

**SLAVE GEOLOGIC PROVINCE TRANSPORTATION CORRIDOR
NEED/FEASIBILITY STUDY**

FINAL REPORT

Government of the Northwest Territories

**Arthur Andersen LLP
Simons International Corporation
Aboriginal Engineering Limited
Enfotec
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TRANSPORTATION CORRIDOR NEED/FEASIBILITY STUDY
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A strategic objective of the Department of Transportation of the Government of the Northwest Territories (GNWT) is to create new transportation infrastructure to promote economic development. To meet that objective, the Department of Transportation is undertaking a number of transportation planning initiatives and studies including need and feasibility assessments, and engineering, environmental, benefit-cost analyses and financing studies. One of the transportation initiatives being studied is the Slave Geologic Province (SGP) Transportation Corridor.

Arthur Andersen in association with Simons International, Aboriginal Engineering Limited, Enfotec, and McCormick Rankin Corporation* were contracted in September, 1998 to undertake the Slave Geologic Province Transportation Corridor Need/Feasibility Study. The Slave Geologic Province (SGP) covers approximately 190,000 square kilometres of land in the region of the Northwest Territories extending north from Yellowknife to the Arctic Coast in a band approximately 300 kilometres wide. The SGP is generally rich in mineral deposits and is recognized as having significant potential for gold, base metals and diamond production. Mineral development in the SGP, however, has been somewhat constrained by the existing transportation system. Specifically, while the southern portions of the Province are accessible by all-weather roads, parts of the northern portion are only accessible by privately developed winter roads, and no road access is available in many other parts of the SGP.

The overall purpose of this study is to examine the need and the feasibility of a transportation corridor into or through the SGP, and to propose appropriate structures for implementing the project. Specifically, the objective of this study is to take a 'high-level' look at the need and feasibility of improved transportation infrastructure in the SGP, and provide recommendations for advancing the project. The study involves an assessment of project need, routing, level of service, construction phasing, major constraints to development, financial viability and financial arrangements. This study will provide strategic direction for future transportation investments in the SGP for the Government of Northwest Territories and, as of April, 1999, for the

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newly created Government of Nunavut, whose mandate will include transportation planning responsibilities for the northern portion of the SGP.

Key analyses of the study are outlined below.

Mining Potential of the Slave Geologic Province is Enormous

The Northwest Territories was ranked as having the greatest mineral potential of all of the provinces and territories in Canada based on a survey of mining companies undertaken by the Fraser Institute in 1997. The SGP is the richest and most promising mining region within the Northwest Territories.

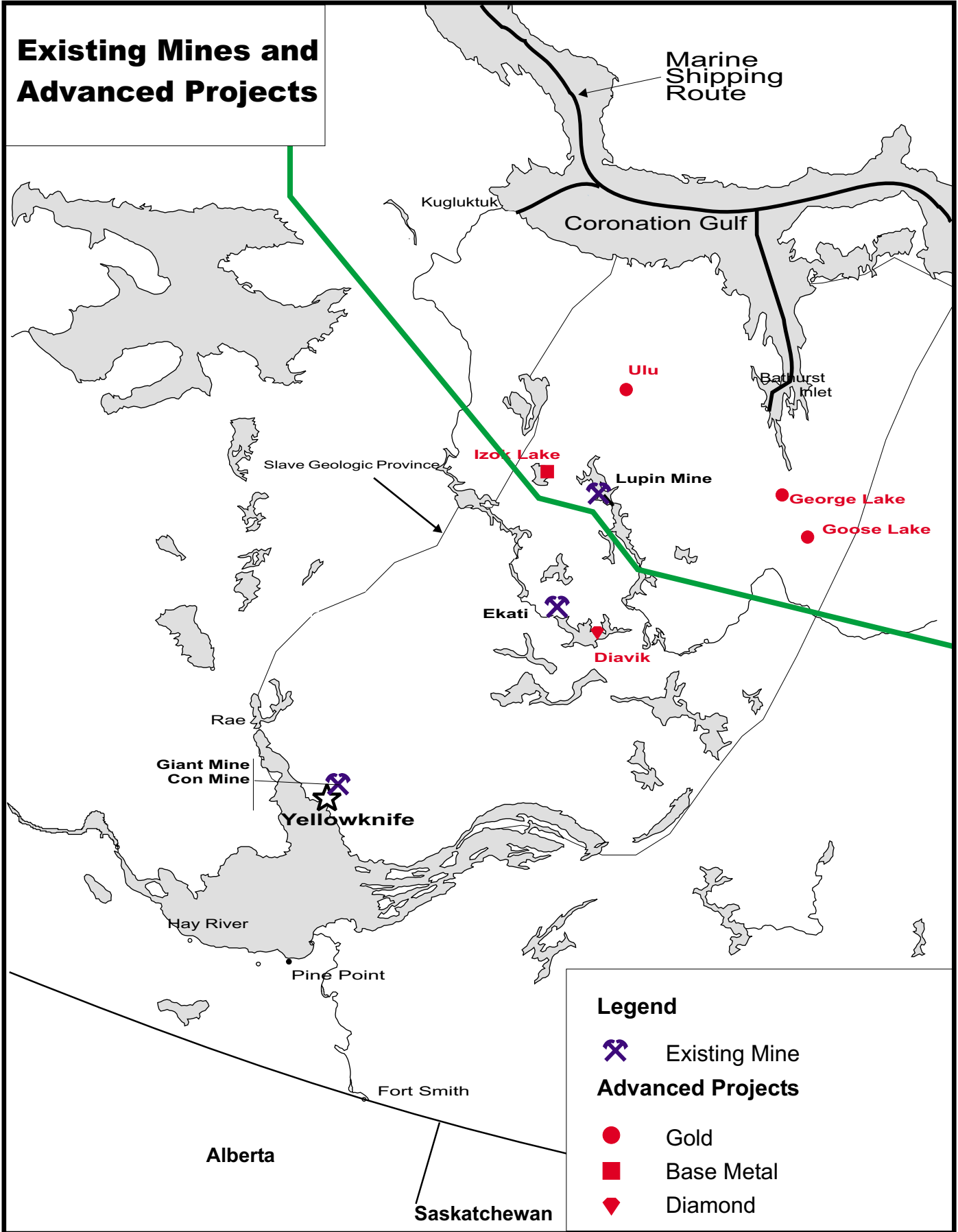
Over the past couple of years the exploration expenditures in the Northwest Territories represented over 20 percent of the total dollars spent on mineral exploration in Canada. This is because of both the increased level of activity and the higher cost of exploration as a result of limited seasonal access.

The importance of recent discoveries as a factor in the funding of future explorations is best illustrated by the increase in exploration activity in Newfoundland and the Northwest Territories following the discoveries of Voisey's Bay and Ekati. Exploration expenditures in the Northwest Territories increased from \$43 million to \$101 million between 1992 and 1993. In Newfoundland, expenditures increased from \$12 million in 1994 to \$71 million in 1995.

To place the mineral potential of the SGP in the long term context, the SGP can be compared to the Abitibi Geologic Province in northern Ontario and Quebec, where more than 100 mines have been developed over the last 100 years. Thus, much of the SGP and surrounding areas are yet to be explored.

Currently there are over 30 mining "projects" in the SGP at various stages of development (see the attached table and map). The table itemizes the existing projects, commodity of interest and the stage of development. The map shows the location of the existing mines and projects.

Existing Mines and Advanced Projects



Legend

-  Existing Mine
- Advanced Projects**
-  Gold
-  Base Metal
-  Diamond

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The foregoing show that a large number of the projects are still in the exploration stages, and of these, only about five are currently considered active. The reasons that the others are inactive include lack of exploration funds due to poor economic conditions, the resource/reserve estimates are currently economically unviable without either additional drilling or improved infrastructure, or current owners are restructuring and properties are in the process of being vended. The improvement of transportation infrastructure in the north will reduce the costs of exploration and increase the probability of some of these properties being put into production. However, it should be noted that a property in the exploration phase can be five to ten years away from production.

Mineral Projects in the SGP

Project/ Mining Operations	Commodity	Status
Lupin	Gold	Operations currently suspended due to decline in gold prices. Estimated mine life of 6 – 8 yrs.
Ekati	Diamonds	Began production in October 1998.
Advanced Projects – feasibility Study underway or completed		
Diavik	Diamonds	Feasibility study near completion.
Ulu	Gold	Feasibility study complete, awaiting improvement in gold prices.
Izok Lake	Base metals	Feasibility study complete, current owners looking to sell property. Feasibility study indicates that the project economics cannot withstand the additional infrastructure costs.
George Lake	Gold	Feasibility study started but put on hold due to decline in gold price. Will benefit from improved infrastructure.
Thor Lake	Rare Earth	Application has been made for a Water Licence.
Advanced Exploration Projects – Pre-feasibility study stage		
Boston	Gold	Awaiting improvement in economics before going to feasibility study. This project is on the eastern shores of Bathurst Inlet and will only benefit from the port infrastructure.
Damoti Lake	Gold	May move to pre-feasibility or feasibility. Awaiting for improvement in gold price.
Gondor	Base Metal	Associated with Izok Lake deposit. Would be mined after Izok Lake deposits.
Jericho	Diamonds	Drilling program underway and initial studies completed.
Nicholas Lake	Gold	Property could go to feasibility study, if gold prices improve.
Exploration Projects		
Boot Lake	Gold	Status of property unknown.
Back Lake	Diamonds	Exploration programs underway, work on the property is progressing
Coronation Gulf	Gold	Diamond drilling complete and preliminary ore resource calculation completed.
Camsell Lake	Diamonds	Exploration programs underway, work on the property is progressing

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		The collection of a bulk sample is planned in 1999.
Epworth	Base Metal	Exploration programs underway, work on the property is progressing
High Lake	Base Metal	Diamond drilling complete and calculation of ore resources done.
Hood River	Base Metal	Could possibly be exploited if Izok put into production.
Kennady Lake	Diamonds	Work on this property is progressing. The collection of a bulk sample is planned in 1999.
Kim/Cass	Gold	Status of property unknown.
Mackay Lake	Diamonds	Exploration program underway, work on the property is progressing.
Mazenod Lake	Base Metal	A scoping study was completed in 1998. This project is also near existing transportation infrastructure.
Musk	Base Metal	Requires additional exploration work before moving project forward.
Pistol Lake	Gold	Western shores of Bathurst Inlet would only benefit from port infrastructure.
Russell Lake	Gold	Near the highway between Rae and Yellowknife.
Sunrise	Base Metal	Diamond drilling complete and preliminary resource estimates calculated.
Tundra (Fat)	Gold	Exploration program currently underway.
Turner Lake	Gold	Some diamond drilling completed.
Wreck Lake	Copper	Early exploration stage.
Yava	Base Metal	Early exploration stage.

