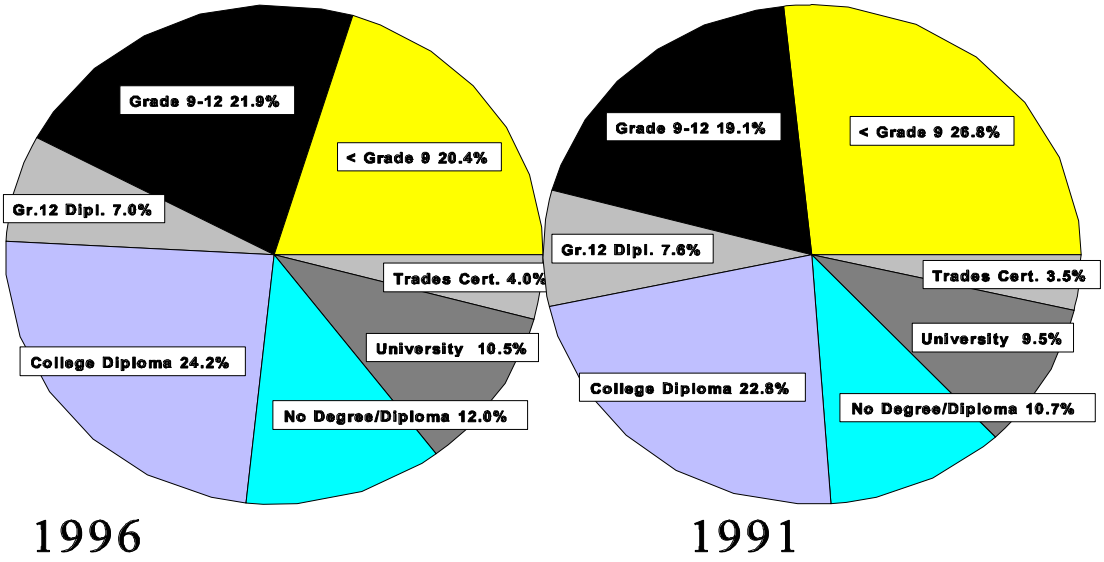
## 6.13 Education, Health, and Well-Being

### *6.13.1 Existing Conditions*

#### 6.13.1.1 Education

Approximately 70% of students in the NWT are likely to leave school before graduating. In 1996, about 42% of the NWT's population 15 years and older had not achieved Grade 12; however, formal education levels are improving among working aged people (Figure 6.13.1). Education circumstances in the NWT are reflected to some extent in the SGP.

**Figure 6.13.1: Highest Level of Education Achieved by the Population 15 Years and Older, NWT, 1996 and 1991**




Source: 1996 Census of Canada and 1991 Census of Canada

In SGP communities, early childhood programs and full and part-time childcare spaces have grown in recent years. Primary and secondary schools in the region function under five different divisional education councils. In 1996/97, these schools operated at an average enrolment of 84% of their capacity. In the last decade, school enrolment in, and high school graduation from, SGP schools have continued to increase.

#### 6.13.1.2 Health and Well-Being

Health Profile

A full range of medical services are available in Yellowknife including specialist, diagnostic, rehabilitative, public health, hospital, and emergency services. Medical services in many of the other

SGP communities are provided through health centres staffed by registered nurses and community health representatives (local health promotion/education personnel), or in the case of Wekweti, Umingmaktok, and Dettah, by a lay dispenser. Other medical services may be available to SGP communities on an itinerant basis through larger centres in the NWT or from southern Canada.

The rate of low birth weights (*i.e.*, birth weights under 2500 grams or 5.5 pounds) is an indicator of reproductive health. Factors which negatively affect fetal growth include tobacco use, poor maternal nutrition, weight gain, and exposure to alcohol and other drugs. The incidence of low birth weights in the NWT and the SGP has been declining in recent years and is now almost the same as the national rate. Fetal Alcohol Syndrome (FAS) and Fetal Alcohol Effects (FAE) are permanent, irreversible birth defects caused when a pregnant woman consumes alcohol. The incidence of FAS/FAE in the NWT and in SGP communities is unknown but is perceived to be high.

The sexually transmitted disease rate in the NWT is 12 times higher than in the rest of Canada. Between 1989 and 1996, the number of cases of sexually transmitted diseases in SGP communities decreased. Virtually all individuals contracting a sexually transmitted disease were between 15 and 35 years of age.

Tuberculosis (TB) has been a persistent health concern in most SGP communities for decades. The Dogrib communities of Rae Lakes, Rae-Edzo, Wekweti, and Wha Ti and the Chipewyan community of Lutsel K'e experience periodic outbreaks of the disease. The most recent outbreak in Dogrib communities was in 1994.

In the NWT, approximately 6,200 years of potential life are lost each year, due to the number of individuals who die before reaching the Canadian average life expectancy of 77 years. The leading causes of death in the NWT are injury and poisoning, disease of the circulatory system, and neoplasms. Alcohol and drugs are a factor in about one-fifth of the deaths caused by injury. SGP communities follow NWT trends.

