The longest winter road in the SGP is constructed annually to service the Lupin gold mine, the Ekati diamond mine, and various exploration projects. This road was first built in 1983, and it is 598 km long, and passes through the heart of the SGP. Ekati is located at km 372.

The Lupin winter road is privately managed by Echo Bay Mines, owners of Lupin, under a License of Occupation issued by the Department of Indian Affairs and Northern Development (DIAND). Echo Bay contracts out the construction and operation of the winter road to Nuna Logistics Ltd. The annual construction and operating cost for this road is approximately $5 million. The users of the winter road pay a fee to Echo Bay, which in 1998 amounted to 14¢-17¢ per tonne per km. These fees are meant to cover costs only and are set at the beginning of the winter season on the basis of the pre-estimated traffic. At the end of the season the actual traffic is used to determine whether additional fees or rebates are due. The Echo Bay license expires in April, 2000 but Echo Bay is planning on extending this if possible.

Timing of the opening and closing of the winter roads depends on seasonal weather variations and the demand from the mines. Over the past 15 years, the opening for the Lupin road has ranged from January 14 to February 17, and the closing has ranged from March 13 to April 14. On average the road has been open for eight weeks but the duration could go as low as three to four weeks if the weather conditions were at their worst. This uncertainty puts great pressure on new mining construction projects as there is no way, other than the winter roads, to get some of the larger and heavier components to the site. If these special loads fail to reach the site, projects could be delayed for up to a year.

The importance of winter roads to the mining industry in the SGP cannot be overstated. Any cost-effective way of extending their season or lowering their annual cost should be fully investigated. A further discussion of winter road considerations is provided in Appendix 3.

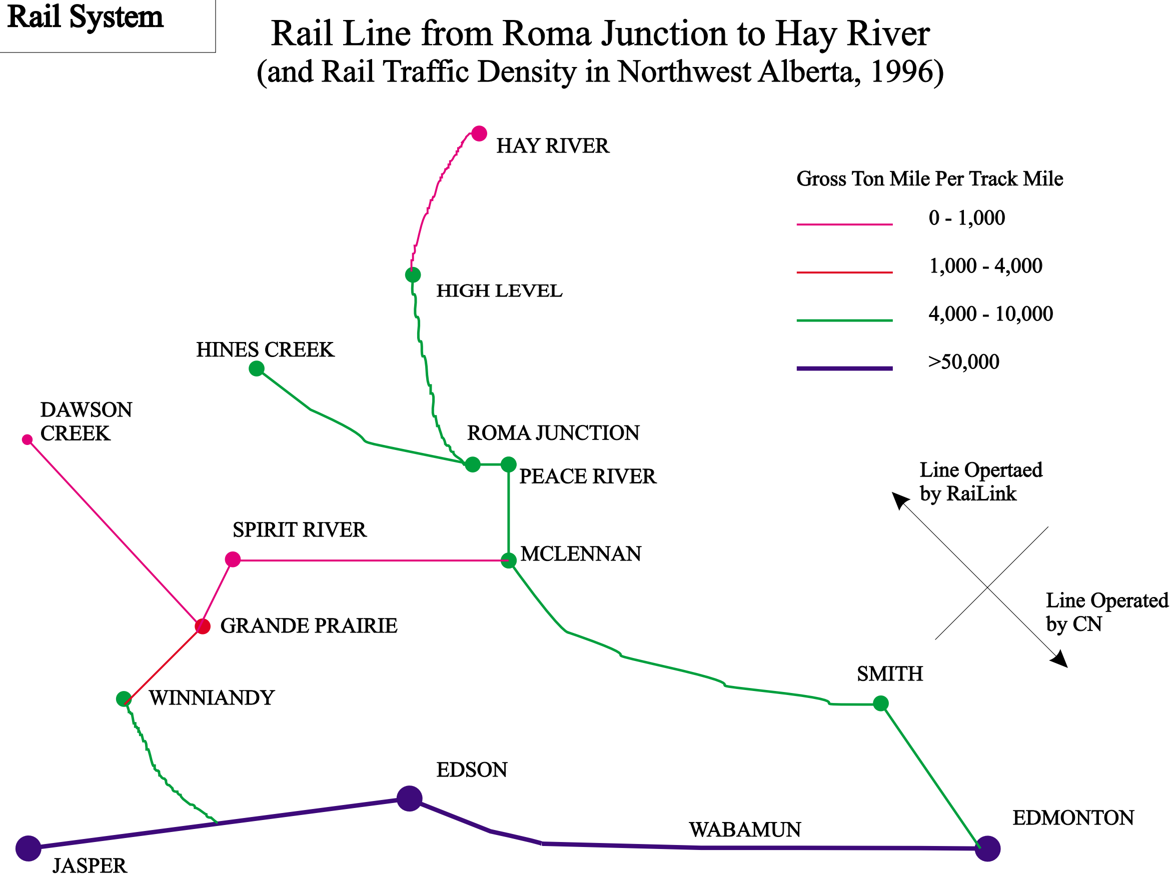
Rail Service

The rail line from Edmonton to Hay River was built 25 years ago to service the Pine Point base metal mine 90 km east of Hay River. The mine produced concentrates that were railed south for processing. Pine Point was shut down in 1991 and the rail line now operates to Hay River only. The portion from Hay River to Smith, Alberta, is operated by RaiLink Ltd. (Canada's third largest rail operator) and the portion south of Smith is run by CN. The rail system in the area is shown in Exhibit 4.2 "Rail System".

In 1997, PROLOG Canada Inc. in its October, 1998 "Transportation Systems Study" reports that 95% of the freight carried by the rail line to Hay River was bulk fuel. Of the total 266,000 tonnes of fuel brought in, 175,000 tonnes were transferred to trucks for hauling to Yellowknife, 79,000 tonnes were barged down the Mackenzie River, and 12,000 tonnes were barged to Yellowknife.

To deliver the 4,000 railcars per annum to Hay River, RaiLink runs a train once or twice a week depending on demand.

Exhibit 4.2
Rail System



Vessels Currently Serving the SGP/Arctic

In the summer, barges owned and operated by Northern Transportation Company Ltd. (NTCL) based in Hay River cross the Great Slave Lake to service Yellowknife. Similarly, NTCL barges from Hay River use the Mackenzie River to service the Mackenzie Valley, the North Slope of Alaska, and the Arctic coastal communities including those in the SGP. NTCL shallow-draft tugs and barges make all of the cargo and oil shipments to the Coronation Gulf and Bathurst Inlet region. In 1997, 33,000 tonnes of fuel and 6,000 tonnes of general cargo were delivered to the West Arctic / Nunavut region by barge. Deep-sea vessels do not service these SGP regions because there are no port or dock facilities to handle them.

NTCL owns 15 tugs and over 100 ice-reinforced barges that are capable of carrying bulk, containers, modules, and oil cargoes. The NTCL fleet takes advantage of the early summer clearing of ice that occurs in several locations in the Arctic. These locations can be reached from mid-July to late September by tugs and barges out of the Mackenzie but not reliably by conventional ocean shipping because of the sea ice blockages. The uncertainty of ocean shipping has allowed NTCL to operate successfully from the North Slope of Alaska to the eastern Arctic even though the overall transport cost of a combined land / barge system is more costly than ocean shipping.

As previously mentioned, there are no deep-sea vessels currently servicing the SGP because there are no facilities for docking and handling them. There are, however, a number of deep-sea vessels which operate in the Canadian Arctic:

- Canadian Coast Guard Icebreakers;
- Large Commercial Bulk Carriers;
- Community Resupply Vessels;
- Product Tankers.

It is important to note that any new base metal mining development in the SGP that requires concentrates to be shipped from Bathurst Inlet will require custom-built vessels to service that market. As confirmed by Fednav, all the existing vessels able to service the high Arctic are already committed to operating mines and, unless a nearby transhipment port is developed, the vessels are too small for shipping large volumes of concentrates to far away discharge ports in the short season.

Air Transport

There are a number of public and private airports in the SGP. Publicly owned airports and scheduled services are shown in Exhibits 4.3 and 4.4, "Major and Minor Scheduled Air Carriers in the Northwest Territories".

Most of the mines have their own airstrips, which are used to transport personnel, deliver exploration equipment and supplies during the initial study phase, deliver construction supplies, export mine products during the operations phase, and bring in emergency supplies at any time. The Ekati mine, which opened in late 1998, had over 600 Hercules flights during the two-year construction period to deliver freight. In addition, over 60,000 people flights were used in the same period to ferry construction personnel on and off the site.