Source: Simons International 1998

Availability and Cost of Transportation is an Impediment to Mining Developments

The accessibility of transportation infrastructure is an important aspect in all phases of a mining project, from initial grassroots exploration through to operations. Accessibility to good transportation infrastructure can result in easier project planning, reductions in capital and operating costs, and reduction in project risks. Without good transportation access, generally only the richest gold and diamond ore bodies will be developed and the development of any base metal operations is unlikely.

Transport costs are part of the cost of all mining developments from the initial exploration through construction to ongoing operations. The relative importance of transport costs to the overall mine economics varies with the location of the mine and the size and type of mineral(s) being mined. Transportation costs are estimated at 1 percent to 2 percent of the cost of construction for all mines. During the mine operation phase, transportation costs make up a much higher proportion of the costs: 10 percent to 15 percent for a diamond or gold mine, and 20 percent to 25 percent for a base metal mine.

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The following general points can be made about the impact of availability and cost of transportation infrastructure on mining development in the Northwest Territories.

- The capital costs associated with the transportation typically include the costs for an airstrip and in some cases, particularly base metal mines, the costs for roads and ports and the cost of additional storage facilities associated with winter road access.
- Limited (seasonal) access translates into increased working capital requirements for supply inventories, and in the case of base metal mines, product inventories.
- Most mines do not require an all-weather road during the construction phase. An all-weather road would reduce construction schedule risks, but have only a marginal impact on the project's capital cost.
- During the operations phase of diamond, gold and base metal mines, the vast majority of inbound cargo consists of fuel for power generation. The products of gold and diamond mines are transported by air. However, the ore concentrates produced by base metal mines must be transported to smelters, largely based in Canada, and accessed primarily by ocean going ships.
- For diamond mines, an all-weather road is not required. The high quality of the ore reserves and the limited supply requirements mean that winter roads can be used, as long as the winter road(s) can handle the increased traffic volumes. This is also true for a majority of gold mine projects.
- The base metal mines ship out large quantities of ore concentrate, and must therefore have access to a port and preferably an all-weather road. It should be noted that most of the base metal mines developed in the Northwest Territories to date, including Polaris and Nanisivik, are on tidewater.

Whether lower transport (truck and air freight) costs incurred in the SGP will turn a given mineral deposit in the SGP into a viable mine cannot be determined without assessing the specifics of each case. Although transport costs are known to be high in remote regions, the costs may be

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offset by higher grade ores or other factors that make the overall mine costs competitive. What can be generalized is that lower transport costs will always enhance the economics of a mine. In some cases, assuming other factors being equal, then the availability of cheaper transportation infrastructure elsewhere in Canada or abroad may be the deciding factor in where the mining companies may invest.

Forecast of Mineral Development Scenarios and their Transportation Needs

Four phases of mining development in the SGP were forecast over the next 20 years, based on consultation with the mining companies operating in the SGP, and a review of current mining activity, and the current status of the projects. It should be noted that a mineral property in the exploration phase can be five to ten years away from production, assuming everything falls into place as expected.

The transport needs for each assumed phase of development is as follows:

Phase #1 (year 1999) represents the current scenario, with two mines, Ekati and Lupin, in operation (for this analysis it has been assumed that the Lupin mine is operational). There are no compelling additional transport needs for this phase. No all-weather road is required. Improvements to the Lupin winter road would be welcomed by the existing mine owners provided they would lower annual costs.

Phase #2 (years 2000 - 2010) assumes that Ekati and Lupin, as well as a second diamond mine (Diavik) and one base metal mine (Izok Lake) are operating. All-weather transportation infrastructure would have to be developed in order for the base metal mine to be put into production. An Arctic port accessed by an all-weather road from a point near the new base metal mine and new ice-breaking bulk carriers are prerequisite transport needs to service the base metal mine. The existing Lupin winter road has the capacity to handle the construction and operation of Diavik's new diamond mine. Some improvements to the capacity and/or operations of the winter road would be helpful.

The existence of the northern port and all-weather road is likely to mean that the majority, but not all, of the fuel currently brought from Edmonton via the winter road, could start being transported via the

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northern port and all-weather road because of cost savings. Most of the supplies for all mines, including Izok Lake, will continue to be transported from southern Canada via the winter road.

Phase #3 (2005 to 2015) assumes that a third diamond mine and an additional gold mine (possibly George Lake) are in operation.

A new winter road from the south to the new mines and/or improvements to the existing winter road will be required to service the increased traffic.

No detailed analysis has been undertaken in this study relative to the winter road capacity but it is a critical issue which needs to be followed up. A separate study which examines the existing design and operating rules and reviews the options available for increasing the capacity of the winter road should be carried out. Possible options include: improving the portages, extending the all-weather road north by 30 km, twinning the lake sections, and changing the operating rules.

The location and magnitude of additional winter road capacity can only be determined when the number, location, timing, and size of the new mines is known.

Phase #4 (years 2010 - 2020) assumes that an additional base metal mine (in the Nunavut part of SGP) is in production and one of the diamond projects proceeds to the underground phase of development. Thus seven mines will be operating in the SGP.

The forecast tonnages indicate that if seven mines are operating in the SGP (in Phase 4) the inbound tonnages, although still relatively small, would almost certainly require more winter road capacity than exists at present. Each mine will need to have at least winter road access from the south for both the construction and operation phases when most commodities other than fuel and some of the fuel would still be sourced from southern Canada. The outbound tonnages by road in Phase 4 are made up solely of concentrates from two base metal mines and must rely on the northern all-weather road and port.

At this level of activity it would be beneficial to upgrade the southern winter road connection to an all-weather standard. It should be noted that the relatively small amount of traffic generated by the diamond and

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gold mines will not be sufficient to finance the southern all-weather road through tolls alone.

Tourism

Key findings related to tourism are as follows:

- Improved access, particularly to the scenic areas such as along the East Arm of the Great Slave Lake and other lakes in the SGP, could benefit tourism by providing opportunities for further development of trails, parks and eco-tourism opportunities. Some types of tourism, such as recreational vehicle based tourism, may benefit from improved access, while other types, such as those that are dependent on remoteness, may be adversely affected.
- Ultimately, the level of economic benefit from increased tourism associated with a new transportation corridor will depend on whether the development will result in additional people visiting the region or visitors extending their length of stay – either of which would have a positive effect, as more money would be spent in the Region.
- Further analysis of impacts on the tourism industry and the extent and distribution of benefits should be undertaken as part of a detailed benefit-cost analysis study. An assessment should be undertaken of whether the availability of a transportation corridor would encourage visitors to extend their length of stay and visit parts of Nunavut (or the NWT) via the SGP transportation corridor. Consideration should also be given to the need and demand for additional tourism infrastructure along specific areas of the SGP, and near the port at Bathurst Inlet. Finally, consideration should be given to the impact and opportunities for tourism that would be associated with the presence of a port facility at Bathurst Inlet.

Financing Feasibility of an All-Weather Road

Key findings of the Financial analysis are noted below:

- A mine located near Contwoyto Lake is assumed to pay tolls on 320,000 tonne/year ore concentrate at an estimated unit price of \$0.125 per tonne-km, and at \$0.10 per km of fuel for the use of an all-

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weather road to a port on Bathurst Inlet. On that basis, the all-weather road from Contwoyto Lake to a port at Bathurst Inlet (similar to that proposed by Nuna Logistics) could be mostly self-financing.

At an assumed private sector borrowing rate of 12.5 percent, the toll revenues would cover 93 percent of capital costs at \$300,000/km road construction cost, and 56 percent of capital costs at \$600,000/km road construction cost.

At the government borrowing rate of 5.5 percent, the corresponding figures would be 179 percent and 108 percent, respectively.

- Because the traffic volumes generated by diamond and gold mines are much smaller, the corresponding figures for an all-weather road for the southern section of the corridor from Rae/Yellowknife would be between 2 percent and 8 percent.

- If an all-weather northern road and port are built, an estimated 80 percent of the fuel import by the SGP mines could come from the north; and the remaining 20 percent from the south via the winter road. The reason as explained below is a substantial saving in cost. Most of the other mine supplies are assumed to continue to be shipped from southern Canada via the winter road.

The following table compares the overall costs to the Ekati mine under the existing winter road system to the costs under a new port and all-weather road system.

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	Existing System Fuel Cost at <u>Ekati</u> (¢ per liter)	New System Fuel Cost at <u>Ekati</u> (¢ per liter)
Purchase Cost in Edmonton/Off-shore	22¢	20¢-22¢
Ocean Freight to Port	-	7¢
Rail Costs to Hay River	3¢	-
Trucking Costs Hay River to Yellowknife	5¢	-
Trucking Costs Yellowknife to Ekati /Port to Ekati	7¢	4¢
Toll/User Fee for Winter Road	4¢	0¢
NWT Petroleum Taxes	<u>0 – 10¢</u>	<u>0 – 10¢</u>
Total Purchase Cost	41¢ - 51¢	31¢ - 43¢

The cost savings could be as much as 10¢ per liter which equals \$119 per tonne. A single mine using 40,000 tonnes of fuel per year could save up to \$4.8 million per year in transport costs alone using the new system. In Phase 4, the total savings of all the mines could be as much as \$24 million per year. In addition, a single mine such as Ekati could save up to \$20 million in working capital if fuel could be brought in year round. A large portion of these savings could be used to pay for the operating costs of the new transport system in the form of a toll or user fee which in the above table were assumed to be 0¢.