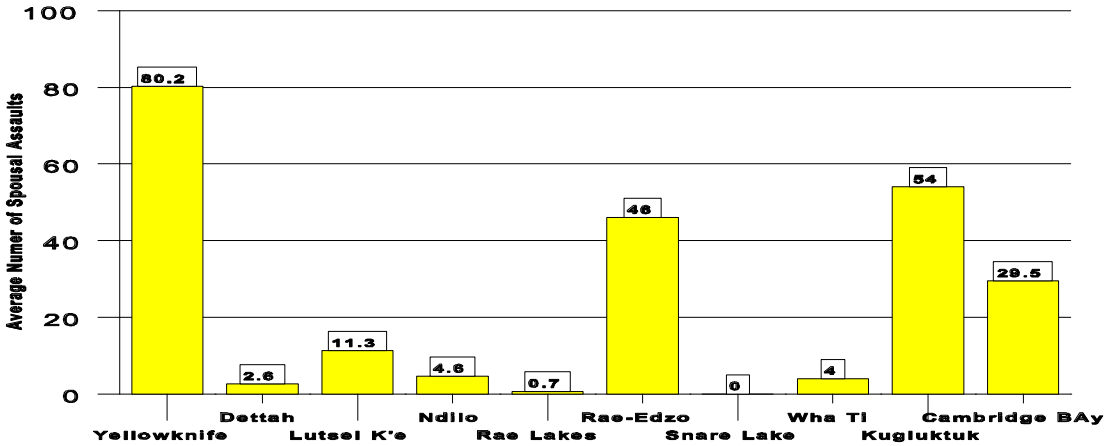
Social and Family Issues

A 1993 survey of frontline workers in the NWT identified the following issues (in order of priority) as troubling northern communities: alcohol and drug use; unemployment; family violence; gambling; and sexual abuse (Nicoll 1993). These issues have been documented as being present in SGP communities.

In 1996, the Bureau of Statistics completed an NWT-wide survey of alcohol and drug use among persons 15 years of age or older. The survey found that although the incidence of alcohol consumption in the NWT was no different than the rate for Canada (71.5% *vs* 72.3%), the rate of heavy (five or more drinks on days when alcohol is consumed) drinking in the NWT was approximately three times the national rate. The use of marijuana and hash in the NWT was 19.8%, which was more than twice the rate for the rest of Canada (7.4%). The survey also reported on the use of solvents or aerosols, which was found to be almost 14 times the rate for Canada (11.1% *vs.* 0.8%). An estimated 50.9% of adults in the NWT smoke cigarettes; the national rate is 27.0%. Almost two-thirds (66.5%) of Aboriginal adults smoke cigarettes - 70.5% of Aboriginal adults in Nunavut *vs*. 62.% in the western NWT.

Family violence is defined as "*physical, sexual, or mental abuse of one person by another person who is a member of the family or with whom the abused person has an intimate relationship*" (Status of Women Council of the NWT 1992). Family violence can include violence between couples, and the abuse and neglect of children and elders. If children are not abused directly, those from violent homes suffer extreme emotional stress; may be physically hurt trying to protect their battered parent; and are more likely to find themselves in abusive relationships (Status of Women Council of the NWT 1992). Perpetrators of spousal assaults are almost always males. Over the six year period from 1991 to 1996, the average number of reported spousal assaults per year in SGP communities ranged from a low of 0 in Wekweti to a high of 80 in Yellowknife (Figure 6.13.2). There are no data indicating the total number of people (*i.e.*, children and other family members) who are affected by the violence of spousal assaults.

**Figure 6.13.2: Average Number of Spousal Assaults Per Year in SGP Communities, 1991-1996**




Source: RCMP

The *Child Welfare Act* provides protection of children who are 18 years of age and younger (for reasons including apprehension, adjournment order, temporary care and custody, permanent care and custody, supervision order, custody by agreement, or support services agreement). In 1996, children in care represented 6.5% and 3.1% of children 19 years or younger in Rae-Edzo and Yellowknife, respectively.

Suicide is defined as an intentional, self-inflicted death (Canadian Association for Suicide Prevention 1994). Reasons for suicide are linked to poverty, and limited prospects for opportunity and advancement (Office of the Auditor General of Canada 1992). The suicide rate in the NWT is more than three times the Canadian rate (43 per 100,000 people compared to 13 per 100,000). The majority of individuals who commit suicide in the north are young Inuit males between the ages of 14 and 24. In the twelve years between 1986 and 1997, a total of 56 suicides were committed in SGP communities. More than one-third (38%) of these suicides were committed in Kugluktuk, where 5.3% of the SGP population resides (GNWT Department of Health and Social Services 1998).

Aboriginal people are over-represented in the justice system in the NWT where the rate of violent crime in the NWT is over five times the national average (Evans *et al.* 1998). *"Aboriginal over-representation is affirmed by report after report documenting the high rates of Aboriginal contact with police and their disproportionately high rates of arrest, conviction, and imprisonment"* (Giokas 1993). Alcohol is a factor in most crimes committed in the NWT and in the SGP, even though a number of communities have either liquor prohibition or restriction.

#### 6.13.1.3 Protection

Protection Services

Protection services are defined in this section as policing, fire suppression services, and emergency plans. RCMP detachments are located in Yellowknife, Rae-Edzo, Wha Ti, Kugluktuk, and Cambridge Bay, and these detachments provide protection services to smaller nearby communities.

Fire suppression services and emergency measures plans are provided by municipal governments. Fires in the NWT and in the SGP communities contribute to fatalities, and a percentage of fires each year are suspected or confirmed as arson. Emergency measures plans to manage, for example, the need to evacuate a community due to forest fires or flooding, exist in all communities. All fire departments in study communities are volunteer except in Yellowknife.