Exhibit 4.3

Major Scheduled Air Carriers
in the Northwest Territories
March ' 98

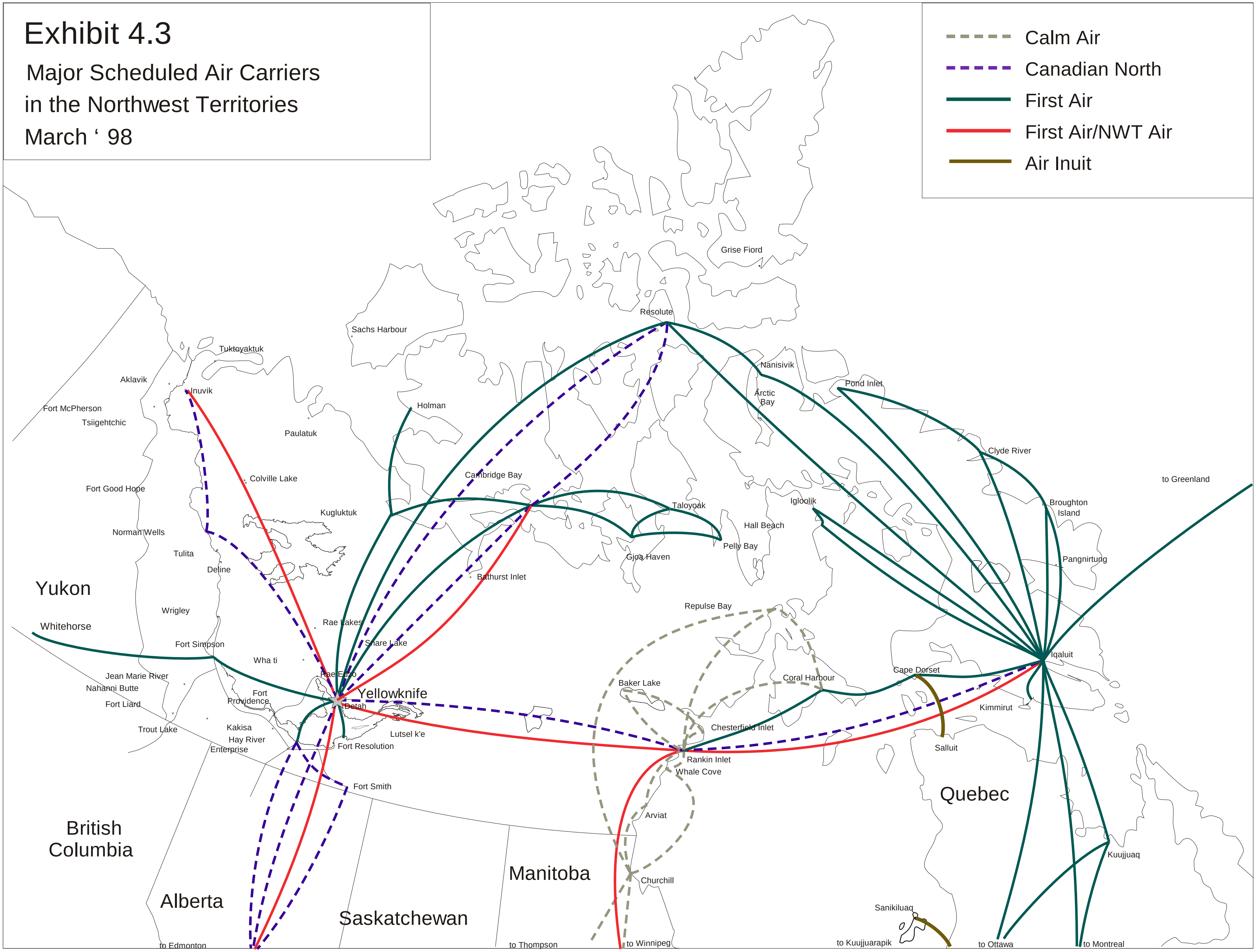
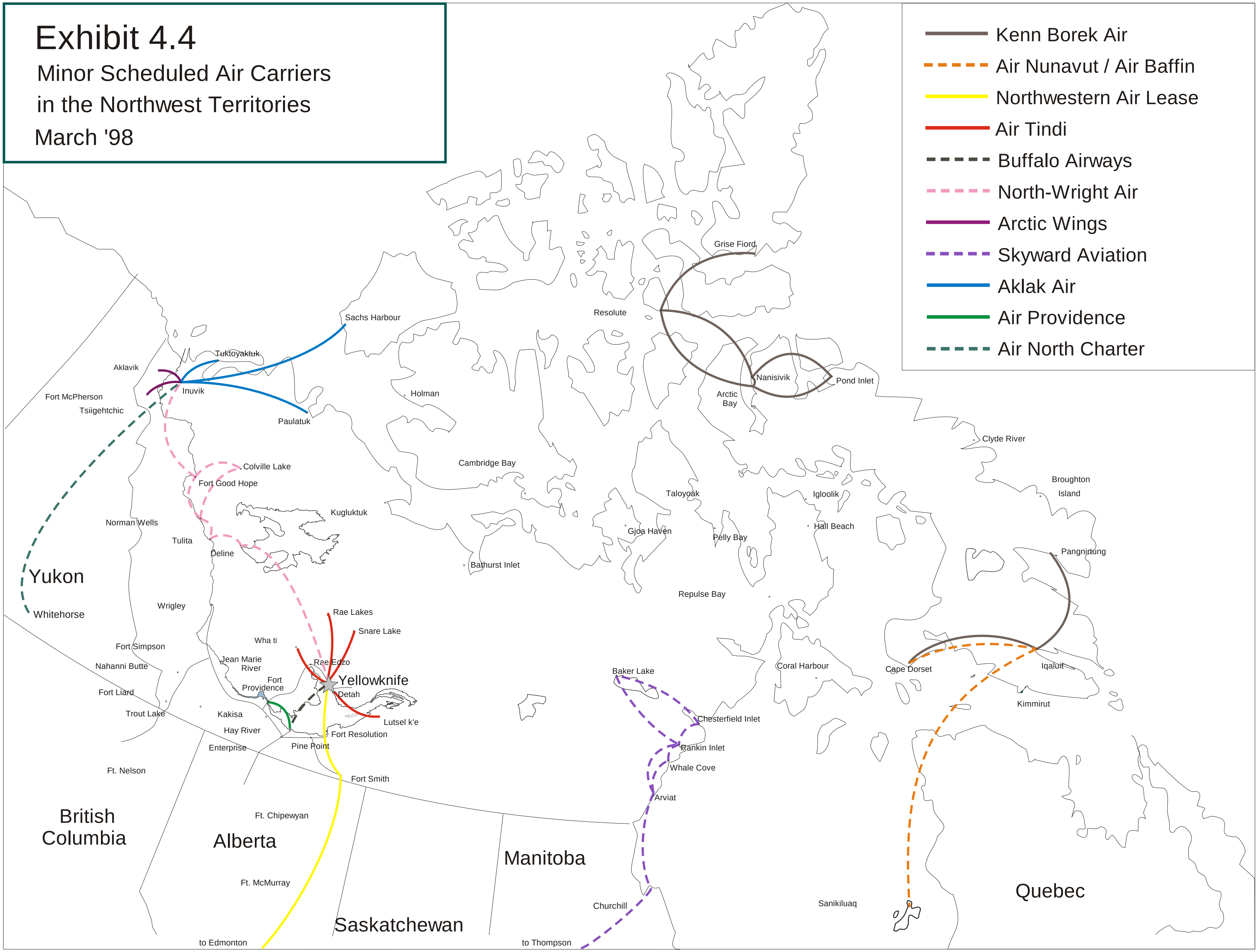


Exhibit 4.4

Minor Scheduled Air Carriers in the Northwest Territories

March '98



Existing Transport Volumes

The total volume of land freight that entered the SGP in 1997 (the year the Ekati mine was constructed), as reported by PROLOG Canada, was 582,000 tonnes (including Yellowknife), made up of 435,000 tonnes of bulk fuel and 147,000 tonnes of general cargo. To put these volumes into a transport perspective, it is noted that the total SGP tonnage is less than 1% of the tonnage handled by the Port of Vancouver and is less than the tonnage handled by many single mines around the world. In other words, even the higher-than-normal 1997 volumes are relatively small in the context of a transport system. However, because much of the system operates in very narrow seasonal windows, the peak demands on the system can be significant.

The total current volume of freight imported by air into the SGP is in the order of 12,000-18,000 tonnes per year.

Existing Transport System Capacity

All-Weather Roads

Each year the DOT publishes a “Highway Traffic” report which details the traffic counts on its road system. DOT estimates that Highway #3 between Rae and Yellowknife is currently operating at less than 10% of its theoretical capacity.

Upgrading and realigning Highway #3 is a long-term goal of the DOT. Under the 1998/99 Highway Strategy, studies will be undertaken to determine the feasibility of increasing the pace of this work. After improvements, the theoretical capacity will increase to approximately 1,120 vehicles per hour but, more importantly, the travel time and cost of freight transport will be reduced.

Traffic on Highway #4 near Yellowknife is approximately 1,500 vehicles per day with peak summer volumes approaching 2,000 vehicles per day. Just past Prelude Lake, traffic drops to an average of 100 vehicles per day, with a summer peak of 150 vehicles per day. None of these volumes are close to the capacity of this highway.

The Environmental Impact Statement for the Ekati mine stated that traffic would increase by about 3% on the busiest sections of Highway #3 near Yellowknife, and 50% on the less used sections of Highway #4 near Tibbet Lake. This increase in truck traffic would occur during the winter, and would correspond to a lull in tourism and vacation traffic, reducing the number of vehicle-truck interactions. Safety is still a concern, however, particularly for local residents on Highway #4.