Further savings for the base metal mines could be realized if the concentrate trucks could be designed to carry fuel back from the port on the return journey to the mine. These savings would accrue to the mine developers and stimulate more investment.

- It is noted that the construction of an all-weather road in the north and port at Bathurst Inlet will be to the Western NWT's eventual benefit. It will lower costs and spur additional development both east and west of the border, which may eventually lead to the upgrading of the southern winter road to an all-weather road. In addition, the flow of supplies from southern Canada to mines on both sides of the border will occur through the Western NWT, and benefit the economy.

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Route Location (Rae vs Yellowknife)

There has been much local discussion related to the issue of whether an all-weather road from the south to the north should start at Rae or at Yellowknife. In addressing this issue, which cannot be resolved at this point, there are many factors which should be considered:

- The Rae versus Yellowknife question does not need to be answered yet. There is no compelling short-term reason for this road from a transport needs perspective. Long-term needs will depend on the amount of mining development in the SGP and whether a base metal mine/port/road development proceeds in Nunavut.
- The routing of the all-weather road would have to be agreed jointly by the financing parties. Until these parties are known, the route, which will also depend on the mines to be accessed, cannot be finalized.
- The costs of the road could vary considerably depending on its start point.
- A number of socio-economic, environmental and cost factors will need to be considered in determining the optimal route for the transport corridor.

Transport System Vision

It is recommended that the governments of both Nunavut and the Western NWT have a clear vision of the overall SGP transport system that will best suit both their needs. Such a vision can be used to solicit both public and private support for the difficult financing and approval processes which lie ahead.

Assuming that a base metal mine, Arctic port, and all-weather road goes ahead in Nunavut, what should the transport vision be for the Western NWT? Given that there is no pressing need for new transport facilities and no immediate prospect of a base metal mine requiring additional transport facilities in the Western NWT, the vision must be a long-term one that takes advantage of the opportunities created by the Nunavut system. In particular, there could be significant savings to Western NWT mines if fuel was imported through the port. However, those savings

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could be realized only by the mines with winter road connections to Nunavut. An all-weather road connecting the Rae/Yellowknife area with the Nunavut all-weather road (into which the mines could connect) would lower both fuel transport and fuel inventory costs for the mines. Also, an all-weather road would allow year-round tourist and local traffic and could eliminate the short winter trucking season for new mines under construction throughout the SGP.

Although the benefits described can only be estimated until the number, location, timing, and type of new mines are better known, it is recommended that the long term transport vision for the Western NWT be an all-weather road that connects into the Nunavut all-weather road from the Rae/Yellowknife area.

Nunavut Transport System

The transport system proposed for Nunavut is a deep-sea port on Bathurst Inlet connected by an all-weather road to a point on the south end of Contwoyto Lake. This system, shown on Exhibit 4.6, would be required from the year 2000 to 2010 to meet the transport needs of Phase 2.

The transport system could be put in place immediately if the Nunavut government wished to take on the risk associated with constructing the transport infrastructure without a specific mine development to support it. Given the extremely high costs, a more acceptable alternative would be to find a base metal mine and port developer and shipper with a willingness to partner with the Nunavut government in financing the transport system and to proceed jointly with the mine and transport system development.

The expected level and type of traffic and the cost considerations of the public/private partners would dictate the design of the port road. The financing partners would determine the specific routing of the road.

Western NWT Transport System

The transport system proposed for the Western NWT is improvements to the existing winter road as dictated by the findings of a detailed winter road capacity study as previously suggested and an all-weather road from the Rae/Yellowknife area to join the Nunavut all-weather port

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road. The all-weather road should only start when the Nunavut road is in place and be completed to meet the needs of Phase 4 expected in the year 2010 to 2015.

Summary and Follow-Up Studies Required

The following points are provided to summarize the follow-up activities required.

The SGP Transportation Corridor should be marketed as Investment in Long Term Well-being of Canada and the North

Some 31 mining projects are at various stages of development in the Slave Geologic Province, including one project which is currently operational, one on stand-by, five projects which have feasibility studies either underway or completed, five additional projects which are at the pre-feasibility stage, and 19 projects which are at the exploration stage.

Clearly, the development of the SGP Transportation Corridor will improve the operating economics of a number of these projects, through a combination of reduced transportation costs and reduced fuel costs, and the combination of these potential savings may cause a number of projects to proceed to more advanced stages.

As a result, the proposed roadway should not be viewed in isolation of the broader direct benefits which it is able to generate, including the increased tax revenues which would therefore accrue to the Federal Government from increased mineral exploration and mining activity, and which presumably could then be redirected from Ottawa to the NWT and Nunavut as their contribution to this roadway. As stated previously, the magnitude of such impacts should be reviewed as part of any subsequent research initiated to more precisely quantify the expected financial performance of the roadway.

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Cooperation between the Western GNWT, Nunavut Government is Essential

The Slave Geologic Province transportation corridor is a single “transportation system” located in two territories. The portions in one territory cannot be developed in isolation of the other. Therefore, it is essential that formal coordinating mechanisms be established between the responsible departments in the two territorial governments.

Continued Liaison with the Aboriginal Groups, Federal Government and the Mining Industry is Required

Additional Studies and Analyses are Required

These include, among others:

- Economic Impact, Taxation Revenue and Benefit-Cost Analysis;
- Winter Road Capacity Analysis;
- Discussion and Analysis of Policy and Operational Aspects of the Winter Road from a Western GNWT Viewpoint;
- A Detailed Tourism Opportunity and Impact Study ;
- An Investment-Calibre Financial Analysis (to be conducted after further discussions with the federal government, Nunavut government, Aboriginal Groups, Mining Industry, etc.).

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SECTION 1.0 – INTRODUCTION

BACKGROUND

A strategic objective of the Department of Transportation of the Government of the Northwest Territories (GNWT) is to create new transportation infrastructure to promote economic development. To meet that objective, the Department of Transportation is undertaking a number of transportation planning initiatives and studies including need and feasibility assessments, and engineering, environmental, benefit-cost analyses and financing studies. One of the transportation initiatives being studied is the Slave Geologic Province (SGP) Transportation Corridor, which is the subject of three specific studies: Multi-Level Mapping and Route Analysis; Environmental Scoping, Existing Data Collection, and Regulatory Identification; and a Corridor Need/Feasibility Study.

Arthur Andersen in association with Simons International, Aboriginal Engineering Limited, Enfotec, and McCormick Rankin Corporation* were contracted in September, 1998 to undertake the Slave Geologic Province Transportation Corridor Need/Feasibility Study. The Slave Geologic Province (SGP) covers approximately 190,000 square kilometres of land in the region of the Northwest Territories extending north from Yellowknife to the Arctic Coast in a band approximately 300 kilometres wide. The SGP is generally rich in mineral deposits and is recognized as having significant potential for gold, base metals and diamond production. Mineral development in the SGP, however, has been somewhat constrained by the existing transportation system. Specifically, while the southern portions of the Province are accessible by all-weather roads, parts of the northern portion are only accessible by privately developed winter roads, and no road access is available in many other parts of the SGP.

The overall purpose of this study is to examine the need and the feasibility of a transportation corridor into or through the SGP, and to propose appropriate structures for implementing the project. Specifically, the objective of this study is to take a 'high-level' look at the need and feasibility of improved transportation infrastructure in the SGP, and provide recommendations for advancing the project. The study involves an assessment of project need, routing, level of service, construction phasing, major constraints to development, financial

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viability and financial arrangements. This study will provide strategic direction for future transportation investments in the SGP for the Government of Northwest Territories and, as of April, 1999, for the newly created Government of Nunavut, whose mandate will include transportation planning responsibilities for the northern portion of the SGP.

Key questions that need to be addressed in assessing the need for, and feasibility of, a Transportation Corridor through the SGP include:

- Is there a need for a transportation corridor into the SGP? If so, what is the most efficient and effective mode of transportation and which mode will result in the greatest overall economic benefits in terms of the mining sector and other types of economic activity such as tourism?
- What level of service is required for road access – a winter road, fair weather road, or all-weather road? What is the optimal phasing of development of the transportation corridor?
- What is the best transportation route that maximizes exposure to existing mines, known mineral deposits, areas of high mineral and tourist potential?
- What are the benefits and drawbacks of the transportation corridor during construction and operation?
- Who will pay for the transportation corridor? What are the options for financing and phasing the transportation corridor? What is the optimal role for public-private partnering? What is the likely outcome and likelihood of construction proceeding under each scenario?
- What is the marketability of the project to various stakeholders and what future strategies are needed to implement the project?

The main body of this report is structured as follows:

Section 2.0 provides a summary of the stakeholder consultation for this study including consultation with Mining, Transportation, Tourism/Economic Development, and Aboriginal stakeholders.

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Section 3.0 documents areas of economic activity in the Slave Geologic Province, including a review of mining and tourism activities within this area.

Section 4.0 provides an analysis of transport options and the needs assessment. It includes a review of transportation volumes and costs, and a summary of the advantages and disadvantages of different transport options including road, rail, and shipping. It also identifies the best combination of modes and phasing of development of the transportation corridor. Key findings and conclusions of the Needs Assessment and Routing phase are summarized in this Section.

Section 5.0 provides a review of the merits of different Financing options.

Section 6.0 provides a scoping of the economic benefits and dis-benefits associated with improved transportation infrastructure in the SGP.

Section 7.0 summarizes conclusions and recommendations for future work.

The Appendices of this report are structured as follows:

Appendix 1 provides the stakeholder consultation interview guide and list of interviewees.

Appendix 2 provides a discussion on the relationship between transportation and mineral development.

Appendix 3 provides information on Ice Roads in the Northwest Territories.

Appendix 4 provides an overview of Arctic Shipping.

Appendix 5 provides detailed financial tables and assumptions used in the assessment of financing options.

Appendix 6 lists background studies and reports used in this study.