Criminal Offences

Compared to other jurisdictions in Canada, the NWT has the highest rate of reported crime. The NWT Crime rate is close to three times the rate for the whole of Canada. Without offences against Territorial statutes such as alcohol offences, 26 offences per 100 population were reported in 1996 (Evans *et al.* 1998). If all offences are reported, the rate in 1996 was almost 42 per 100 population in the NWT. Crime rates in the SGP reflect NWT trends.

### *6.13.2 Potential Project-Environment Interactions*

Potential project-environment interactions that may result from construction and operation of the SGP TC include the following:

- Changes to the stability and predictability of social structures, organizations, and relationships at the individual, family, and community level;
- Changes to the distribution of and use of material goods;
- Changes in the quality of life and expressions of self-confidence and self-esteem;
- Changes in social behaviours and expressions of individual stress, alcohol and drug use, family violence and breakdown, gambling, and child-adult relationships; and
- Changes in the physical and mental health of various populations.

### *6.13.3 Likely Issues of Concern*

Environmental scoping meetings provided opportunities for residents to raise issues that likely will require further consideration if the SGP TC were to proceed.

- Increased vehicular activity in the SGP may threaten resident safety, human health, quality of life, and environmental integrity. Community residents in a number of SGP communities expressed concern for the potential of fuel and toxic substance spills on the land and water, and the potential effects of these substances to the health of wildlife and fish, and to the people who harvest and consume these resources. Other residents spoke of increased dust, emissions and noise resulting from more vehicular activity and the possible threats posed to the health of the SGP ecosystem.
- The SGP TC may place additional stress on already fragile social, economic and cultural environments, affecting the health and well-being of communities and individuals. There is concern about increases in population and the pressures that may be brought to bear on existing populations and infrastructure; and the potential for greater exposure to, and increased use of alcohol and illicit drugs. Residents who have experience with roads worry about the social stresses than can be created in communities as a result of these activities.
- Community residents, particularly in smaller communities, are concerned about the effects of the SGP TC on caribou, fish, and marine mammals harvests, particularly in cases where these resources are a primary source of food and/or nutritious food.

### *6.13.4 VSCs and VSC Boundaries*

The generally poor or uncertain health and well-being of the SGP population is a significant concern to community residents and governments. Significant resources are being invested in understanding health and well-being issues in SGP communities, and searching for innovative approaches and solutions to these problems. There is little agreement on the extent to which current health and well-being issues have been shaped by: the cumulative effects of a century of dynamic socio-cultural and economic activities; the extent to which all peoples have participated in and/or controlled socio-cultural change; or the pace and nature of contemporary globalization and economic forces. Regional communities continue to express concern for their social safety and security in light of the growing industrialization of the SGP.

It is the view of some Aboriginal people living in the smaller SGP communities that the health of the traditional economy is inextricably linked to the health and well-being of communities, families and individuals. Harvesting not only contributes to economic security, but maintains culture and individual self-confidence and esteem, and helps to shape social relationships and structures. The loss or diminishing presence of harvesting activities in the day-to-day life of some SGP residents may add to already poor and uncertain health and well-being conditions. Increasing industrialization may pose threats to the social well-being and security of more vulnerable individuals in the region. Given the extent to which social problems have been managed, mitigated, or eliminated in the past, regional communities continue to express doubts about the ability of modern day leaders and structures to manipulate social change for the benefit of all peoples. In Cambridge Bay, people spoke of the need to mitigate negative social effects through interventions which involve the whole family unit.

Spatial boundaries of assessment should encompass communities and residents in and adjacent to the SGP. Community participants have indicated that temporal boundaries should include not only the construction and operations of the SGP but also planning, closure, and post-closure phases.

### *6.13.5 Data Gaps and Future Study Needs*

Participants in environmental scoping meetings identified the need to monitor and mitigate potential health and social well-being effects of industrial activities in the SGP including the SGP TC, should it proceed. A set of community-based indicators (Parlee 1998) for use in monitoring change in the human environment in SGP communities has been developed in Lutsel K'e. Follow-up research is underway to measure changes in community health and well-being in that community. Further research should examine the extent to which the Lutsel K'e indicators can be applied to other communities. This research should ensure a better understanding of the relationships between changes in employment and labour income, alcohol and drug consumption and gambling, and the care, safety and dignity of family members.

## 6.14 Community Services and Infrastructure

### *6.14.1 Existing Conditions*

#### 6.14.1.1 Housing

In 1996, the average size of households in the NWT was 3.4 persons. The average size of households in SGP communities ranges from a low of 3.0 persons in Yellowknife to a high of 4.5 in Rae-Edzo. The Northwest Territories Housing Corporation reports that the lack of adequate, suitable and/or affordable housing remains an issue in the NWT and in many SGP communities. In 1996, the percentage of households lacking adequate, suitable and/or affordable housing (*i.e* incidence of core need) in the NWT was 23.2%, a rate which is approximately two times the national rate (Northwest Territories Housing Corporation 1997). Information collected on occupied private dwellings in SGP communities during the 1996 Census of Canada shows that slightly more than one-half (52%) of dwellings were constructed between 1981 and 1996; 47% are owned, and 53% are rented.

#### 6.14.1.2 Public Infrastructure

The level of public infrastructure in SGP communities varies depending upon the size of the community. Schools, fire halls, community halls, office space, health centres, maintenance garage bays and parking garage bays exist in most SGP communities. Larger communities (*e.g.* Yellowknife, Cambridge Bay, Kugluktuk and Rae-Edzo) have a higher level of infrastructure, including some or all of the following: arenas; curling rinks; above ground and in-ground swimming pools; and elders' facilities. The communities of Umingmaktok and Bathurst Inlet have little or no public infrastructure, while residents of Dettah and Ndilo also use public facilities in Yellowknife.