Lupin Winter Road Capacity

The capacity of a winter road is influenced by several factors:

- Ratio of length of overland road (portage) to length of frozen lake road. Trucks can travel faster over portages than over the frozen lakes thus increasing the road capacity of roads with a higher portage to lake ratio.
- Ice thickness. The allowable load limit and hence capacity of ice roads is determined by the thickness of the lake ice.
- Travel speed. The speed limit on the lake sections of all NWT ice roads is 30 kph. This limit allows trucks to travel behind the pressure wave they create in the lake ice thus preventing ice cracks and potential break-up.
- Truck separation. The ice needs time to heal after each truck passes. Trucks travel in convoys of up to five trucks. Convoys are generally spaced one to two hours apart to give the ice time to refreeze.
- Weather. Aside from being a major factor in determining the start and close of the winter road season, the weather can also affect the operation and capacity of a winter road. For example, warmer temperatures could lengthen the time it takes lake ice to heal between trucks and constant blowing snow could impact normal traffic flows.

No detailed analysis has been undertaken 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. The options known at present include: improving the portages, extending the all-weather road north by 30 km, twinning the lake sections, and changing the operating rules.

Later in this report the winter road capacity is again discussed in the context of the timing of potential mine developments. The exact nature of these additions can only be determined when the number, location, timing, and size of the new mine is known.

Rail Capacity

The rail line is operating well below its train movement's capacity but its load carrying capacity is now being examined by RaiLink to see if heavier cars can be carried. This will likely result in fewer cars rather than any significant increase in freight volumes carried by rail, even though the unit transport costs should be lower with larger cars.

Barge System Capacity

The barge system could increase its capacity by adding more barges. At the present time, the barge company does not foresee any major change in its fleet size.

Existing Transport Costs

In 1997, when the construction materials for the Ekati mine resulted in an increase in the tonnage for general cargo, fuel still accounted for 75% of the total tonnage of freight entering the SGP. Clearly, the cost of transporting fuel is the most significant transport cost to SGP businesses and consumers. As a guide to understanding how much is spent each year on transporting fuel into the SGP, the following table was prepared. The cost figures shown were provided during the stakeholder interviews:

	Fuel Cost in Yellowknife (¢ per liter)	Fuel Cost at Ekati (¢ per liter)
Purchase Cost in Edmonton	22¢	22¢
Rail Costs to Hay River	3¢	3¢
Trucking Costs from Hay River to Yellowknife	5¢	5¢
Trucking Costs from Yellowknife to Ekati	-	7¢
Toll/User Fee for Winter Road	-	4¢
NWT Petroleum Taxes*	0 – 10¢	0 – 10¢
Total Purchase Cost	30¢ - 40¢	41¢ - 51¢

* Depends on type of fuel: Diesel non-motive = 3.1¢, Diesel motive = 9.1¢, Gasoline Zone A = 10.7¢, Gasoline Zone B = 6.4¢, Heating = 0.0¢

Note: All taxes shown above were provided by the Dept. of Finance, NWT.

In 1997, the total amount spent on transporting fuel in the SGP is estimated to be 8¢/l x 175,000 tonnes x 1,190 l/tonne = $ 16.7 million for all the fuel to Yellowknife plus 11¢/l x 35,000 tonnes x 1,190 l/tonne = $4.6 million for the fuel to Ekati for a total of $21.3 million. The cost of fuel air-lifted in has not been included in these figures.

Impact of Transport Costs on Mining Developments in the SGP

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.

- 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.

- Limited access translates into increased working capital requirements for supply inventories, and in the case of base metal mines, product inventories.
- Most operations 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 capital cost.
- For the diamond operations, an all-weather road is not required. The high quality of the ore reserves and the limited supply requirements means that winter roads can be used, as long as the capacity exists. This is also true for a majority of the gold projects and operations.
- The current base metal projects must have access to a northern port and preferably an all-weather road.
- For a given base metal project, the estimated costs of the infrastructure is prohibitive to the project development.
- Mine developers prefer to defer costs from the pre-production phase to the operating phase because this shift in costs can dramatically increase the project rate of return.

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 offset by higher grade ores or other factors that make the overall mine costs competitive. All that can be generalized is that lower transport costs will always enhance the economics of a mine. The extent of such a benefit to mines in the SGP can be seen by examining the transport costs in relation to the development and operating costs of a typical base metal mine (Mine 1) and a typical diamond or gold mine (Mine 2). The following table illustrates the relative cost of freight as a percentage of total capital and operating costs for both a diamond and base metal mine.

	Approx. Total Cost ($ million)	*Approx. SGP Transport Cost ($ million)*
Pre-Production Mine 1	$300 - $800	$6 - $15
Pre-Production Mine 2	$700 - $1,200	$10 - $20
Annual Operation Mine 1	$25 - $65	$6 - $15*
Annual Operation Mine 2	$45 - $80	$5 - $8

* Assumes that port and all-weather road are in place and excludes the cost of ocean freight.

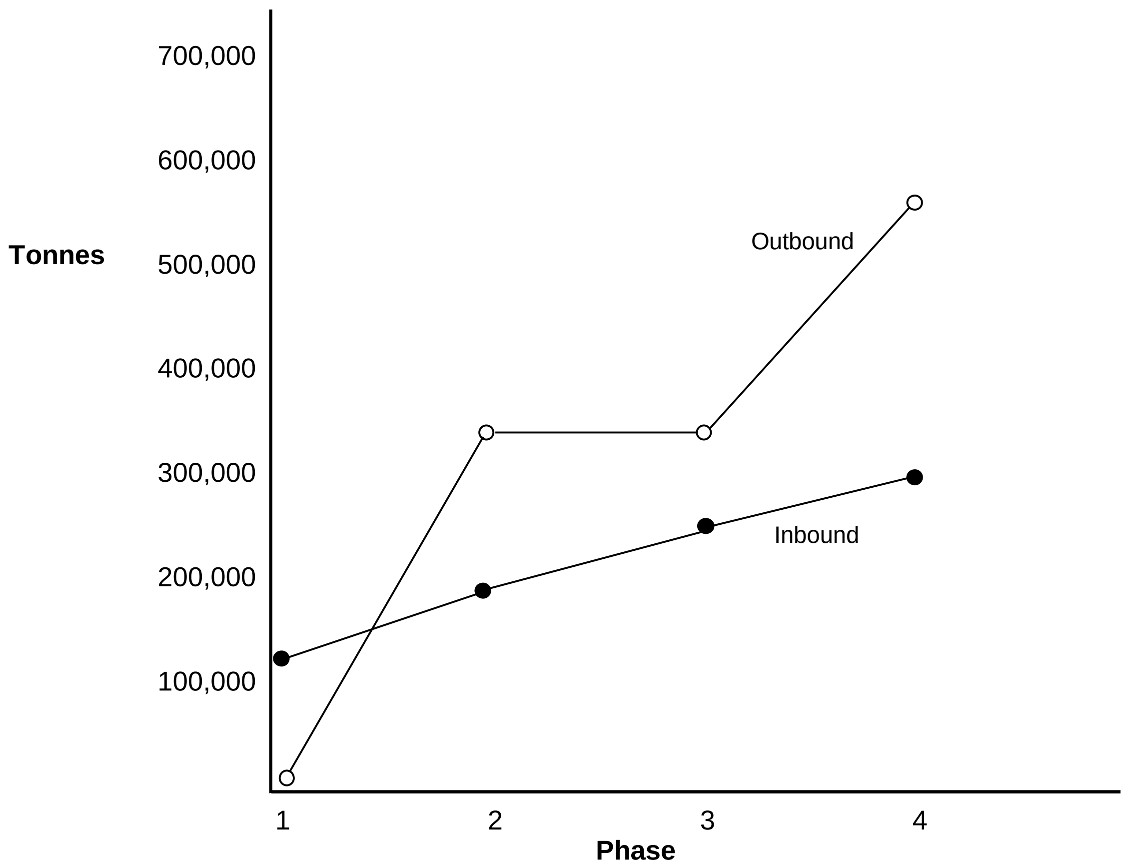
Note: Figures are gross estimates, Simons International, 1998.

ASSESSMENT OF TRANSPORT NEEDS

Forecast Mining Transport Volumes

A graph showing the inbound and outbound tonnage associated with the phases of development described in Section 3.0 is provided overleaf in Exhibit 4.5 " In and Outbound Tonnage for Various Development Phases". The tonnage was calculated from the known tonnage of current operating mines, the stakeholder interviews, and other reports made available by the GNWT.

Exhibit 4.5 - Inbound and Outbound Tonnage for Various Development Phases



Source: Simons International, 1998

The graph shown in Exhibit 4.5 is significant because it shows that if seven mines are operating in the SGP (Phase 4) the inbound tonnages, although still relatively small, would more than double. Whether the mines will bring in these tonnages through the northern port or from the south over winter roads will depend on the location of each mine and the cost/logistics of each commodity to be imported. Connections from the north and south are required, with the split based on the economics of individual mines. Each mine will decide whether the winter roads used in their construction are kept open to bring in their inbound tonnages. The outbound tonnages in Phase 4 are made up solely of concentrates from two base metal mines and depend entirely on a road and port system being in place.

Forecast Mining Transport Needs

Development Scenarios

The phases of mining development described in Section 3.0 of this report and the associated transport volumes shown in Exhibit 4.5 are all based on an assumed transport development scenario which foresees a combined base metal mine and port/road/ships development going ahead by the year 2010. Other scenarios are also possible, such as:

- no combined base metal mine and port/road/ships development going ahead at all;
- port/road/ships development going ahead without a base metal mine.

Since there are parties known to be interested in proceeding with a new transport system, it is considered reasonable to assume that one will proceed.