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SECTION 2.0 – STAKEHOLDER CONSULTATION

APPROACH AND KEY FINDINGS

A significant component of the Needs Assessment and Routing Phase of the study was consultation with key stakeholders including representatives of the mining industry, transportation industry, area economic development and business groups, and Aboriginal groups. The purpose of these consultations was to obtain information on economic activity within the study area and to solicit comments on key issues. These consultations were also used as an opportunity to obtain some preliminary input on the level of interest and ability of the groups/organizations in public-private partnering and different financing arrangements for the transportation infrastructure.

A discussion of the key issues identified during the stakeholder interviews is summarized in this section. Information pertaining to the interests of different stakeholder groups in public-private partnering and financing the transportation infrastructure is used in the analysis of financing options, and discussed in Section 5.0 of this report. A copy of the interview guide and list of interviewees is provided in Appendix 1.

Mining Companies

Representatives of the majority of the mining companies operating or exploring in the SGP were interviewed during the study. These included representatives of Lupin, Ekati, Diavik, Izok Lake, George Lake and various other mining interests (see Appendix 1).

Key findings of these interviews included:

- Improvement to the level of transportation infrastructure in the Northwest Territories is not deemed a necessity for the existing and proposed diamond mines – representatives of Lupin, Ekati and the proposed Diavik operations all indicated that these operations are viable with the current transportation infrastructure.
- The development of all-weather transportation infrastructure is a necessity for the development of Izok Lake and other potential base metal opportunities.

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- The SGP is an attractive area to mining companies from a geological standpoint, however, the lack of good transportation infrastructure and land tenure issues are disadvantages of this area for mining operations.
- The routing of the transportation corridor is a key issue in terms of the degree of benefit it can bring to mining operations - two potential transportation corridors were identified; both corridors are dependent on the port location – Kugluktuk (Coppermine) or Bathurst Inlet. Representatives for Izok Lake and from Rhonda Mining prefer the northern portion based on their project economics.
- The design and operation of the transport system must be dictated by the requirements of the mining operations.
- Representatives of the mining operations indicated that up-front capital funding for the transportation corridor is unlikely to come from the mining companies. In the view of interviewed mining stakeholders, the only potentially feasible financing scheme is payment of ongoing maintenance and operating costs for the infrastructure, plus recovery of capital, by a user fee or toll.

Transport Companies

Representatives of all of the major transport companies now operating in the SGP/Arctic were interviewed during the study. These included representatives of:

- Northern Transportation Co. Ltd. (tugs and barges)
- Fednav Limited (deep-sea shipping)
- RaiLink Ltd. (rail freight)
- Robinson Enterprises Ltd. (trucking)
- Nuna Logistics Ltd. (ice road operation)

As expected, none of the companies were opposed to improving the transport infrastructure in the SGP and all wanted to be involved in whatever process was used to accomplish such improvements. As was not expected, all these companies could see the logic of a northern supply option and even those companies that could potentially lose

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business to such an option (e.g., RaiLink, NTCL, and Robinson Enterprises Ltd.) indicated that the resulting increased mining activity would more than compensate for any such short term losses.

Key issues identified during these consultations are outlined below:

- ❑ The need for on-going consultations and information regarding transport infrastructure changes was considered critical for companies that have a large number of employees working in the area.
- ❑ The political reality of the SGP with respect to Nunavut and the Northwest Territories must be addressed by any proposed transport system.
- ❑ The design and operation of the transport system must be dictated by the needs of the users.
- ❑ Public/private partnership funding of the transport system is seen as a prerequisite to its implementation. For example, three of the companies expressed a willingness to become involved in the public/private partnership process and one offered to be an equity partner provided that the transport system was acceptable. Another company also confirmed that it was prepared to invest in two new Panamax vessels for the Arctic provided that the throughputs were large enough and bankable over the long term.
- ❑ There was general agreement among transport stakeholders that, with the current operations, there is no immediate need for an all-weather road in the SGP. However, it was noted that further development of the SGP, and in particular, the base metal mines, require the development of permanent transportation infrastructure.

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Economic Community Development and Tourism

Representatives of the following economic and community development, and tourism agencies were interviewed for this study:

- Hay River Chamber of Commerce;
- Town of Hay River;
- City of Yellowknife;
- Yellowknife and Area Chamber of Commerce;
- Northwest Territories Resources, Wildlife, and Economic Development (Parks and Tourism section);
- Nunavut Tourism;
- Northwest Territories Arctic Tourism.

For the most part, key issues discussed during these interviews related to routing (Yellowknife versus Rae) and potential effects on tourism. A summary of the key findings of these interviews is provided below:

- Discussions with representatives of the City of Yellowknife focused on the issue of whether the road should be routed near Yellowknife or Rae. From the perspective of the City of Yellowknife and Yellowknife and Area Chamber of Commerce, a route emanating from Yellowknife was preferred. Reasons for preferring this route, identified during these interviews and in follow-up submissions provided by the City of Yellowknife, are as follows:
 - A focus of the City of Yellowknife has been to promote Yellowknife as a mining supply centre and a transportation hub for the Western Northwest Territories and the Kitikmeot Region of Nunavut, and a transportation corridor emanating from Yellowknife would be consistent with this focus;
 - A route near Yellowknife would make appropriate use of the infrastructure that has already been developed in the City;
 - A route near Yellowknife would maximize regional employment and income benefits derived from the mining industry by strengthening Yellowknife's role as a mining center for the SGP;

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- The area from Yellowknife to the Ingraham Trail is a cottage cluster, and the presence of the route in proximity to this area could improve access and encourage further cottaging development;
 - By-passing the Yellowknife area could have an adverse effect on its economy, which would have an adverse multiplier effect in the Western Arctic.
- Discussions with representatives of the Town of Hay River and the Hay River Chamber of Commerce focused on the routing of the transportation corridor:
- The Town of Hay River and the Hay River Chamber of Commerce support the construction of a road from Rae through the communities of Wha'ti, Snare Lakes, and Rae Lakes into the SGP;
 - the key reason preference is given for this routing is that an all-weather transportation corridor near Rae/Edzo would significantly increase access for these small communities, and may facilitate further community and economic development.
- Stakeholders involved in tourism planning generally agreed that a transportation corridor could have a beneficial effect on tourism if it improved access to lakes and scenic areas such as the East Arm of the Great Slave Lake, and the Ingraham Trail.
- The transportation corridor was not viewed as likely to have a significant beneficial effect on tourism related to hunting and fishing. Specifically, it was commented that a corridor could be disruptive to hunting and fishing activity in some remote areas. The presence of a transportation corridor was not considered to be a direct benefit for tourists travelling to hunting and fishing lodges in the SGP, as it would be more convenient and time-efficient to fly to these areas.

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- The presence of a transportation corridor was not viewed as being a significant benefit to tourism in Nunavut. Flying into Nunavut would appeal to most visitors rather than travelling along the transportation corridor because it would allow them to reach their destination in Nunavut within a shorter time.
- Other tourism-related comments and concerns included:
 - The need to ensure good road quality (tourist level road, not just a mining road) and control dust;
 - A circle route may be more interesting for tourists, rather than a north-south route;
 - The need for greater involvement/input of tourism officials on corridor alignment – specifically, reviewing the satellite images and scouting for optimal areas for new parks.

Government/Investment

Representatives of Department of Indian and Northern Affairs and Government of the Northwest Territories (Economic Development, Trade and Investment) were interviewed for this study. Key issues discussed during these interviews related to whether there is sufficient demand for an all-weather transportation corridor and the optimal phasing. Specifically, issues included:

- Is there sufficient demand for a transportation corridor into the SGP?
- What is optimal phasing - should it be now or in 10-20 years?
- Do the resources have a world market value that could justify the costs?
- Would further economic development follow? How many prospects would come on line with and without the all-season road?
- What are the secondary impacts, including the need for additional infrastructure in the communities adjacent to the corridor. What are the human resource implications? What does this mean in terms of the potential for population and growth?

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Key findings of these interviews were:

- The Federal Government owns much of the land within the SGP, and therefore their interest in the transportation corridor would be intense. The fact that any highway would traverse crown lands would potentially make the negotiation of the public/private partnership more difficult in that the Federal Government does not have a clear policy in the granting of leases or licenses over their land for privately constructed and operated transportation infrastructure.
- DIAND's principal interest would be in the areas of environmental impact, environmental assessment, licensing and permitting, and mineral development issues.

Aboriginal Groups

Interviews were conducted with representative of a large number of Aboriginal Groups including Snare Lakes, Dogrib Rae Band, Rae Lakes, Wha Ti, The Kitikmeot Corporation, Treaty 11 Council, Yellowknives Dene Band, North Slave Metis Alliance, and the Metis Nation.

All of these groups are currently aware of the transportation initiatives being studied. All groups are in support of a transportation corridor provided that consideration is given to environmental issues and strict controls are implemented in order to ensure environmental protection. The following summarizes the major points made by the Aboriginal groups:

- Various Aboriginal land claims would be very important to future development within the Slave Geologic Province and would impact jurisdictional issues surrounding any proposed infrastructure.
- Treaty 11 supports the development of a route north of Rae as they believe it will provide access to remote communities and access to the Snare Lakes hydro-power facility. They also believe that construction will be less expensive and have fewer environmental impacts than routing elsewhere. Treaty 11, however, is concerned about the effect the northern route would have on caribou migration.

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- ❑ Treaty 11 indicated that the construction of the road north of Rae would improve the communities' economies and assist with community well-being as well as the unemployment situation.
- ❑ The Yellowknives Dene Band support the route through the Yellowknife area. However, they are concerned that a northern port would adversely impact the western arctic economy and increase unemployment rates.
- ❑ Representatives of Kitikmeot Corporation indicated that the Bathurst Inlet port and access road should be built, maintained, controlled and managed by the Inuit; although potential investors from the western Arctic should be considered, it is important that "control" remains with the Inuit.
- ❑ All groups indicated that local residents, particularly elders, should be consulted extensively in planning the corridor, through the environmental review and design stages.
- ❑ Most of the comments made by representatives of the Aboriginal groups focused on potential environmental and social impacts.