#### 6.14.1.3 Transportation

In 1994, there were approximately 2,200 km of all-weather roads and 1,300 km of winter roads maintained by the GNWT and another 800 km of private roads constructed to access mineral exploration and development projects. There are 52 public airports within the NWT. All SGP communities are accessible by air. Currently use of Rae-Edzo's private airstrip is limited to the winter season. Facilities and services range from very limited (Bathurst Inlet) to highly developed (Yellowknife).

Yellowknife, Dettah and Rae-Edzo are linked by all-weather road to southern Canada. Wha Ti and Rae Lakes are linked with Rae-Edzo by winter road, and an ice road across Yellowknife Bay connects Yellowknife with Dettah. Marine docking facilities exist in Yellowknife, Lutsel K̨e, Cambridge Bay and Kugluktuk. Supply barges destined for Cambridge Bay and Kugluktuk originate in Hay River or Inuvik. Hay River is also the origin of barges destined for Yellowknife and Lutsel K̨e. Materials are also shipped from Yellowknife to Lutsel K̨e.

### *6.14.2 Potential Project - Environment Interactions*

Potential project-environment interactions that may result from construction and operation of the SGP TC include the following:

- The demands of a larger, likely more diverse population due to in-migration, on the capacity of local infrastructure and services;
- Changes in local spending on goods and services and the effect on public and private infrastructure and services;
- Changes in capitalization for services and infrastructure in harvesting/renewable resources and other economic sectors;
- Changes in regional transportation and commodity (re)supply services and infrastructure;
- Changes in enrolment in education and training programs linked to industrial employment opportunities;
- Challenges posed to community socio-economic structures, organizations and relationships from new employment interests and conditions;
- Changes in demand for health and social services and infrastructure; and
- Changes in protection and public safety requirements.

### *6.14.3 Likely Issues of Concern*

Community participants commented on the potential changes in shipping routes and the effects on human and wildlife safety, and environmental protection. Community participants are worried about the personal safety of people using a road in the SGP. Residents worry that vehicles may break-down and that people may freeze. They are particularly concerned about the idea of shipping in Bathurst Inlet and the potential for accidents. Some suggested that there were safer shipping options (*i.e.* Coronation Gulf) compared to the navigational hazards of the narrow and island dotted Bathurst Inlet. Community participants indicated that regional development of infrastructure (roads and ports) must serve people in the regional communities. Some residents in Kugluktuk worry that the SGP TC may disrupt the resupply of other communities.

The development of transportation infrastructure in the SGP is predicated on clarity of land ownership including region/community boundaries. Currently, land ownership is unresolved in the southern areas of the SGP and boundaries are an issue throughout the region.

### *6.14.4 VSCs and VSC Boundaries*

In recent years, the capacity of community services and infrastructure has been influenced by community transfer initiatives, reductions in funding, and changes in local organizations and structures. In many regional communities, decision-making regarding the delivery of community services is being consolidated in locally elected human services boards. These boards are taking on more responsibilities and have greater accountability for meeting individual, family and community needs. In some respects, the work of human services boards is being taken on with limited financial resources. The construction and operation of a transportation corridor and the subsequent changes that may be induced in the human environment, may create new stresses and demands on local services. Regional residents worry that the human and financial resources may not be available to respond to

existing and new demands (*e.g.*, for renewable resources services, education and training services, protection and safety services, transportation services, health services, and family and social services).

The spatial boundary would encompass communities and residents in and adjacent to the SGP. Temporal boundaries should also include the closure and post-closure phase to examine the potential effects of issues such as reduced demand on infrastructure, implications of self-government and costs of excess capacity.

### *6.14.5 Data Gaps and Future Study Needs*

During environmental scoping meetings, residents in many communities questioned the need for the project and/or the need for a project based on finite mineral resources. As routing, feasibility and cost-benefit planning proceeds, updating of previous routing and shipping alternatives research (*e.g.* the Coronation Gulf port) may be necessary to satisfy the concerns of communities.

Many residents participating in the environmental scoping meetings were clear that decision-making respecting the development of transportation infrastructure, particularly of the magnitude of the SGP TC, must be undertaken within the context of the overall health of all elements of the region's ecosystem. Decision making must be linked to, for example, economic development strategies for the region; regional land use plans; and social-cultural cost-benefit studies. Presently, these plans/studies have not been undertaken for the whole of the SGP. While reference was made in some communities to the important role of mining and infrastructure development to the local/regional economy, no overall strategies or plans seem to be available that provide evidence of public support for this direction.

Many residents spoke of the need for people, particularly the elders, from the different communities to gather together to discuss this project. It was felt that this level of discussion would enable many of the potential impacts of this proposal to be identified. Other members identified the need to pursue the collection of traditional knowledge and share this information with decision makers.

Community participants suggested that there is a long recovery time for environmental damage and a need for contingency plans and emergency response capabilities.

### *6.14.6 Bibliography*


BHP Diamonds Inc. and Dia Met Minerals Ltd. 1995. NWT Diamonds Project Environmental Impact Statement. Yellowknife, NT.

Bureau of Statistics. 1998a. Labour Force - 1996 Census Results - Northwest Territories. Government of the Northwest Territories, Bureau of Statistics. Yellowknife, NT.

Bureau of Statistics. 1998b. NWT Community Profiles. Government of the Northwest Territories, Bureau of Statistics. Yellowknife, NT.