In the case that a new transport system does not proceed, the diamond and gold mines shown in Phases 2, 3, and 4 would not be affected as they can use winter roads for both construction and operation. Only the base metal mines would not proceed.

Development Phase Transport Needs

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

Phase 1 (current):

There are no compelling additional transport needs for this phase. No new 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):

An Arctic port accessed by 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).

Although the Lupin winter road has the capacity to handle the construction and operation of one new mine such as Diavik, there could be a need for extra winter road capacity depending on the number, location, and timing of additional mine developments. As previously suggested, the winter road capacity issue needs further study. It may well be that building a new winter road to service the new mines in this phase, is the best option. A study that looks in detail at the needs of the proposed new mines and the capacity improvement options for the winter roads will resolve this issue.

Phase 3 (years 2005 - 2015):

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. The routing of a new road will depend on the location of the new mines.

Assuming that the Western NWT's long-term goal is an all-weather road connection to the port, then progressive additions to the all-weather road from the south to the north could also be completed subject to financing limitations.

Phase 4 (years 2010 - 2020):

This phase would have seven mines operating in the SGP. At this level of activity it would be beneficial to have an all-weather road extending from the south of the SGP to the Arctic Ocean. All seven mines could connect into this system either to export their concentrates or import their fuel and other general cargoes. If an all-weather road connecting the south (Rae/Yellowknife area) to the port is not completed as these mines come on stream, each mine would need to have winter road access from the south for both the construction phase and during operations when many commodities would still be sourced from southern Canada.

Tourism Demand

Tourism levels are affected by a number of factors including the product-market mix, level of tourism infrastructure available, ease of travel, access to tourism attractions, and competition elsewhere. The transportation system within tourist regions is only one of many factors affecting tourism demand. Compared to other regions in Canada, tourism visitation to the Northwest Territories and Nunavut has been constrained by the high cost of travel (particularly high airfares) and underdeveloped tourism infrastructure.

The existing level of tourist demand for an all-weather transportation corridor into or through the SGP is low due to the volume and nature of tourism in this area. Specifically, tourism activity in the SGP occurs mainly at established park sites in the southern part of the region and at specific hunting and fishing areas throughout the SGP. Tourists engaging in hunting and fishing in the SGP generally do so as part of a hunting/fishing package provided by tour operators and local outfitters. Eco-tourism in Nunavut generally occurs close to established communities and the Arctic Ocean, rather than within the interior lands.

As discussed in Section 3.0, improved access created by a transportation corridor would not necessarily benefit tourism associated with hunting and fishing, as outfitters' clients are more likely to prefer the convenience of flying into the remote areas where outfitter camps and hunting grounds are located. In addition, even if the corridor is used to access the SGP, a means of transport would still be required from the corridor to the interior areas, which may not be readily accessible. Overall, a transportation corridor into or through the SGP is not needed to accommodate existing tourism demand, as demand is already accommodated through other transportation modes and these remain appropriate for the level and nature of tourism to the SGP.

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. Improved access, particularly to the scenic areas along the East Arm of the Great Slave

Lake, could benefit tourism by providing opportunities for further development of trails, parks and eco-tourism opportunities.

Ultimately, the level of economic benefit from 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. However, if the road opens up access to a new area, and this just results in a reallocation of visitors among areas (e.g. camping at a Park along the East Arm rather than along the Ingraham Trail), but the same overall amount of visitor spending in the NWT, then no net economic gain would result. The analysis of whether the road will increase the level and length of tourist visitation to the NWT is critical in assessing the value of the road from a tourism perspective. This level of analysis is beyond the scope of the Need / Feasibility Study, and should be undertaken as part of a detailed benefit-cost analysis study for the SPG Transportation Corridor, as discussed in Section 6.0.

TRANSPORT SYSTEM OPTIONS

Modes of Transport

The existing all-weather road, rail, winter road, barge, and air modes of transport in the SGP have evolved to suit both the types and volumes of freight that have had to be brought into the SGP and the unique geographic and weather conditions prevailing in the region. Other modes of transport have been investigated in the past, particularly those which have been used to transport concentrates in other parts of the world.

Modes Transporting Concentrates

Base metal mines produce bulk concentrates, which must be taken to a processing plant such as a smelter where the final metals are produced. Mines around the world use a variety of modes to transport their concentrates to a smelter including trucks, pipelines, overland conveyors, ships, barges, tramways, and railways. New modes created by developments in technology are also being offered to the industry by suppliers interested in capturing a share of this large market. These modes include hovercraft, dirigibles, monorails, and pneumatic capsules. To date, no large-scale applications of these new modes is known in the mining industry. The mine owner generally makes the final choice of mode after all the relevant cost, schedule, environmental, reliability, and risk issues have been examined and compared.

The Izok Project is a potential base metal mine located 360 km north of Yellowknife that would export over 320,000 tonnes per year of bulk concentrates. In 1992, the owners carried out studies to determine the overall feasibility of mining the ore and transporting the concentrates to world markets. International consulting companies were engaged to examine nine different options for transport: winter road, all-weather road, rail, slurry pipeline, monorail, aerial tramway, pneumatic capsule, hovercraft, and dirigibles. Five of the options also examined the possibility that the concentrates would be transported south by overland route to a smelter rather than north to a port for shipping to a smelter.

All of the transport options for Izok Lake were ranked on a Net Present Value basis (at a discount rate of 10%). In summary, the results showed that none of the southern options were cost competitive with the northern port options and that either a winter or an all-weather road were the most cost effective modes of transporting the concentrates from the mine to the port:

	NPV Ranking (*Best Option = 100)*
Winter Road to Port	100
All-weather Road to Port	101
Slurry & Fuel Pipeline	106*
Aerial Tramway to Port	111*
Hovercraft to Port	117*
Monorail to Port	130*
Hovercraft to Edzo	133*
Railway to Port	139*
Pneumatic Capsule to Port	142*
All-weather Road to Enterprise	149*
Monorail to Enterprise	192*
Railway to Enterprise	235*
Airship to Port	239*
Airship to Edzo	291*

* These options would likely still require winter road access in addition to the concentrate transport system ranked above.

The cost advantages of the northern route to a port and the use of roads found in the above study would apply to any base metal development in the central and northern SGP. Base metal mines located south of Great Slave Lake and close to a rail head could find it advantageous to rail their concentrates south, as proven by the Pine Point mine.

Winter Roads vs All-weather Roads

In addition to the analysis carried out by the Izok Lake owners in 1992, Metall Mining issued in 1994 a document called "Creating The Opportunity" which outlined the state of the Izok Project as it was then known. Included in this document is a description of the transport system used in the feasibility study. This system comprised a port near Kugluktuk at the Arctic Coast with a 288-km road connecting it directly to the mine site at Izok Lake. Both a winter road and an all-weather road were examined and it was concluded that an all-weather road was better for the project in spite of the higher initial construction costs because:

- less concentrate and fuel storage facilities at both the mine and the port were required;
- much smaller truck fleet required due to year-round season and faster truck speeds;
- mine concentrates reach market earlier (rather than being stored) thus increasing crucial early revenues.

The overall economic advantages of an all-weather road to the mining industry combined with the year-round access for tourists and local residents make a strong case for preferring an all-weather road to winter roads for a long-term transport system.

Deep-sea Shipping

With respect to deep-sea shipping, David Dickins Associates Ltd. undertook a study for the Northwest Territories Department of Transportation. It examined the technical aspects of deep-sea shipping in the western Arctic. This study was issued in September, 1998 and it shows that deep-sea shipping is technically viable in the region subject to certain conditions. The report refers to the potential Bathurst Inlet port and its possible use as a central distribution point for fuel and dry cargoes.

The ice conditions at the two approaches leading to Bathurst Inlet (the Eastern Access and the Western Access) are the governing factor for servicing Bathurst Inlet with deep-sea vessels. Ice-breaking vessels or ice-strengthened vessels assisted by ice-breakers will be required to guarantee service every year to Bathurst Inlet.

Using the export tonnage shown for Phase 2 and after reviewing the March 18, 1993 report prepared by Canarctic Shipping Company Limited entitled "Coronation Gulf Shipping Feasibility Study" it is concluded that two ice-breakers carrying 50,000 tonnes of cargo deadweight may have to be constructed to service the new mine:

Two vessels x four one-month round trips per year equals 8 vessel loads or 400,000 tonnes capacity. The first base metal mine is expected to have an average throughput of 320,000 tonnes per year which may mean one less vessel call or smaller parcel loads per vessel when only the first mine is in operation.

Alternately, it may be possible for a shipping company to modify some existing bulk carriers or use smaller vessels for delivery to a trans-shipment port within approximately a two-week round trip distance from Bathurst Inlet. The actual vessel fleet configuration would be determined after in-depth studies by the potential shipping partners.

In terms of ocean freight costs for exporting concentrates, it is the considered opinion of the current shippers from high Arctic mines that the freight rates from Bathurst Inlet will be competitive with other high Arctic mines. The rates will be in the range of US$40 to US$60 per tonne. The cost of Arctic shipping is clearly a major factor for any base metal mine development in the Arctic.

TRANSPORT SYSTEM CONSIDERATIONS

Nunavut / Western NWT Transport Systems

If one assumes that any large transport infrastructure program in the SGP will require government funding in whole or in part then the imminent creation of Nunavut means that Nunavut will be one of the governments involved. As a further consideration, it would seem reasonable that the Nunavut Government would have Nunavut infrastructure as its primary priority, not Western NWT infrastructure. Any proposed SGP transport system, therefore, should ideally integrate a Nunavut system with a Western NWT system so that the SGP system as a whole makes business sense and both parts of it can be developed separately or in tandem.