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SECTION 3.0 – AREAS OF ECONOMIC ACTIVITY

OVERVIEW

This section provides an overview of economic activity within the SGP. It is based on published secondary source information and interviews with key stakeholders, as discussed in Section 2.0. Mining is the key economic sector in the SGP. Several mines are currently operating in the SGP, and the area has been host to many past mineral producers and is recognized as having significant potential for gold, base metals and diamond production. In contrast, other types of economic activity within the SGP are limited. The discussion of economic activity within the SGP therefore focuses on mining activity. A brief discussion is also provided on tourism activity in the SGP.

Mining Activity

The Northwest Territories was ranked as having the greatest mineral potential of all of the provinces and territories in Canada based on a survey of mining companies undertaken by the Fraser Institute in 1997¹. The SGP is considered to be one of the richest and most promising mining regions within the Northwest Territories.

Historically, the SGP has been an important contributor to the overall value of minerals produced in the Northwest Territories. Exhibit 3.1 on the following page illustrates the total value of minerals produced in the Northwest Territories and an estimate of the value of mineral shipments from the SGP over the past twelve years. The relative importance of the SGP in terms of overall shipments has increased in recent years, with the SGP consistently accounting for over one-third of the total value of mineral shipments from the Northwest Territories since 1991.

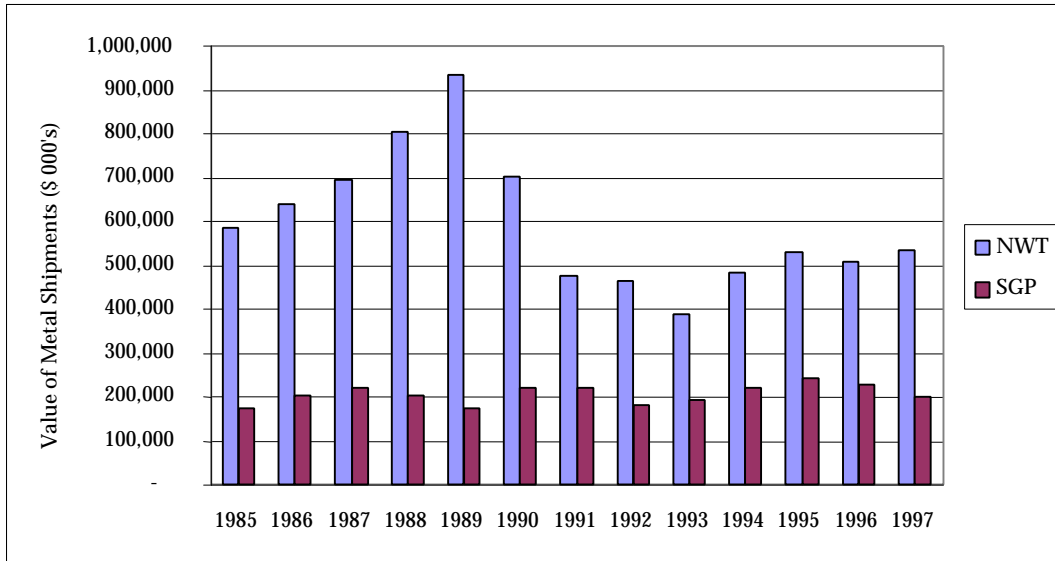
On the exploration side, the Northwest Territories consistently ranks as one of the most active areas in terms of total exploration expenditures. Specifically, exploration expenditures in the Northwest Territories in 1997 were in the order of \$180 million. This was only slightly lower than the expenditures level of Ontario, and significantly higher than all other provinces. Exhibit 3.2 on the following page illustrates exploration expenditures by province/territory in Canada for 1997.

¹ The Fraser Institute, Survey of Mining Companies Operating in Canada: Fall 1997.

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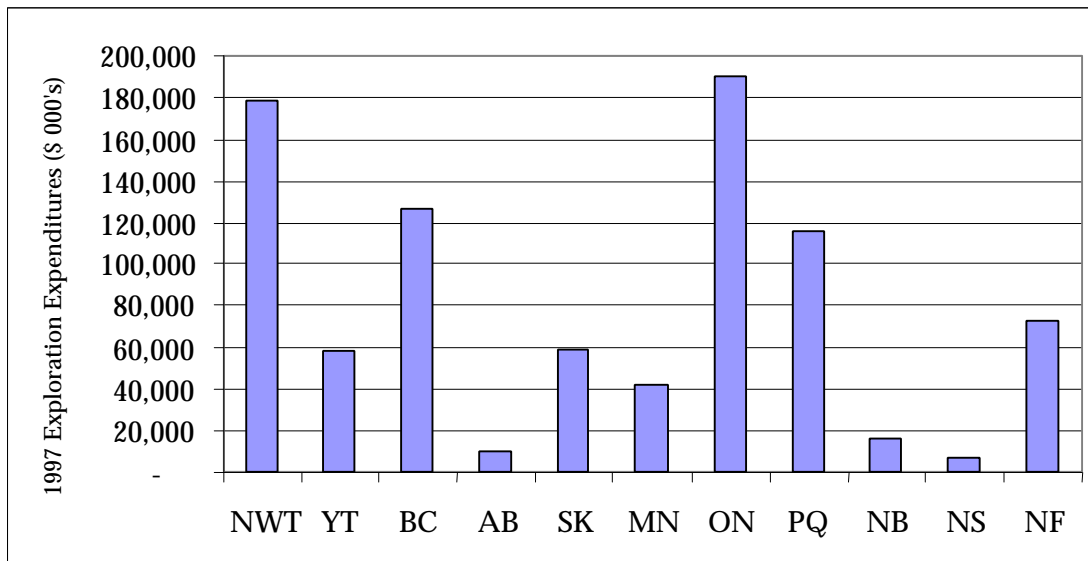
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Exhibit 3.1 - Value of Mineral Shipments



Source: Government of the Northwest Territories, Bureau of Statistics, 1998.

Exhibit 3.2 - 1997 Exploration Expenditures by Territory/Province



Source: Government of the Northwest Territories, Bureau of Statistics, 1998.

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The level of exploration on a macro level is dependent upon the general state of the industry and metal prices. On a more local basis the level of exploration activity is generally dependent upon the following factors:

- Geological environment and geological data available;
- Regulatory regime;
- Access to infrastructure;
- Land access and tenure;
- Level of mineral production in the area;
- History of recent discoveries.

The accessibility of transportation infrastructure is an important aspect in all phases of a mining project, from initial grassroots exploration through to operations. Accessibility to good transportation infrastructure can result in easier project planning, reductions in capital and operating costs, and reduction in project risks. Without good transportation access, generally only the richest gold and diamond ore bodies will be developed and the development of any base metal operations is unlikely. A further discussion of the importance of transportation and other factors to mining operations is provided in Appendix 2.

The importance of recent discoveries as a factor in the funding of future explorations is best illustrated by the increase in exploration activity in Newfoundland and the Northwest Territories following the discoveries of Voisey's Bay and Ekati, as shown in Exhibit 3.3. Exploration expenditures in the Northwest Territories increased from \$43 million to \$101 million between 1992 and 1993. In Newfoundland, expenditures increased from \$12 million in 1994 to \$71 million in 1995.

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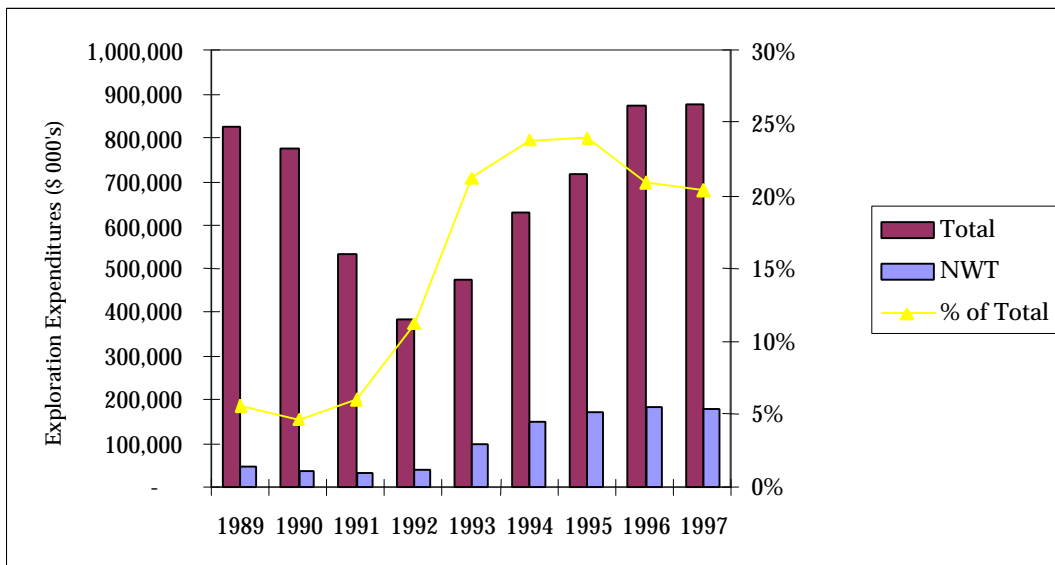
Exhibit 3.3 - Historic Exploration Expenditures (\$ millions)

	NWT	YT	BC	AB	SK	MN	ON	PQ	NB	NS	NF	Total
1989	46	15	187	6	63	37	218	185	14	21	36	828
1990	36	18	227	11	42	41	153	196	17	11	23	775
1991	32	17	136	7	32	30	110	138	16	5	12	532
1992	43	10	72	5	26	32	77	94	12	3	11	385
1993	101	19	66	7	53	27	76	106	11	2	9	477
1994	150	26	85	9	51	41	113	130	10	2	12	628
1995	172	39	79	11	44	33	130	123	13	3	71	718
1996	183	55	117	14	45	40	178	128	16	6	91	873
1997	179	58	126	11	59	42	190	116	16	7	73	876

Source: *The Fraser Institute, Survey of Mining Companies in Canada; Fall 1997.*

Exhibit 3.4 also shows that over the past couple of years the exploration expenditures in the Northwest Territories represented over 20% of the total dollars spent on mineral exploration in Canada. This is due to the increased level of activity and to the higher cost of exploration as a result of limited seasonal access.