Canadian Association for Suicide Prevention. 1994. Suicide a Media Resource Book. Calgary, Alberta

Dogrib Treaty 11 Council, Renewable Resource Committee. 1997. Relationship Between Caribou Migration Patterns and the State of Caribou Habitat. Yellowknife, NT.

Evans, J., R. Hann, and J. Nuffield. 1998. Crime and Corrections in the Northwest Territories. Prepared for the Government of the Northwest Territories, Minister of Justice and Minister of Health and Social Services. Yellowknife, NT.

Giokas, John. 1993. *Accommodating the Concerns of Aboriginal People Within the Existing Justice System.* in Aboriginal People and the Justice System - Report of the National Round Table on Aboriginal Justice Issues. Canada Communication Group. Ottawa, Ontario

Health and Social Services. 1998. Suicide Statistics. Unpublished material, Department of Health and Social Services, Government of the NWT, Yellowknife.

Lutra Associates Ltd. 1998. Time on Assistance: A Study of the Patterns of Welfare Use in the Northwest Territories from 1984 to 1998. Unpublished Report. Prepared for the Government of the Northwest Territories, Department of Education, Culture and Employment. Yellowknife, NT.

Nicoll, M. 1993. Frontline Workers Survey - Summary Report of Findings from A Research Project Conducted for the Special Committee on Health and Social Services. Prepared for the Legislative Assembly of the NWT. Yellowknife, NT.

Northwest Territories Housing Corporation. 1997. 1996 Housing Needs Survey - Overall Results. Report No. 1, May 1997. Yellowknife, NT.

Norecon Ltd. 1997. NWT Economic Review and Outlook. Prepared for the Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development, Economic Planning. Yellowknife, NT

Office of the Auditor General of Canada. 1992. Comprehensive Audit of the Department of Health: A Report to the Legislative Assembly of the Northwest Territories**.** Ottawa, Ontario.

Parlee B. (in collaboration with Lutsel K'e First Nation). 1998. A Guide to Community-Based Monitoring for Northern Communities. Project Funded by Canadian Arctic Resources Committee and West Kitikmeot/Slave Study Society. Yellowknife, NT.

Resources, Wildlife and Economic Development. 1997a. Northwest Territories Economic Framework Sector Profile - Transportation & Communications (Draft). Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development. Yellowknife, NT.

Resources, Wildlife and Economic Development. 1997b. Northwest Territories Economic Framework Sector Profile - Wildlife (Draft). Government of the Northwest Territories, Department of Resources, Wildlife and Economic Development. Yellowknife, NT.

Statistics Canada 1996. Canada Census.

Status of Women Council of the NWT. 1992. Break the Silence...End the Violence: Family Violence Prevention Kit. Yellowknife, NT.

UMA and Associates.1998. Environmental Effects Report Socio-Economic Assessment. Prepared for Diavik Diamonds Project. Yellowknife, NT.

Sangris, F.1998. Traditional Knowledge Report. Prepared for Diavik Diamond Mines. Yellowknives . Dene First Nation.

# 7 CONCLUSION

## 7.1 Introduction

The DOT of the GNWT is preparing a strategy to plan for the development of a transportation corridor through the SGP for the purpose of mineral development and transshipment (DOT 1998). As presently conceived the transportation corridor would consist of an all-weather road linking the existing NWT highway system with the SGP and a port on the Arctic coast, likely in Bathurst Inlet (Figure 2.1).

This environmental scoping study has identified biophysical, social, economic, and cultural issues of concern to project stakeholders regarding the potential development of the SGP TC. Chapter 6 of this report documents preliminary Valued Ecosystem Components (VECs) and Valued Social Components (VSCs) selected on the basis of issues identified by project stakeholders. For each of the VECs and VSCs, the existing conditions are described; potential project-environment interactions are identified; likely issues of concern are documented (based largely on the issues reported in Chapter 5); boundaries for the assessment are proposed; data gaps identified; and future study requirements are discussed. This information will provide future proponents and regulators with the basis for confirming the scope of an environmental assessment of the proposed SGP TC, should the project proceed. The information included in Chapter 6 was developed based on the concept of the SGP TC as described in Chapter 3 of this report; however the information would also be of use to a proponent considering an alternative transportation corridor as many of the VECs, VSCs, issues, and concerns would be similar.

Additionally, this scoping study documents current regulatory and environmental review processes to which the project would be subject, should it proceed. The Nunavut, Mackenzie Valley, and *Canadian Environmental Assessment Act* environmental assessment processes are described and a likely scenario for environmental review of the SGP TC has been identified. Proponent requirements, timelines, and cumulative effects assessment requirements of a future assessment of the SGP TC are discussed.

The results of this scoping study, along with the other studies currently underway, will enable the DOT to develop a strategy for the development of transportation infrastructure in the SGP and assist future proponents in meeting environmental assessment requirements. A summary of the scoping project's major findings are presented below.

## 7.2 Development in the SGP

During the project, a number of different issues were raised regarding the potential development of the SGP TC (Table 5.4.1). While many of the issues raised were related directly to potential effects of the project on the natural and human environment, there were a number of recurring issues which, while related to the SGP TC, are broader in nature than the specific proposal and probably merit public discussion in advance of formulating a specific transportation corridor proposal. At a number of locations, the public questioned why the SGP TC was being considered now, and how it related to current economic or social policies of the GNWT. People expressed concern that money was being spent on studies for a potential mega-project to serve industry, before the public has had the opportunity to debate the merits of such a project. Several people stated that support by the GNWT for

a transportation corridor in the SGP implied support for non-renewable resource development over other forms of economic development. Additionally, a member of the public in Lutsel K'e questioned that if they supported the GNWT in acquiring authority over non-renewable resource development from the federal government, would the GNWT use resource revenues to fund the development of the Transportation Corridor, against the wishes of local people? The need for public debate on the kind of economic development desired for the NWT, and specifically the SGP prior to consideration of the SGP TC, was raised by a number of people.