Prevailing Conditions

Major considerations for any transport system in the SGP are the geographic, geologic, and weather conditions prevailing in the region. The extreme winter cold, the extensive surface area covered by water, the lack of roadbed building materials in many areas, the long distances between communities, and the general lack of infrastructure place unique demands on transport. All options for improved transport in the SGP, therefore, should involve only those systems that have been proven in similar environments.

Seasonal Effects on Transport and Storage Systems

By definition, a winter road operates only in the winter whereas a port operates during the ice-free summer. This seasonal variation will be dealt with in the least cost manner by each mine development.

The port will have to have stockpiles of concentrates at the port site to avoid ship demurrage. The base metal mines could stockpile at the mine site over the summer and use only winter roads to get their concentrates to the port or they could build all-weather roads to the main port access road to deliver their concentrates year-round to the port and eliminate mine storage costs.

It must also be realized that most if not all of the mines operating in the SGP will keep their winter road access to the south even with an all-weather connection to the port. The winter road will still be required to deliver many commodities which are sourced from southern Canada.

Recent NWT Transport Developments

A number of developments have occurred recently in the Northwest Territories which will have a positive impact on transport in the SGP:

- For the first time, a bathymetric survey has been completed around the western Arctic into Bathurst Inlet. The official results of this survey, which was carried out by the Canadian Hydrographic Service, will be published in April, 1999 but the Final Field Report confirms a safe navigational route into Bathurst Inlet for deep-sea vessels.

- There have been several advances in Arctic shipping which have taken place over the past 20 years:
  - Full-scale measurements of operating ice-breakers have led to improvements in structural design and the balance between hull strength, power, and vessel mass.
  - Vessels now use spoon bows, friction reducing devices, and hull form design changes to avoid getting beset in the ice.
  - The reliability of shaft train components has increased as a result of research into propulsion failures of ice-breakers over the past 10 years.
  - Ice navigation technology, which uses satellite imagery, allows ice-breakers to avoid heavy seas.
  - Increased environmental protection from the use of double hulls and self-contained waste systems.
- The discovery of diamonds in the SGP will lead to more mining developments which will increase the freight volumes to be moved and thus help to lower the overall transport unit costs.
- The decision to create Nunavut in April, 1999 may stimulate political support for transport investments.

At this time, it is too early to say what the exact impacts will be from these developments but the general thrust should be to increase the volumes of freight to be moved and / or improve the method and cost of moving them.

Port Site and Road Routing

The concept of a having a deep-sea Arctic port to service the mining industry has been examined over the years by a number of different companies, primarily base metal mine owners. The Izok Lake project in particular has been examined several times but has never materialized. In retrospect, one can see why - the cost of providing the complete transport infrastructure, which includes a port and an all-weather road, is simply too high for the Izok Lake owner to carry alone.

Except for base metal mines, the mining industry has been able to explore and develop gold and diamond mines in the SGP with the existing transport infrastructure and is prepared to continue doing so. Although new transport infrastructure, such as all-weather roads or improved winter roads would be beneficial to these mines, the mine owners are not prepared to invest in such infrastructure because of the high cost/benefit ratio. In the case of an all-weather road, there are also potential environmental repercussions to the mines.

A new Arctic port and associated transport system is technically feasible but its economic feasibility is marginal unless one includes in the analysis all the potential economic benefits it could provide to the new government(s).

In recent times, there have been two corridors proposed to develop the Izok Lake deposit. Prior to that there were many other corridors studied by the GNWT, the federal government, and others. The choice of transport corridor in the end will depend on which mines are active at the time the corridor is decided and the location of the base metal mine which will drive the road and port development. Although the Izok Lake deposit is currently the prime candidate for being that base metal mine, there is no guarantee that Izok Lake will go ahead and another mine may be the ultimate road and port developer.

The port and road proposal put forward by Nuna is similar in its overall concept to parts of the transport system recommended in this report. Specifically, Nuna Logistics, through a joint venture with the Kitikmeot Corporation, proposed in its June, 1998 Concept Paper to build a port near Bathurst Inlet connected by two road sections into the west

Kitikmeot region of Nunavut. The first road section would extend from the port to the east side of Contwoyto Lake and the second section would extend from Lupin on the west side of Contwoyto Lake to Izok Lake. The concentrates from Izok Lake would cross Contwoyto Lake by barge in the summer and ice road in the winter. The mine developer would invest in the necessary barge facilities and the section of all-weather road from Lupin to Izok Lake. Two 50,000 DWT vessels and a truck fleet were assumed.

The choice of port site and the routing of the all-weather road would have to be agreed jointly between the financing parties. This point cannot be over-emphasized because until these parties are known, the port site and routing cannot be finalized. From the Nunavut government's point of view the ideal road routing would probably be the least cost route which goes from the port to a central point in Nunavut close to the Western NWT border. Such a terminus would be the most convenient to the existing mines, the diamond mines now in the study stages, and several of the potential new gold mines. The south end of Contwoyto Lake has been assumed in this report as the terminus of the port road which best meets the Nunavut criteria.

From the base metal mine developer's point of view, the best location for the terminus of the port road will be the new mine. The Izok Lake developer may prefer to go directly north from Izok to a port at Kugluktuk to avoid having to cross Contwoyto Lake. Although this route may be marginally better for the Izok Lake developer, it is not nearly as convenient or beneficial to the other existing and potential mine developers in either Nunavut or the Western NWT. As previously stated, however, the final routing will be decided jointly by the financing parties, and will require additional analysis of corridor alignment issues.

Routing Corridor

Engineering and environmental scoping studies were conducted concurrently with this need/feasibility study, and information was exchanged between the teams for the respective studies to assist in the identification of optimal routing for the SGP transportation corridor. Several potential routes were identified, as a component of the multi-level mapping engineering study, and these were reviewed in this current study. The work for the environmental scoping study, however, had not advanced far enough to provide environmental and socio-economic information that could be incorporated into the analysis of routing as part of this current study. Therefore, at this stage, optimal routing cannot be determined. However, a corridor area of high economic activity potential has been identified based on the work undertaken in this study. This corridor is delineated in Exhibit 4.6. The corridor includes areas that were determined to have high potential for mining and/or tourism activity. Areas of high mining potential were based on a review of information obtained through stakeholder interviews, the current level of exploration activity, the geological domains in those areas, and proximity to the most attractive mining areas. Areas of high tourism potential were based on secondary source information, stakeholder interviews, and additional information provided by the NWT Resources, Wildlife and Economic Development Department. The overall corridor, as shown in Exhibit 4.6, includes many, but not all, of the potential route areas identified through the Multi-Level Mapping study.

It should be noted, however, that while an attempt has been made to delineate an area of high economic activity potential, the specific location and level of future economic activity related to both mineral exploration activities and tourism is almost impossible to predict. It should be noted that the actual selection of the route in itself would likely generate additional exploration activity within an economic band along the route chosen. It is recommended that further analysis of optimal routing be undertaken based on input from the environmental scoping study, and a further investigation of areas of tourism potential. Further consultation should also be undertaken with mining and tourism industry representatives during the refinement of routing.