Exhibit 3.4 - NWT Expenditures as a % of Total Exploration Expenditures



Source: *Government of the Northwest Territories, Bureau of Statistics, 1998.*

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Mining Activity in the SGP

Significant events in 1998 in the SGP included the start-up of the Ekati diamond mine, the suspension of operations at the Lupin gold mine and the shutdown of the Colomac gold mine.

Currently there are over thirty projects in the SGP at various stages of development. Exhibit 3.5 itemizes the existing projects, commodity of interest and the stage of development. Exhibit 3.6 shows the location of the existing mines and projects, which are considered to be in the advanced stages (i.e., feasibility study stage or awaiting a production decision). A more comprehensive illustration of the identified mineral showings in the SGP is provided in Exhibit 3.7.

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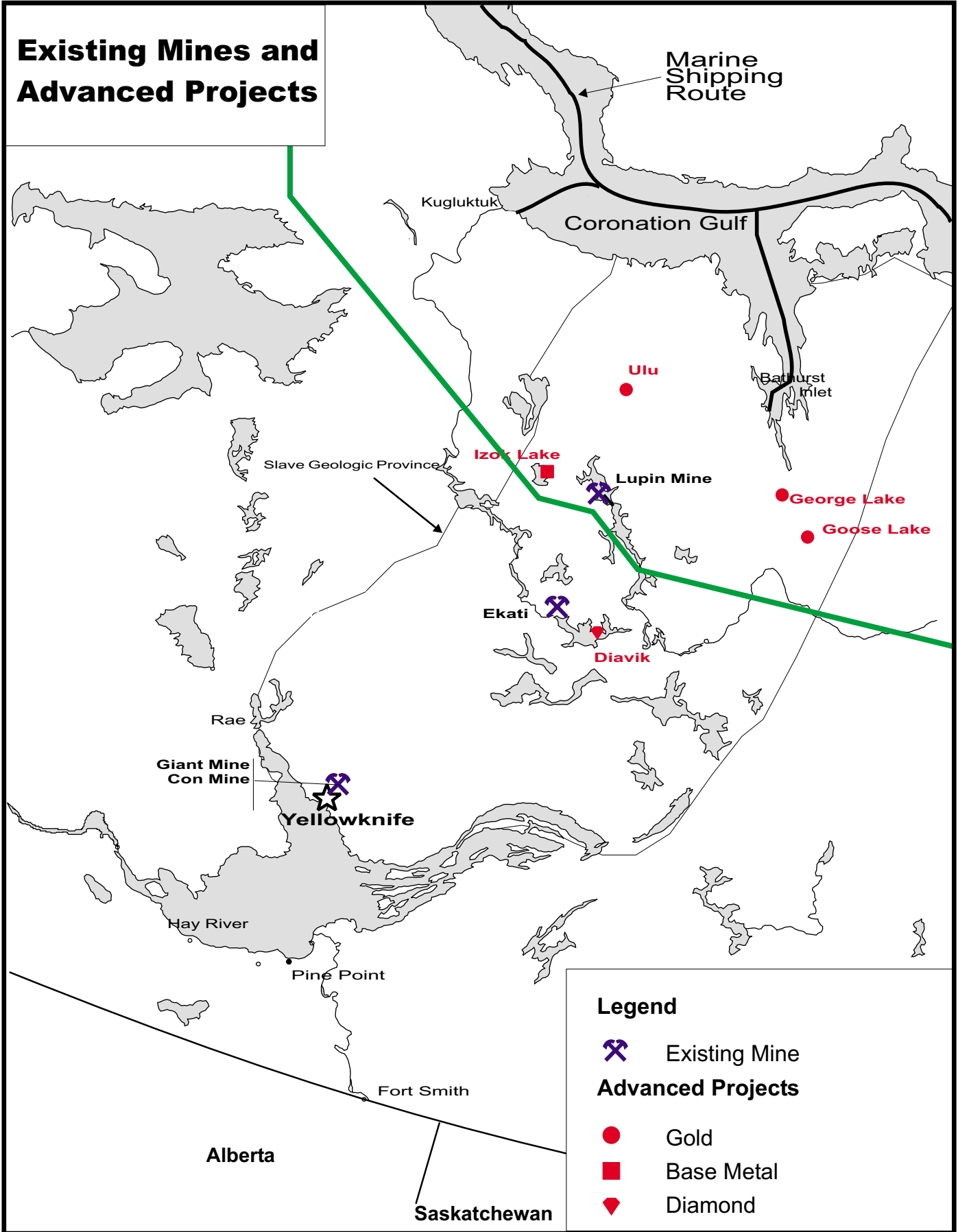
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Exhibit 3.5 - Mineral Projects in the SGP

Project/ Mining Operations	Commodity	Status
Lupin	Gold	Operations currently suspended due to decline in gold prices. Estimated mine life of 6 – 8 yrs.
Ekati	Diamonds	Began production in October 1998.
Advanced Projects – feasibility study underway or completed		
Diavik	Diamonds	Feasibility study near completion.
Ulu	Gold	Feasibility study complete, awaiting improvement in gold prices.
Izok Lake	Base metals	Feasibility study complete, current owners looking to sell property. Feasibility study indicates that the project economics cannot withstand the additional infrastructure costs.
George Lake	Gold	Feasibility study started but put on hold due to decline in gold price. Will benefit from improved infrastructure.
Thor Lake	Rare Earth	Application has been made for a Water Licence.
Advanced Exploration Projects – pre-feasibility study stage		
Boston	Gold	Awaiting improvement in economics before going to feasibility study. This project is on the eastern shores of Bathurst Inlet and will only benefit from the port infrastructure.
Damoti Lake	Gold	May move to pre-feasibility or feasibility. Awaiting for improvements in gold price.
Gondor	Base Metal	Associated with Izok Lake deposit. Would be mined after Izok Lake deposits.
Jericho	Diamonds	Drilling program underway and initial studies completed.
Nicholas Lake	Gold	Property could go to feasibility study, if gold prices improve.
Exploration Projects		
Boot Lake	Gold	Status of property unknown.
Back Lake	Diamonds	Exploration programs underway, work on the property is progressing.
Coronation Gulf	Gold	Diamond drilling complete and preliminary ore resource calculation completed.
Camsell Lake	Diamonds	Exploration programs underway, work on the property is progressing. The collection of a bulk sample is planned in 1999.
Epworth	Base Metal	Exploration programs underway, work on the property is progressing.
High Lake	Base Metal	Diamond drilling complete and calculation of ore resources done.
Hood River	Base Metal	Could possibly be exploited if Izok put into production.
Kennady Lake	Diamonds	Work on this property is progressing. The collection of a bulk sample is planned in 1999.
Kim/Cass	Gold	Status of property unknown.
Mackay Lake	Diamonds	Exploration program underway, work on the property is progressing.
Mazenod Lake	Base Metal	A scoping study was completed in 1998. This project is also near existing transportation infrastructure.
Musk	Base Metal	Requires additional exploration work before moving project forward.
Pistol Lake	Gold	Western shores of Bathurst Inlet would only benefit from port infrastructure.
Russell Lake	Gold	Near the highway between Rae and Yellowknife.
Sunrise	Base Metal	Diamond drilling complete and preliminary resource estimates calculated.
Tundra (Fat)	Gold	Exploration program currently underway.
Turner Lake	Gold	Some diamond drilling completed.
Wreck Lake	Copper	Early exploration stage.
Yava	Base Metal	Early exploration stage.