Related to the question of project need was a concern that new road initiatives by the GNWT should be planned to benefit community residents rather than the mineral industry. Several people stated that mining is a short-term development, and that if public expenditures were to be made on transportation infrastructure, the infrastructure should serve the communities rather than the mineral industry. The potential of road access to lower the high cost of living in the Dogrib and Kitikmeot communities was raised on a number of occasions. Marine shipping into Bathurst Inlet raised concern in Kitikmeot communities and a number of participants felt that shipping to a port on the Coronation Gulf would be safer and present lower environmental risk. A representative of one GNWT department felt that road access to communities would help reduce program and service delivery costs. The potential for new communities to be developed along the corridor was raised in one public meeting.

Aboriginal people expressed frustration that they had no say in development and received few if any benefits from existing developments. During the scoping project, the Akaitcho Territory Tribal Council, representing NWT signatories to Treaty # 8, issued a public statement that they would not permit any further development on their traditional territory (including parts of the SGP) until they had settled a land claim agreement with the federal government. A consistent message was heard from representatives of Aboriginal and claimant organizations from Nunavut, the Dogrib Region and Akaitcho Territory – namely that they want to build, own, and control a SGP TC. In the case of the Akaitcho Territory Tribal Council, settlement of the land claim is their priority; however, once the claim is settled they may be interested in being involved in developing the road. In the Kitikmeot, the Kitikmeot Corporation (owned by Kitikmeot Inuit Association) and Nuna Logistics have proposed to construct a port at Bathurst Inlet and an all-weather road from the port to Lupin Mine and the Izok Lake base metal deposit. There appears to be little discussion of this proposal in the region.

Another significant concern raised during the public consultations was the need for more public consultation and discussion on the proposed SGP TC. The project could result in significant changes to the SGP, and the activities and lives of people, who for generations have traditionally used, and currently use the area. One person at a public meeting described the effects of a permanent road into the SGP as irreversible and that appropriate analysis and discussion is required prior to taking such irreversible actions. Information dissemination and public consultations were limited during the scoping project and consisted of distribution of a public information document throughout the communities of the SGP, staffing of an information booth at the 1998 Geoscience Forum in Yellowknife, and public meetings in eight communities. Public meetings were not held in the communities of Wha Ti, Rae Lakes, and Wekweti because the Chiefs of these communities requested that meetings not be held. At best, the public consultation conducted under this scoping project should be considered cursory. At many forums, it was the first time people had the opportunity to review any specific information about the project, allowing limited opportunity for consideration of potential effects. In some communities, most notably Bathurst Inlet and Umingmaktok, people had either not

heard of the GNWT or Nuna/KC proposals or were only vaguely aware that they were under consideration. Additionally, the nature of public meetings does not generally promote in-depth analysis of topics under consideration. A two day workshop held with the Lands and Environment Committee of the Yellowknives Dene First Nation provided the greatest opportunity for detailed analysis of the potential effects of the SGP TC. One of the strongest recommendations coming from the meeting in Dettah was the need to have elders from all areas of the SGP meet and discuss the merits and effects of the SGP TC. The need to involve youth in the consultation was also raised. Further public discussion regarding the need, rationale, and specifics of the SGP TC is required. Many people also felt that decisions regarding the proposed SGP TC should be made by those most affected by the project. Additionally, several participants in public meetings voiced their concern that a total cost/benefit analysis (including social and environmental costs) of the project is required before decisions about the project are made.

### 7.3 Project Specific Issues

The importance of the Bathurst Caribou Herd to the people of the study area was raised at all public consultations. Aboriginal cultures have depended on the caribou for many generations. Caribou continues to be an essential part of the diet of many Aboriginal residents of the SGP and the potential effects of the SGP TC on caribou was the most prevalent issue during public consultations. The proposed SGP TC covers most of the habitat of the Bathurst Herd from the calving grounds at Bathurst Inlet to the wintering grounds within the forested area north and east of Great Slave Lake. People are concerned that development of the corridor may change the migration patterns of the Bathurst Herd, resulting in abandonment of current habitat and/or decrease in herd size. Additionally, widespread concern was raised over the potential for increased harvesting of the caribou as a result of year-round road access to caribou habitat. Some people noted that a road would provide a smooth walking surface which could attract caribou and raise the potential for increased caribou mortality through vehicle/wildlife collisions. A change in migration routes or a decrease in population would have negative effects on Aboriginal harvesters and communities, other domestic harvesters, and the commercial operators providing services to sport hunters.

Providing all-weather access to the SGP was a significant concern among participants at all public meetings. The potential for unsustainable levels of renewable resource harvesting was the primary concern. The potential for unauthorized land uses springing up along the road and the loss of wilderness character as a result of the all-weather access was raised in several meetings. A connection to the existing highway system and essentially the rest of North America was perceived as undesirable by many. On the other hand, some people in the NWT and Nunavut felt that providing all-weather access to the SGP was critical to the economic development of the NWT and West Kitikmeot region of Nunavut.

The potential for increased levels of harvesting was a significant public concern. The potential for reduction of harvesting opportunities, displacement from current harvesting locations, potential restrictions on harvesting, compensation for lost opportunities, and the potential cultural effects were issues raised during consultation.