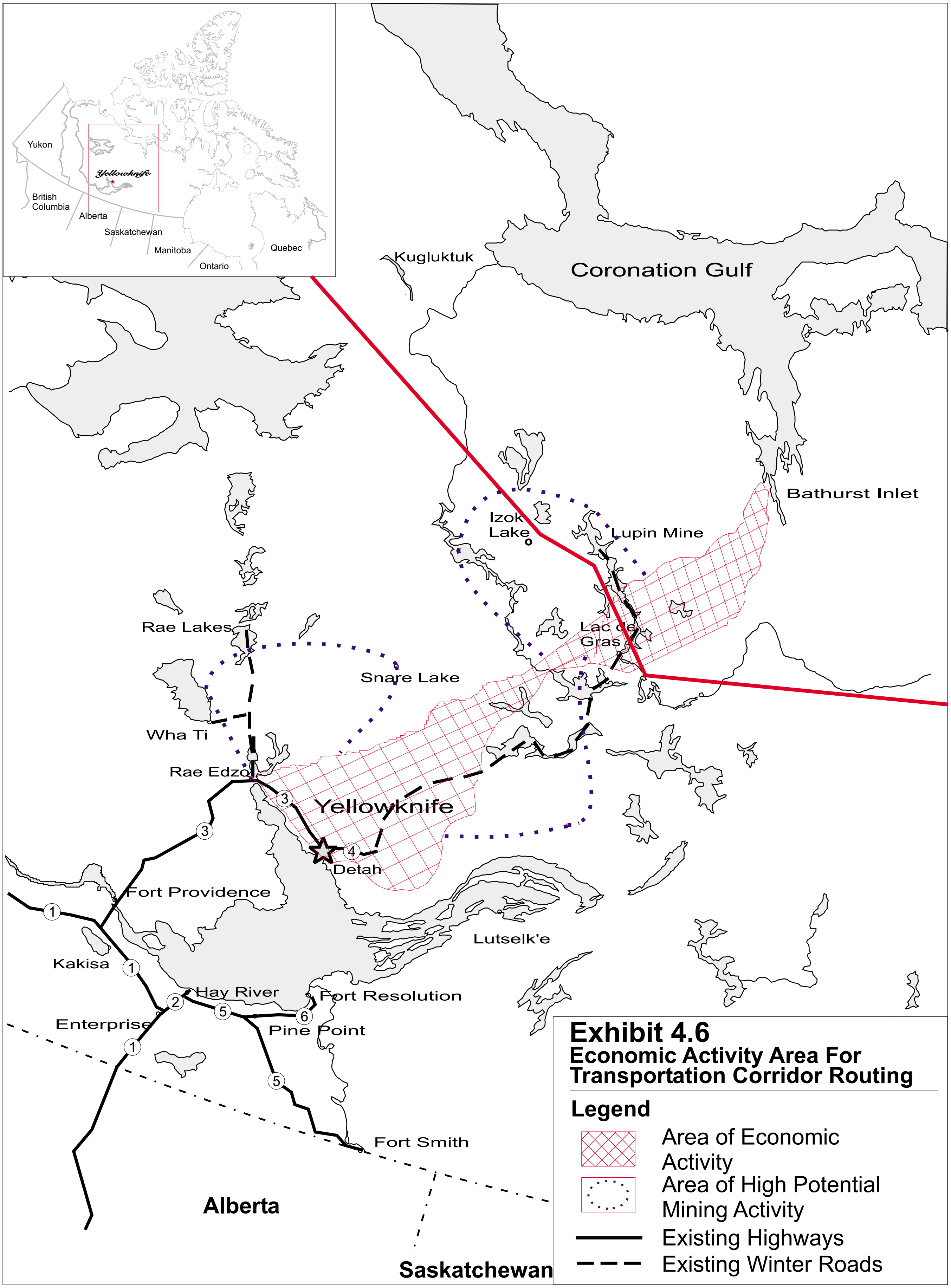


Exhibit 4.6
Economic Activity Area For Transportation Corridor Routing

The issue of the optimal origin and destination for the route also requires further study. Specifically, the issue of Rae versus Yellowknife starting point of the route will require an assessment of a number of social, economic, environmental and cost factors, as discussed on the following page. The recommended port site is a deep-sea port on Bathurst Inlet connected by an all-weather road to a point on the south end of Contwoyto Lake.

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:

1. 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.
2. 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.
3. The road may take several years to complete and it would be advantageous if each additional road section that is completed had immediate benefits.
4. The costs of the road could vary considerably depending on its start point.
5. Tourist considerations favour Yellowknife as the start point.

A number of social, political, environmental and cost factors will need to be considered in determining the optimal route for the transport corridor.

RECOMMENDED TRANSPORT SYSTEM FOR SGP

Key Findings

The existing transport system in the SGP is able to meet the current needs of the mining and tourist industries and no compelling reasons were found in this assessment for providing additional transport facilities:

- No mine requires an all-weather road during the construction phase.
- Gold and diamond mines can use winter roads during their operations phase (subject to sufficient capacity being available).
- Base metal mines, of which there are none in the SGP, must have a port and (preferably) an all-weather road to access the port. The base metal mines will also need winter roads to the south for both construction and operation.

The only sound business reasons for investing in additional transport facilities in the SGP would be:

- If a base metal mine development is found which can and will support the construction of an Arctic port/road system.
- If the demand for additional winter road capacity caused by new mines exceeds the capacity of the existing Lupin winter road or the demand is in areas not serviced by the Lupin winter road.

At this time, it appears most likely that the base metal mine development which will support a new transport system is the Izok Lake Project. Assuming that to be the case, the system needed to allow that project to proceed is an all-weather road from the Contwoyto Lake area to Bathurst Inlet.

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 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 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.

The design of the port would be governed by costs and navigational, geotechnical, and layout considerations (access, concentrates storage, fuel storage, housing, etc.). A single berth with a concentrate shiploader would handle the bulk concentrate vessels. A separate barge berth may be required for a re-supply operation. The port site would include a tank farm and year-round housing. More berths and storage sheds could be added as more mines came on stream.

The design of the ice-breaking vessels would be left to the shipper.

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 road. The all-weather road should only start when the Nunavut road is in place and be completed to meet the needs of Phase 3 expected in the year 2005 to 2015.

Future Transport Costs

On page 39, the existing costs of transporting fuel into the SGP were examined and a table was prepared showing the overall costs. A similar table is given on the following page comparing the overall costs to the Ekati mine under the existing system to the costs under a new port and all-weather road system.

	Existing System Fuel Cost at Ekati (¢ per liter)	New System Fuel Cost at Ekati (¢ 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	0 – 10¢	0 – 10¢
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.

SECTION 5.0 – FINANCING OPTIONS

The purpose of this section of the report is to present and discuss various financing alternatives which would enable the Government of the Northwest Territories (the "GNWT") to realize the construction of the proposed Slave Geologic Province Transportation Corridor (the "SGPTC" or the "Project" or the "Roadway"). In this section, we present general background information such as traditional approaches to financing infrastructure improvements, evolving models / methodologies for financing roadways, and their respective applicability to the SGPTC, and we provide an initial look at the potential revenues and costs which this roadway could generate. Finally, we discuss in more detail potential risks and opportunities for advancing this road, including identifying areas which will require additional study (areas which are generally outside the scope of this initial, high level review) in order to finalize and more precisely define the range of revenues, costs and level of debt financing which the roadway could support.

TRADITIONAL APPROACHES TO FINANCING

Traditionally in Canada, "public" infrastructure projects (i.e., bridges, roads, highways, water treatment facilities, etc.) have been financed with the governing agency responsible for these facilities issuing general obligation debt to cover their cost of construction. Once the infrastructure was operational, this same agency would also be responsible for assuming all operating obligations and costs (repairs, maintenance, capital improvements, etc.). Under this traditional method of project financing, little or no regard has generally been provided to any direct methods of cost recovery, whether it be recovery of up-front capital or annual operating costs; rather the provision of this infrastructure has been viewed more as an obligation of the government of the day and financed out of the tax base, as opposed to an investment which should demand some monetary return on invested capital.

Over time, however, governments at all levels have increasingly been experiencing pressure to continue to provide services and infrastructure, and indeed expand the range of services and infrastructure available to the tax paying public, while maintaining operating and capital budgets at the same or lesser levels. This pressure to "do more with less" has forced all levels of government to examine alternative delivery and financing strategies that rely on increased support of the private sector in providing services that have historically been the domain of the government. The provision of transportation infrastructure is no exception to this, as many projects of this sort are becoming increasingly difficult to finance through traditional public sector methods. As a result, an increase in the use of "Project Financing" as opposed to "General Obligation Debt", combined with the increased involvement of the private sector, has resulted.

PROJECT FINANCING

Third party project financing is defined as the raising of funds to finance an economically separable capital investment project, in which the providers of funds look solely to the cash flow from the project as the source of revenue from which to service their loans, and provide them with a return on and a return of their invested equity. In certain instances, securities and borrowings are designed to be serviced and redeemed ***exclusively*** out of project cash flow (i.e., project debt is "non recourse" to project sponsors); alternatively, project sponsors (who generally include the government) may provide undertakings that obligate them to supplement the project's cash flow under certain circumstances. An example of the former includes Highway 104 in Nova Scotia, while an example of the latter includes Highway 407 in Ontario and, as we currently understand it, the DeLong Mountain Transportation System in Alaska.

The term "project financing" is however, widely misused and perhaps even more widely misunderstood. To clarify the definition, it is important to appreciate what the term does not mean. Project financing is not a means of raising funds to finance a project that is so weak economically that it may not be able to service its debt or provide an acceptable rate of return to equity investors. In other words, it is not a means of financing a project that cannot be financed on a conventional basis. In such instances, it is possible that project financing would either not be provided, or that the amount of money which must ultimately be financed is reduced to better match project cash flow (as was the case in Nova Scotia where both the Federal Government and the Government of Nova Scotia committed funds to cover approximately 50% of the cost of the road; the remaining 50% was financed, on a non-recourse basis by the "road" itself). Ways in which a project that has inadequate revenue to support its cost can be made more financially viable include:

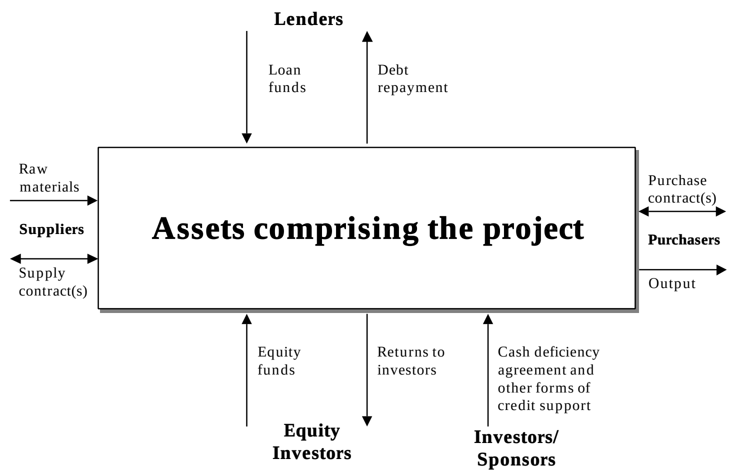
- re-engineering of the project to reduce its overall capital cost;

- "buying down" the amount which must be financed (as occurred in Nova Scotia);
- supplementing project revenues from other sources to ensure that annual project debt commitments can be made; and/or
- the government sponsor agreeing to provide its guarantee on project debt to achieve a more competitive interest rate (and thereby reduce annual debt payment obligations).