Source: Simons International 1998

Existing Mines and Advanced Projects



Legend

-  Existing Mine
- Advanced Projects**
-  Gold
-  Base Metal
-  Diamond

Slave Province Mineral Showings Development Stage

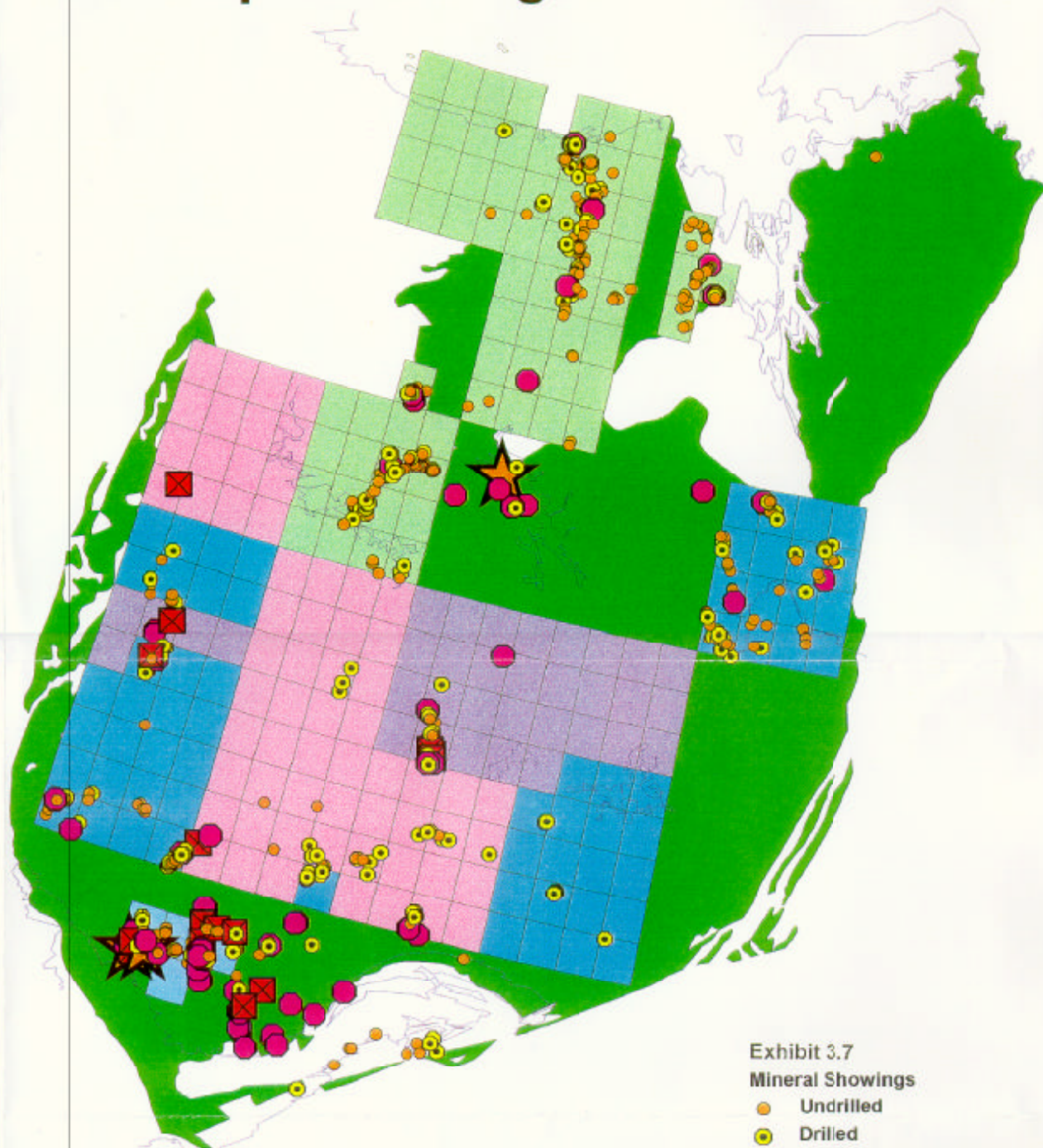


Exhibit 3.7
Mineral Showings

- Undrilled
- Drilled
- Resources Calculated
- Past Producer
- ★ Producer

Research Coverage

- 1993 Complete
- 1993 Incomplete
- 1998 Complete
- 1998 Incomplete
- 1998 In Progress

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The foregoing show that a large number of the projects are still in the exploration stages, and of these, only about five are currently considered active. The reasons that the others are inactive include lack of exploration funds due to poor economic conditions, the resource/reserve estimates are currently economically unviable without either additional drilling or improved infrastructure, or current owners are restructuring and properties are in the process of being vended. The improvement of the infrastructure in the north will reduce the costs of exploration and increase the probability of some of these properties being put into production. However, it should be noted that a property in the exploration phase can be five to ten years away from production.

Potential Mineral Development Scenarios

Based on the review of mineral activity within the SGP and interviews with the stakeholders, four phases of mining development were determined. These phases are based on the current activity in the SGP, the current status of the projects, and the anticipated development that may occur as a result of permanent infrastructure. These development scenarios roughly forecast the potential for mineral development over the next twenty years. Due to confidentiality, the potential diamond projects have not been named, except for Ekati which is in operation.

- **Phase #1** - represents the current scenario where there are two operating mines, Ekati and Lupin. For this analysis it has been assumed that the Lupin mine is operational.
- **Phase #2** – assumes that Ekati and Lupin are operating, as well as a second diamond mine and one base metal mine. The permanent transportation infrastructure would have to developed in order for the base metal mine, likely the Izok project as it is the most advanced, to be put into production. The timing for this scenario ranges from 2000 to 2010.

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- **Phase #3** – this phase assumes that a third diamond mine is operating as well as an additional gold mine. Given the current stage of many of the prospects in the SGP, the timing for this scenario is likely from 2005 to 2015. The additional gold project could be the George Lake project. With the transportation infrastructure in place, the economics of the George Lake project are enhanced.
- **Phase #4** – assumes that an additional base metal mine is in production and one of the diamond projects proceeds to the underground phase of development. The transition from open pit to underground will increase the inbound freight tonnage. The timing for this scenario is 2010 to 2020. It is assumed that Lupin will have replaced the original Lupin mine, with ore from one of Echo Bay's satellite deposits.

Tourism Activity

In the *Draft Northwest Territories Economic Framework Sector Profile for Travel and Tourism*, it is stated that total annual tourism spending by visitors to the Northwest Territories is approximately \$65 million on local goods and services. Tourism is reported to be the third largest export, behind mining and petroleum. However, unlike these other sectors, tourism is a renewable resource industry that provides direct opportunities for use of traditional aboriginal skills. In 1996, non-resident visitation to the Western Arctic Region was estimated at 65,590. About 57% of these visitors were travelling for leisure (including visiting friends and family), and 43% were travelling on business. About 90% of leisure travellers visited during the summer months, compared to about 60% of the business travellers.

The Northwest Territories appeals to specific tourist market segments such as big game hunters, anglers and recreation and eco-tourism markets. Data have not been published on Northwest Territories visitation by these specific market segments. However, data are available on usage of campgrounds. Based on 1995 data, it is known that visitors spent 16,409 person-nights on territorial campgrounds in the Northwest Territories. The most heavily used parks are situated in proximity to the larger communities or along major highways. The most used campgrounds include the Fred Henne (Yellowknife), the Happy Valley and Chuk (Inuvik), Hay River, and Lady Evelyn (Kakisa).

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Published background information were reviewed and discussions were held with tourism officials for the Northwest Territories to determine the range and location of tourist/recreation features within the general transportation corridor study area. Based on this work, several tourist/recreation features were identified within the study area, particularly in the southern sections. These features consisted mainly of parks and outfitters lodges. Tourism features are identified in Exhibit 3.8, and a discussion of these uses is provided below.

Yellowknife/Ingraham Trail Area

The Ingraham Trail extends more than 40 kilometers east of Yellowknife and includes a series of picnic areas, hiking trails, territorial campgrounds, and boat launch areas, as identified below:

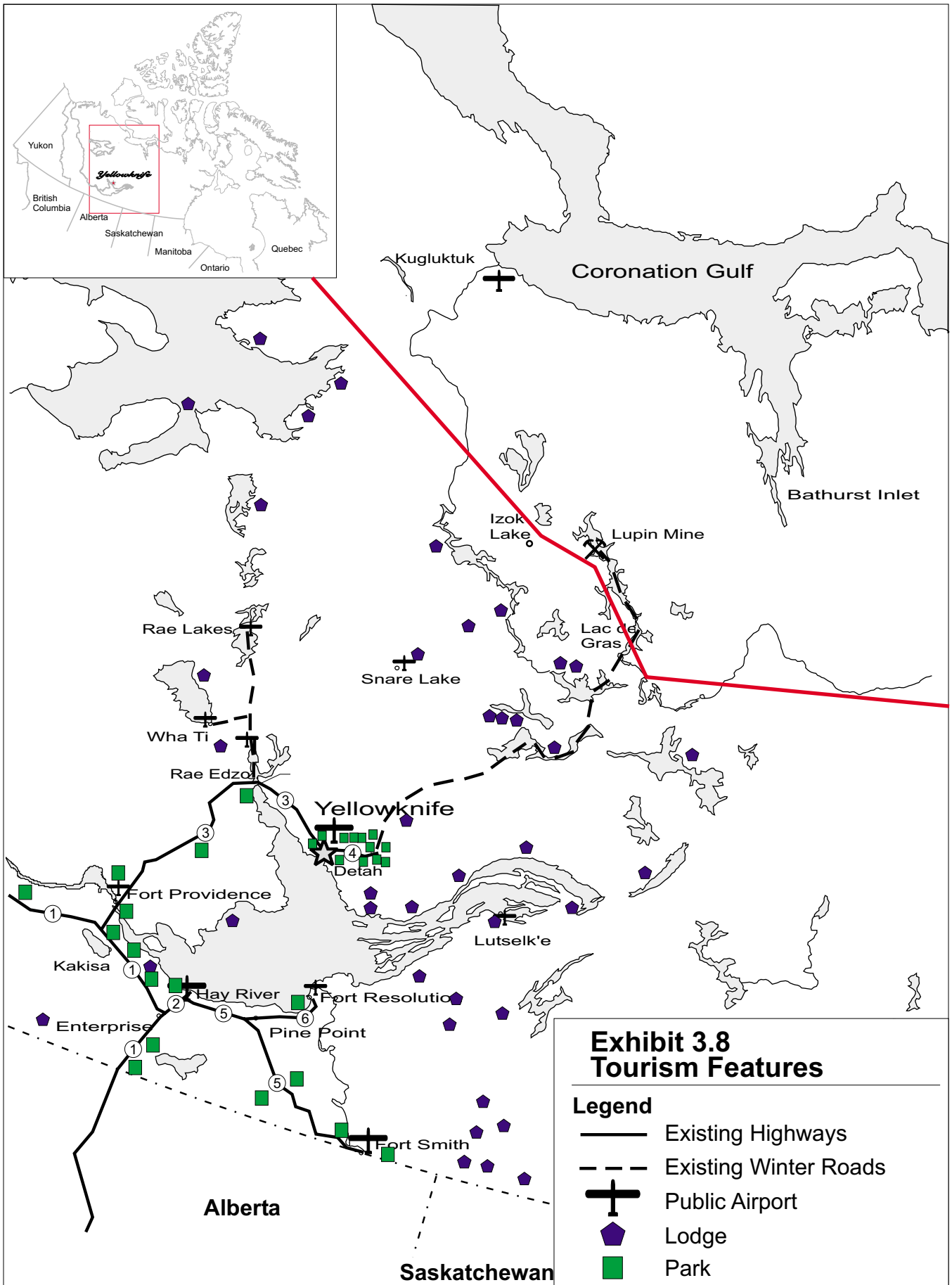
- Yellowknife Picnic Area;
- Prosperous Lake;
- Madeline Lake;
- Pontoon Lake;
- Prelude Lake Park;
- Powder Point Boat Launch;
- Hidden Lake Park;
- Cameron Trails Falls;
- Cameron River Park;
- Reid Lake Park.

For the most part, the above parks are day-use only. Campsites are available at two parks – Prelude Lake and Reid Lake Parks.