Concerns over wildlife other than caribou were also identified during the project. Several participants stated that where all-weather roads are developed wildlife populations and species diversity declines. Specific concerns were raised regarding grizzly bears, which are already in conflict with existing developments in the SGP. One of the most significant aspects a future environmental assessment of the SGP TC would have to address relates to wildlife habitat, particularly eskers. Eskers provide a less expensive source of road building material than can be acquired from a quarry operation. Substantial eskers exist in the SGP and provide important habitat for a number of species. The effects of material extraction from eskers on wildlife would be a significant issue to be addressed in a future environmental assessment. The project's effects on vegetation, including medicinal plants, roots and berries are a concern to residents of the SGP.

The marine shipping component of the SGP TC is only vaguely defined at present. The focus of this scoping study on the marine environment was Bathurst Inlet, the proposed location of a port. While hydrographic charting has demonstrated access into Bathurst Inlet is possible for ships, residents of the area expressed concerns regarding the safety of navigation and the potential effects of accidents on the marine environment. It was noted by one public meeting participant that the assessment of potential environmental effects of shipping should include the shipping routes west to Alaska and east to the Atlantic Ocean. The potential for extension of the shipping season into the period of ice cover raised concerns over the safety of on-ice travel by wildlife and residents.

The need for economic opportunities in the NWT and Nunavut was acknowledged by all stakeholders; however opinions about, the kind of economic development that should be pursued differed among people as discussed above. Most people expressed concern that the SGP TC and resulting developments have to provide local training and employment opportunities. The need for the project proponent to sign impact and benefits agreements with Aboriginal organizations was seen as a mechanism of ensuring local benefits. The potential to reduce the cost of living in communities through road access was a common theme in public consultations. Existing tourism operators in the SGP stated that development of all-weather road access would eliminate the wilderness experience they are selling. However, the SGP TC could create the potential for new road-based tourism in the SGP.

A number of potentially negative social effects of the SGP TC were identified during the project. People in some communities stated that their communities and cultures are currently in a state of change and the SGP TC would likely result in further change to the social environment. Specific concerns included: increased availability and use of liquor and illegal drugs; loss of cultural diversity and language; impacts to families; and changes to the traditional way of life.

In summary, the environmental scoping of the SGP TC identified a number of issues which would require attention during the environmental assessment of the project. The issues identified in this report are based on the concept of the SGP TC presented in Chapter 3 of this report. It is reasonable to expect that these issues would be relevant to most other significant transportation proposals in the SGP.

## 7.4 Regulatory and Environmental Assessment Requirements

There has been considerable change and evolution of the regulatory framework for environmental assessment, land use planning, and resource management in Canada's North in recent years, due to:

- New and revised federal legislation (*e.g.*, the *Canadian Environmental Assessment Act* (*CEAA*) and regulations, the *Mackenzie Valley Resource Management Act* (*MVRMA*) and regulations);
- The creation of Nunavut; and
- The finalization of Aboriginal land claims agreements (*e.g.*, Nunavut Land Claims Agreement (NLCA), Inuvialuit Final Agreement, Gwich'in Comprehensive Land Claim Agreement, Sahtu Dene and Metis Comprehensive Land Claim Agreement).

Through the land claim settlement process, jurisdictional responsibility over certain lands, resources, and land and water use has been, and is being, transferred to Aboriginal groups from the federal government (primarily the Department of Indian Affairs and Northern Development). Through land claims agreements and new federal legislation aimed at implementing provisions of the agreements, new regulatory bodies are being established with responsibility for regulating the use of settlement and Crown lands and water within settlement areas and in areas where no claims have been settled. Concurrently, new procedures and requirements are being established for the review of applications for permits and licences for the use of land and water. Permits, licences, and authorizations likely required for the SGP TC are identified in section 4.2 of this report.

The SGP TC as currently envisioned spans two jurisdictions: Nunavut and the Northwest Territories. Given the geographic extent of the SGP TC (as it is presently conceived), and the potential for significant public concern and local and transboundary environmental effects, it is reasonable to expect that a joint panel review will be warranted. Provisions for joint review are described in sections 4.4 and 4.5 of this report. In addition to these provisions, there have been discussions between NIRB and other environmental assessment authorities regarding the establishment of a "Northern Canada Convention on Environmental Impact Assessment" that would address coordination of environmental assessment functions. (The Canada-Wide Accord on Environmental Harmonization and Sub-Agreement on Environmental Assessment does not apply in areas where an environmental assessment process exists pursuant to a land claim agreement.)

A joint review process likely would be established through negotiations between NIRB, MVEIRB, the Canadian Environmental Assessment Agency, and the RAs pursuant to *CEAA*. An agreement between the parties may comprise a project-specific Memorandum of Understanding (MOU) (P. Scott, pers. comm. 1999) that specifies: the process to be followed; the roles and responsibilities of the proponent and of each party to the MOU; the scope of the project to be assessed; the factors to be considered in the assessment and the scope of those factors; the nature of public involvement; and a timeline for review and decisions by regulatory authorities, among other things.

It is possible that a future proponent may propose to develop only a portion of the SGP TC. For example, Nuna Logistics and the Kitikmeot Corporation have developed a proposal to construct a port on Bathurst Inlet and an all-weather road south from the port to existing mines. Such a proposed development may be located wholly within either Nunavut or the Mackenzie Valley. It is reasonable to expect that such a proposed development would generate significant public concern and, further,

that many of the issues raised in respect of the SGP TC, as noted above and in Chapter 5 of this report, would be relevant. Therefore, it is reasonable to expect that an environmental assessment (if in the Mackenzie Valley) and/or panel review (in either jurisdiction) would be required. Participation of either NIRB or the MVEIRB in the review of environmental effects of a project outside of their respective jurisdictions requires the approval of the Minister of DIAND.