Examples of projects which ultimately proved to be unsuccessful in obtaining 100% financing and which required that they be re-engineered to reduce their overall capital cost and/or be provided with a government donation, include Highway 104 in Nova Scotia and various "multi-use spectator arenas" currently being constructed in Canada (for example, in Brampton, Guelph and Sarnia Ontario).

As can be inferred from the foregoing, most infrastructure projects require careful financial engineering to ensure that the project can support an acceptable level of debt, and perhaps of equal importance, that the various risks and rewards of the project are allocated among the involved parties in a manner that is mutually acceptable. Figure 5.1, following, illustrates the basic elements associated with an infrastructure project that is financed on a project basis.

Figure 5.1
Basic Elements of Project Financing



Typically, project financing is centred around a discrete asset, a separate facility or a related set of assets that have a specific purpose, for example, a power-generating station, a toll road or some other item of infrastructure which has the ability to generate income and cash flow. As alluded to above, this facility or asset must be capable of standing on its own as an independent economic unit. The operations of this asset, which likely are supported by a number of contractual arrangements (maintenance, policing, revenue collection / enforcement, etc.), must be organized so that the project has the unquestioned ability to generate cash flow to repay its debt and provide a return on equity, otherwise a government guarantee would generally be required.

A project must include all the facilities that are necessary to constitute an economically independent, and operationally viable entity (for example, a project cannot be an integral part of another facility; rather it must exclusively be able to utilize the entirety of the cash flow it generates to service debt). With respect to public sector projects, revenues cannot be directed to a government's consolidated revenue account; they must be accumulated within a special account which is only accessible for servicing project debt, repaying project investors and supporting project operations (unless the government is willing to guarantee or otherwise finance the project).

Project financing can be beneficial to a government agency where the project is such that usage would be strongly demanded and users would be willing to enter into long-term agreements to utilize the project; where such agreements have strong enough provisions that a bank or other lending body would be willing to advance funds to finance construction; and/or where the predicted usage of the facility, and the associated revenues which it could potentially generate, are such that a certain degree of confidence and assurance can be provided. For example, project financing can be advantageous to a developing country or region when it has a valuable resource deposit, where parties are interested in developing that deposit, and where long-term contracts can be secured to ensure a sustainable revenue stream for the project. Where such contracts cannot be secured, or where use cannot be accurately predicted, it is likely that project financing would only be available with a high interest rate, or not at all.

REQUIREMENTS FOR PROJECT FINANCING

Typically, when an infrastructure project is taken forward as an investment opportunity in order to secure project financing, it will have no operating history with which to evaluate its overall creditworthiness. As a result, the ability to actually secure financing will depend on the ability of the project's sponsor to convince potential investors (whether banks, other financial institutions, pension funds, etc.) that the project will be technically feasible and economically viable.

Technical Feasibility

Lenders must be satisfied that the technological processes to be used in the project are feasible for commercial application on the scale contemplated. For highway projects, this means that the road must physically be able to carry its intended traffic throughout its entire corridor without undue interruption and/or without undue impact to the natural environment. At a minimum, lenders will require opinions from independent engineers and other consultants, verifying that the proposed roadway can be constructed through its intended corridor, and that from the pure engineering perspective, that it is capable of supporting the level and type of traffic that the roadway is intended to support.

Economic Viability

The ability of a project to operate successfully and generate positive cash flow is of paramount importance to prospective lenders. These providers of funds must be satisfied that the project will generate sufficient cash flow to cover its costs of operation, service project debt *and* pay an acceptable rate of return to equity investors. In arriving at this conclusion, potential financiers will look to the assumptions which were used to derive estimates of project revenue and costs of operation. For a highway project, such reviews would generally include challenging assumptions with respect to projected usage, revenue per use, revenue per type of use, and assessments of the various costs of operation. In addition, it will be equally important for potential investors that project economics are sufficiently robust to keep the project profitable in the face of adverse developments, such as an escalation in construction costs, delays in construction or in the start of operations, interest rate changes, fluctuations in operating costs, and of particular importance to the SGPTC, fluctuations in world prices of various of the minerals found in the Slave Geologic Province (which may cause the operations of certain mines to cease and therefore negatively impact the economic viability of the highway).

RISK

As alluded to in the preceding discussion, project investors will need to satisfy themselves that each of the various risks which are associated with the project are such that the investor believes that (i) their return expectations adequately compensate them for accepting financial exposure; (ii) that certain risks have been appropriately and adequately addressed; and (iii) that the responsibility for minimizing those risks which can be alleviated has been allocated to the party who is best able perform that role. Generally, such risks include, among others:

- construction risk (the risk associated with completing the project on-time and on-budget);
- traffic volume risk (the risk associated with the project being able to support sufficient traffic volumes at a certain tariff level to support a quantifiable and reliable minimum revenue stream);

- business risk (the risk associated with the project being able to generate other revenues to further supplement its cost of operation);
- financing risk (the risk associated with the project being able to support its debt obligations and provide investors with a return on equity);
- interest rate risk (the risk that the interest rate at a future date will be significantly different from its initial offering rate, should the project need to be refinanced – this risk can be minimized or eliminated with the provision of a government guarantee);
- political risk (the risk that political authorities in the area will interfere with the timely development and / or longer-term economic viability of the project, for example, through the imposition of burdensome taxes or onerous legal restrictions regarding mineral exploration and mining, and potential federal and aboriginal land / ownership issues); and
- world economic risk (the risk that world price of gold, diamonds, copper, etc., will fall and undermine the continued economic viability of the various mines in the Slave Geologic Province, and therefore negatively impact the amount of traffic which would be capable of using the road).

Each of the above noted elements of risk, among others, may have dire impacts on the economic viability of the project, and in this regard, investors will look directly to these areas of risk to determine whether they believe the project is sufficiently attractive to warrant their investment. Such investors will also look to place a "value" on each element of risk, and assess whether they believe they can achieve a desired level of return. If they cannot, it is likely that the potential investor will either reduce the amount it is willing to commit to the project, or alternatively, decide not to invest in the project. In each of these instances, if the required level of financing cannot be raised, it is likely that either the project will not go forward, or that some level of government intervention would be required to "buy-down" the amount required to be financed or to supplement project revenues to ensure that sufficient revenues are available to provide investors with their required return on investment.

APPLICATION TO THE SGP TRANSPORTATION CORRIDOR

In order to assess the foregoing on the overall financial feasibility of the proposed SGPTC, we developed an interactive cash flow model to depict a base scenario of project capital costs, operating revenues and operating costs over a twenty-year projection period. This model was designed in such a manner so as to demonstrate, **on an order of magnitude basis and consistent with the intent of this preliminary review of project feasibility**, the level of debt which the project could support (i.e., the proportion of project capital cost which could be financed exclusively from the operation of the roadway), and from this, determine the level of project capital cost which various levels of government would likely need to provide in order to make the roadway financially feasible.

Additional work will be required to more precisely quantify and finalize the estimates presented herein, particularly as they relate to potential usage (as defined by the amount of fuel, goods and concentrate which can be projected, with a high level of certainty, to be transported over the roadway), such that potential lenders and equity investors would be more confident in their investment decisions. Such work is, of course, outside the scope of this preliminary review.

The usual approach to conducting a cash flow analysis of this sort is to utilize a number of assumptions as inputs to a pro-forma cash flow model in order to assess the financial performance of a project. In this regard, our model firstly estimates, again on an order of magnitude basis, the potential demand for the roadway (measured in terms of tonnes of goods and consumables, and litres of fuel projected to be imported by the various mines, and tonnes of concentrate estimated to be transported from the various mines). Estimates of total potential "inflow" (fuel, goods and consumables) and "outflow" (concentrate) traffic were derived from Exhibit 4.5. Roadway usage tariffs (by type of commodity) were then applied to these demand estimates to then derive annual revenue projections. Finally, our model projects project operating costs.

Based on the difference between project revenues and operating costs, we then estimate the amount of "debt" which the roadway could support. In determining project debt levels, we assume that the roadway would achieve break-even operations, and that all net cash flow (i.e., the difference between annual project revenues and operating costs) would be applied to repay debt. Two separate financing models have been utilized, one to depict government ownership of the roadway and therefore responsibility for the financial performance of the road, and in the other, a public-private partnership model which assumes that project debt will be financed on a non-recourse to the GNWT/other government sponsors.

Three revenue and two project capital cost scenarios are also depicted, with the revenue projections presenting a base case, a model which assumes traffic revenues are 20% higher than the base case, and a model which assumes traffic revenues are 20% less than the base case. The capital cost scenarios analyze the roadway assuming the cost to build the road would approximate $300,000 (as projected by Nuna Logistics) to $600,000 per kilometre (twice the Nuna estimate to acknowledge uncertainty and risk).

The purpose of designing and constructing any type of cash flow model is to predict the financial performance of a project, in part, by forecasting future events in a manner that can reasonably be expected to result. In developing this model, we relied, in part, on information provided by Nuna Logistics, who recently undertook a preliminary review of a permanent roadway between Contwoyto Lake and Bathurst Inlet, with a deep-sea port located at the terminus of the project (on Bathurst Inlet). Our model also relies upon information developed as part of this study, and in particular, on the estimates of potential demand (inbound and outbound tonnage) as illustrated in Exhibit 4.5. Each of the more critical assumptions and hypotheses that are assumed to have a major effect on operations are discussed below.