The Fred Henne Territorial Park is situated in Yellowknife, and includes a wide range of facilities including campsites.

Rae/Edzo

Few tourist features are located in the Rae/Edzo area. These include the North Arm Park, which is a day-use facility.



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Other Areas

Data are not available on the actual level of tourist activity within the Slave Geologic Province. However, as much of the region is inaccessible during the summer and shoulder seasons (except by air), it is likely that the level of tourism activity in this area is lower than in other more accessible areas in the Northwest Territories. However, approximately 25 outfitter lodges are located within the SGP, with most of these situated along lakes. For the most part, these lodges are only accessible by winter roads and by plane. The average spending by outfitters clients per trip is estimated at about \$3,000 (Northwest Territories Parks and Tourism Division). As mentioned previously, published information is not available on this market segment, although and the need for market research on this segment is noted in the *Draft Northwest Territories Economic Framework Sector Profile for Travel and Tourism*.

The estimated impact of tourism in Nunavut is \$30 million. Discussions with tourism officials in Nunavut suggest that the vast majority (about 99%) of visitors access Nunavut by air, and the remainder come by cruise ship. Most of the tourism takes place in communities such as Rankin Inlet, Cambridge Bay, Baffin Island and National Parks, Ellesmere Island National Park Reserve and Auyuittuq National Park and at other parks and facilities such as Coppermine Park, Cambridge Bay, Historic Sites, Mt. Pelly Park, and the Northwest Passage Historic Trail.

Visitors are mainly attracted to Nunavut for eco-tourism and nature based opportunities. Hunters, while accounting for a relatively low portion of overall visitors, are very significant in terms of overall economic impact to Nunavut.

As noted above, a significant portion of tourism activity in the SGP is related to hunting and fishing packages. While not available for this study, further information should be collected from outfitters operating in this area as part of the follow-up benefit-cost analysis. Specifically, these outfitters should be contacted regarding the profile and number of non-resident clients per year, location of activities and potential impacts to this sector.

It should be noted that there are many scenic areas, particularly those adjacent to lakes throughout the SGP that may have high potential for

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increased tourism activity. Further investigation is needed to identify these areas and, as part of detailed route planning, assess opportunities for improved access to such areas.

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**SECTION 4.0 – ANALYSIS OF TRANSPORT OPTIONS AND
NEEDS ASSESSMENT**

This section provides an overview of the existing transportation system, transport volumes and transport costs. It also provides an assessment of transport needs and routing considerations.

EXISTING TRANSPORTATION SYSTEM

The SGP is currently served by all-weather roads, winter roads, rail, barge and air transport facilities.














All-Weather Road System

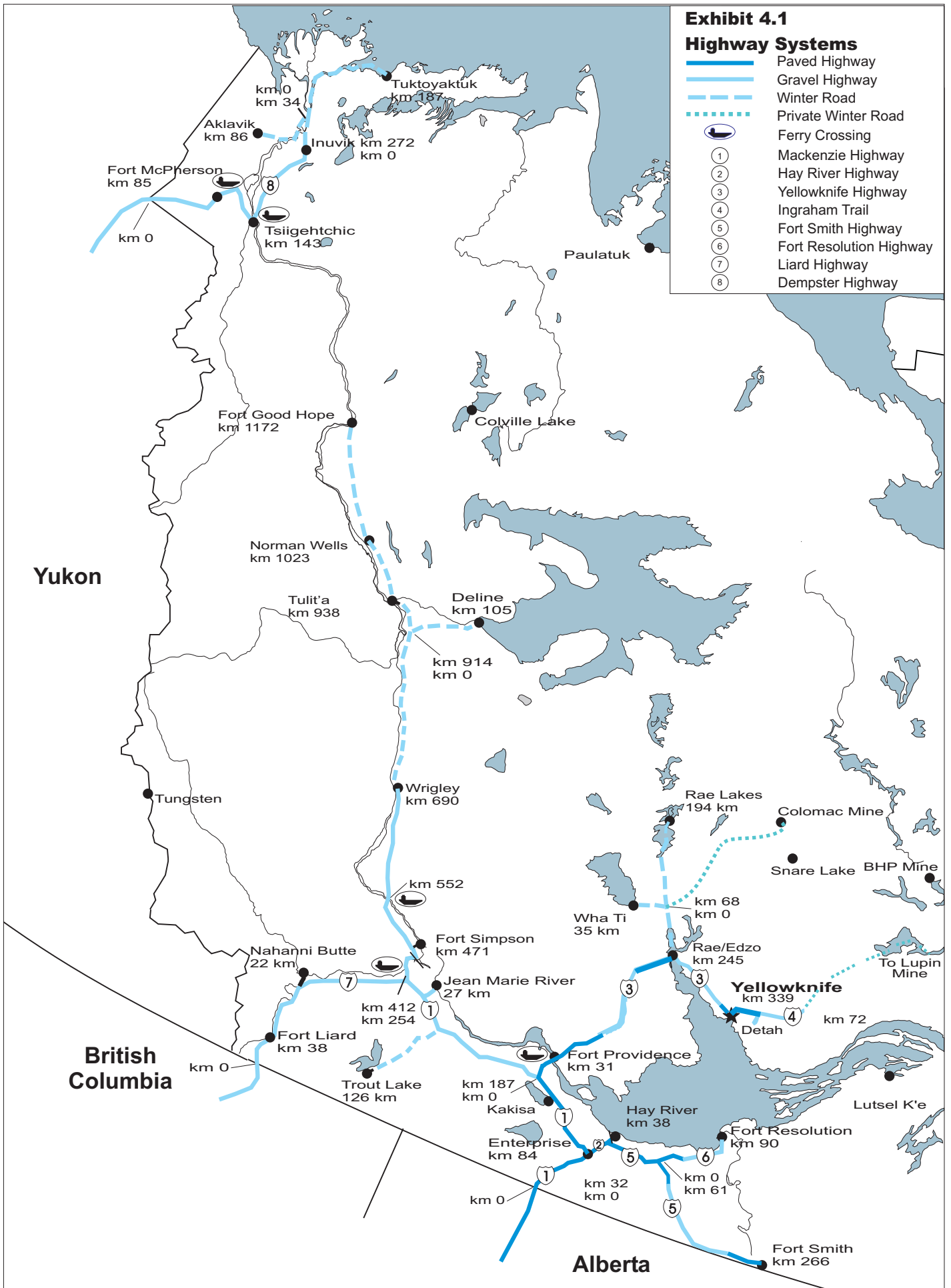
Exhibit 4.1, “Highway System (West)” shows both the all-weather and winter road systems. Highway #1 (Mackenzie Highway) is the main access from Alberta to the Northwest Territories. It approaches Enterprise from the south, then turns northwest and follows the Mackenzie River to Wrigley. Highway #3 (the Yellowknife Highway) is the main access road to the SGP. It branches off from Highway #1 just west of Kakisa at the western end of Great Slave Lake. It crosses the Mackenzie River by ferry or ice-bridge at Fort Providence, passes through the sister communities of Rae-Edzo on the North Arm of the Great Slave Lake, and continues on to Yellowknife.

Both Highways #1 and #3 are part of the National Highway System. Highway #1 is paved to the junction of Highway #3, and Highway #3 is paved to Rae. The reconstruction of Highway #3 between Rae and Yellowknife is a long-term goal for the DOT. Work on a 13-km section near Rae and a 6-km section near Yellowknife is scheduled to begin in early 1999. Studies will be conducted under the 1998/99 Highway Strategy to determine the economic feasibility of accelerating the pace of reconstruction work.

Exhibit 4.1

Highway Systems

-  Paved Highway
-  Gravel Highway
-  Winter Road
-  Private Winter Road
-  Ferry Crossing
-  Mackenzie Highway
-  Hay River Highway
-  Yellowknife Highway
-  Ingraham Trail
-  Fort Smith Highway
-  Fort Resolution Highway
-  Liard Highway
-  Dempster Highway



**SLAVE GEOLOGIC PROVINCE TRANSPORTATION CORRIDOR
NEED/FEASIBILITY STUDY
FINAL REPORT**

**SECTION 4.0 – ANALYSIS OF TRANSPORT OPTIONS AND
NEEDS ASSESSMENT**

The Dory Point Ferry on Highway #3 near Fort Providence typically operates from mid-May to mid-January. Between 1993 and 1997, opening dates ranged from May 6 to 15, and closing dates from January 10 to 29. The ice-bridge typically opens to light vehicles in December and all vehicles in mid-January, and closes in mid-April. Between 1994 and 1997, the ice bridge opened to light vehicles between December 4 and 20, to all vehicles between January 10 and 15, and closed between April 12 and 25. Traffic to the SGP may therefore be restricted twice a year, for a few days during freeze-up and for three to four weeks in late April or early May.

Other restrictions en route to Yellowknife include the limited capacities of the Mackenzie River ferry and ice bridge, the Frank Channel bridge (72,720 kg), and the Yellowknife bridge (104,540 kg). Special arrangements are required to ensure the safe passage of heavy project vehicles.

Highway #4 (the Ingraham Trail) takes traffic 70 km east from Yellowknife to Tibbit Lake, where the Lupin winter road begins. The first 22 km of Highway #4 are paved. Highway #3 from Rae to Yellowknife, and Highway #4 both run along the southern edge of the SGP, while the Lupin winter road carries traffic to the central regions.

Winter Road System

Winter or ice roads are constructed each year to resupply local communities and to service mines in the SGP. A 194 km long winter road from Rae to Rae Lakes with a 36 km spur to Wha'ti is constructed each year by the DOT, for the purpose of community resupply. Both of these communities lie just west of the SGP boundary.

Until the recent closure of the Colomac gold mine, a winter road was also constructed from the Rae/Edzo area to the Colomac gold mine in the SGP. This road was privately constructed and operated by Royal Oak Mines, the owners of the Colomac mine. Public Works and Services of the GNWT had arranged for construction of a cat train from this road to Snare Lakes on an as-needed basis for delivery of construction materials and resupply of fuel. Both of these roads went out of operation when Colomac closed.