Depending on the configuration of the proposed development, transboundary effects may be of concern. For example, the proposed development may affect the migratory Bathurst Caribou Herd and may have other effects on the adjacent jurisdiction due to increased access. However, as in this scenario the project would be located wholly within only one jurisdiction, it is not certain that a joint review panel (NIRB-MVEIRB) would be established. Rather, a review process may be established that accommodates the interests, and enables the participation of, the adjacent jurisdiction. For example, a project located wholly within Nunavut may be reviewed by a NIRB panel that includes representation from the MVEIRB (see Section 4.4.1). In this scenario, *CEAA* requirements may be met either through a joint panel (with one or both of NIRB and MVEIRB) or process substitution. If a joint review is conducted, an MOU or other agreement as described above may be established.

The environmental assessment undertaken must assess the potential cumulative effects of the project. As the SGP TC is intended to stimulate non-renewable resource development in the SGP, the cumulative effects assessment is expected to be a major component of the overall assessment. Requirements for cumulative effects assessments are only vaguely described in the Nunavut and Mackenzie Valley processes. The Canadian Environmental Assessment Agency provides more guidance with respect to cumulative effects assessment. One participant at a public meeting stated that unless an adequate cumulative effects assessment of the SGP TC can be done the project should not proceed. Future proponents and regulators will have to determine the spatial and temporal extent of the required cumulative effects assessment. A future assessment of cumulative effects should follow methodologies that have been tested in other jurisdictions and accepted by regulators.

Monitoring of project effects is a requirement of all three environmental assessment processes. Project proponents will have to monitor the environmental effects of the project and develop measures to mitigate unacceptable effects. Compensation for certain effects, such as lost harvesting opportunities, may be required in some cases. The need for, and scope of, future environmental compliance and effects monitoring programs will be determined through the assessment process. Similarly, mitigation, compensation and environmental protection measures would also be determined through the environmental assessment.

Environmental assessment of the project must incorporate both scientific and traditional knowledge. The Nunavut Impact Review Board is presently developing guidelines for the use of traditional knowledge in environmental assessment. Past environmental assessments carried out elsewhere in Canada also provide examples of how traditional knowledge maybe incorporated into an assessment. Residents of the area posses a significant amount of traditional knowledge which will assist proponents in assessing and mitigating or enhancing potential project effects.

## 7.5 Data Gaps and Future Study Needs

Available data regarding VECs and VSCs in the SGP are documented in this report and a listing of relevant documents is provided in a companion volume to this report. Data gaps and future study needs are identified according to VECs and VSCs in Chapter 6 of this report and are summarized below. Most of the studies recommended should be undertaken after the broad corridors presently under consideration are refined to a more specific route or routes; however, some regional level studies are also required.

Once a potential route or routes have been defined there will be a need to identify terrain types along the route with the objective of avoiding sensitive or unstable terrain. A granular resource inventory should also be prepared to assist in determining volumes and location of sources. Site specific geotechnical investigations will also be required to determine subsurface conditions at locations where structures will be constructed.

Micro-climate studies may be required at locations where specific structures are proposed to enable factors such as wind and snowdrifting to be addressed during project design. Additionally further research regarding the potential effects of climate change on the project and the project's contribution to greenhouse gas emission inventories should be conducted.

A detailed environmental study of the marine environment in the vicinity of the port will be required once a location is determined. Such studies should involve the collection of bio-physical and socio-cultural information and would facilitate the design and assessment activities.

The distribution of plant communities within the proposed SGP TC should be undertaken. After the route has been determined a field survey should be completed with the purpose of identifying rare or sensitive vegetation communities which should be avoided. Both regional and route specific wildlife habitat inventories should be completed to enable the potential effects of the project to be determined and assist with design and mitigation. Specifically the identification of breeding bird habitat and raptor nest locations is recommended.

After identification of potential routes, site specific studies should be undertaken to document and analyze water quality and quantity conditions and fish habitat and populations at watercrossings and water bodies potentially affected by project activities.

The coverage of archaeological survey data is incomplete for the SGP. Further review of available literature sources are recommended to identify all known sites in the vicinity of the proposed route. Upon completion of the literature review, field surveys would be required. With regards to current human use of the SGP, all current land uses should be documented in terms of their spatial and temporal extent.

A number of socio-cultural research initiatives are recommended to enable a thorough assessment of project effects, including:

- Recent subsistence hunting, trapping, and fishing activity trends in the SGP;
- The effect of industrial work activities on the family unit and other social structures within non-industrialized communities;
- The short and longer term effects of an increasingly industrialized economy and participation in this economy, to Aboriginal peoples, for example, in terms of harvesting patterns, country food consumption, diet, lifestyles, emotional/physical well-being and continuity/strength of culture/language; and
- Evaluation of the applicability of indicators of community change identified in Lutsel K'e;

However, prior to proceeding with site specific studies and project design it is recommended that a thorough public consultation program be developed and implemented to provide SGP residents with more information about the project and its relationship with economic development in the NWT.

It should be remembered that the need to collect baseline data well in advance of applying for project approvals and environmental assessment was emphasized by environmental assessment agencies in the NWT and Nunavut.