Capital Cost Assumptions:
Main Roadway

In developing our estimates of Project capital costs, we had regard to a costing study conducted by Nuna Logistics, which benchmarked the cost of construction for a permanent roadway in the Slave Geologic Province at roughly $300,000 per kilometre. As we understand it, this estimated cost of construction includes the following components:

- road design;
- equipment costs;

- construction materials;
- labour costs;
- accommodations (camp construction);
- travel; and
- contingency fees.

We utilized this per kilometre road construction cost as our lower end construction cost estimate, and applied this to the entirety of the roadway. We have assumed for the purpose of this analysis, that the entire roadway, from Yellowknife to Bathurst Inlet would measure 600 kilometres (400 kilometres from Yellowknife to the NWT/Nunavut border near the southern end of Contwoyto Lake, and 200 kilometres from the NWT/Nunavut border to Bathurst Inlet). The total roadway construction cost, assuming a $300,000 per kilometre construction cost would therefore be some $180 million.

We also developed a higher cost estimate, to account for possible risk and uncertainty of construction requirements associated with the lower cost scenario. This estimate assumes a per kilometre construction cost of $600,000; therefore total roadway construction costs under this scenario are projected to total approximately $360 million.

This analysis also assumes that each mine/deposit would be responsible for constructing any necessary infrastructure required to connect it to the main transportation corridor. For example, for the Izok Lake deposit, the costs associated with a spur from Contwoyto Lake to the deposit and the barge/winter road operations on Contwoyto Lake are not included within this analysis. It has therefore been assumed that these costs would be borne by each mine developer.

Bathurst Inlet Port

The construction cost of the port facility on Bathurst Inlet has been estimated by Nuna, at $30 million. This cost, as we understand it, is inclusive of the cost of constructing the port facility and all related and ancillary facilities, including fuel storage tanks, docks, dredging, and camp facilities. Not included in this estimate is the cost of equipment required to load and unload goods from vessels.

Contingency Fee

Despite prudent budgeting and cost estimating exercises, there is always some level of risk that cost overruns may be incurred. The inclusion of a contingency fee in our model recognizes this fact, and is intended to provide an appropriate cushion to keep the project on budget. Typically, a contingency of between 5% and 10% of the anticipated cost of construction is appropriate, and in this regard, we have assumed a 10% contingency, equivalent to an additional $21 million under the lower cost development scenario, and $39 million under the high cost development scenario.

Total Capital Costs

Total capital costs for the project, from Yellowknife to Bathurst Inlet, including contingencies and the construction of the port facility, is therefore projected to range from $231 million to $429 million:

	Assumed Capital Cost		
Component	**Low Scenario**		**High Scenario**
Yellowknife– Nunavut Border	$120,000,000	to	$240,000,000
Nunavut Border– Bathurst Inlet	60,000,000	to	120,000,000
Port on Bathurst Inlet	30,000,000		30,000,000
Contingency	21,000,000	to	39,000,000
Total	***$231,000,000***	***to***	***$429,000,000***

The reader should note that our analysis assumes that initially, only the port on Bathurst Inlet and a permanent road between this facility and approximately the Nunavut/NWT border will be required; it is not until “Phase 4”, assumed as commencing in 2011, when an all-weather road from Yellowknife to Bathurst Inlet will be required.

Operating Cost Assumptions:
Roadway

Operating and maintenance costs for highways vary widely, and are dependent upon various factors including frequency of usage, type of usage, terrain, weather, etc. Our discussions with various stakeholders have indicated that operating costs on a per kilometre basis vary from approximately $10,000 to as high as $15,000. For the purpose of the study, we have assumed that the level of maintenance required for the subject roadway would approximate the middle of this range, or $12,500 per kilometre. This fee is assumed to be inclusive of all costs, including labour and materials.

Bathurst Inlet Port

With regard to operating costs for the port, our discussions have identified a range of between $2.0 million and $4.0 million on an annual basis. Once again, for the purpose of this study we have used the median value of $3,000,000.

Management Fee

Generally speaking, a management fee would normally be incurred as compensation for running the day-to-day operations of the project. We have assumed that a third party would be retained to oversee such operations, regardless of whether the project is "owned and operated" by the GNWT or a private sector partner, and have estimated this fee based on a standard 3% of gross operating revenues. For the entire project (i.e., roadway and port), this fee is projected to total some $470,000 annually in the first year.

Total Operating Costs

Total operating costs for the project, from Yellowknife to Bathurst Inlet, including management fees, is therefore projected to be some $11 million annually.

Component	**Assumed Operating Cost**
Yellowknife – Contwoyto Lake	$5,000,000
Contwoyto Lake – Bathurst Inlet	2,500,000
Port on Bathurst Inlet	3,000,000
Management Fee	469,735
Total	***$10,969,735***

Operating Revenue Assumptions:
Quantification of Goods Movements

The operating revenues expected to be captured by the SGPTC are assumed to be derived from two main sources, tolls collected from parties transporting goods, fuel and concentrate to and from the various mines located in proximity to its right-of-way, and fees collected from the handling of materials at the port facility on Bathurst Inlet.

The methodology for determining the actual toll for such shipments is partially dependant on the type of goods being shipped, and in particular bulk supplies, mining concentrate, and ore would likely be assessed a toll based on a given rate per tonne, per kilometre[2]. Fuel on the other hand, is more likely to be assessed a toll based on a rate per 1,000 litres, per kilometre. This methodology therefore requires fairly detailed estimates to be made with regard to the type and amount of goods being shipped and the distance traveled. For the purpose of this analysis, we have based our projections on estimates of the number and type of mining projects expected to operate in the vicinity of the roadway. The basis for these estimates are described in more detail in Section 4.0.

Clearly, the economic and financial feasibility of the roadway is intrinsically linked to the overall feasibility of the various mines which they are expected to serve, and therefore cannot be considered in isolation. For example, it would be inappropriate to assume that a roadway would handle 500,000 tonnes of concentrate or aggregate per annum, if the mines using the roadway have a total expected output of less than this amount. In this regard, we have utilized the estimates sourced through stakeholder interviews, calculated from known tonnage of current operating mines, and other reports made available by the GNWT. These estimates are discussed in more detail in Section 4.0, and are presented in Exhibit 4.5. A summary of the projected usage of the roadway, by phase of development, is contained in Figure 5.2, following. Appendix 5 provides more detailed description.

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2 "*Consumables*" refer to goods that are consumed during mining operations, including fuel, reagents, grinding media and explosives. "*Supplies*" refer to maintenance and operating goods, including warehouse supplies, equipment parts and food.

In terms of the actual inflows and outflows of materials (fuel, supplies, consumables, concentrate) which could be expected to traverse the roadway, we have assumed that 80% of all inbound fuel and 25% of all inbound goods and consumables entering the SGP between 2001 and 2010 would be shipped to storage facilities located at Bathurst Inlet, and then transported southward along the permanent roadway to the Nunavut/ NWT border (approximately 200 kilometres in length). At this point, some of the materials would be taken further south; however, for simplicity, we have assumed that these goods would be transported to their final destination via a winter road, the revenues from which would accrue to the benefit of the owner/operator of that road (our analysis is therefore restricted to the operations of the permanent roadway). The remaining 20% of inbound fuel and 75% of inbound goods and consumables would continue to be transported northward from Yellowknife along winter roads, again with the revenues associated with the transportation of such goods accruing to the benefit of the winter road operator.

After 2010, we assume that the entire permanent roadway, from Yellowknife to Bathurst Inlet would be completed, and at this time, 75% of imported fuel would be shipped southward from Bathurst Inlet, with the remaining 25% shipped north from Yellowknife (with all shipments occurring along the all-weather road). Similarly, the amount of goods and consumables shipped southward from Bathurst Inlet would continue to total 25% of projected demand, with the remaining 75% being shipped northward from Yellowknife. 100% of all outbound traffic carrying concentrate would continue to be transported northward to Bathurst Inlet.

Goods Movements	Phase 2	Phase 3	Phase 4
Inbound Fuel – from North	80%	80%	75%
Inbound Fuel – from South	0%	0%	25%
Inbound Fuel – along Winter Road	20%	20%	0%
Inbound Goods – from North	25%	25%	25%
Inbound Goods– from South	0%	0%	75%
Inbound Goods– along Winter Road	75%	75%	0%
Outbound Goods – to North	100%	100%	100%
Outbound Goods – to South	0%	0%	0%
Outbound Goods – along Winter Road	0%	0%	0%

Figure 5.2
Projected SGPTC Usage

	2001-2005	2006-2010	2011-2020
INBOUND TRAFFIC			
Commodity			
Fuel (litres)			
Diamond #1	52,400,000	52,400,000	79,600,000
Gold #1	28,300,000	28,300,000	28,300,000
Diamond # 2	48,000,000	48,000,000	48,000,000
Base Metal #1	22,000,000	22,000,000	22,000,000
Diamond #3	-	19,000,000	19,000,000
Gold #2	-	36,000,000	36,000,000
Base Metal #2	-	-	15,000,000
Sub-Total	150,700,000	205,700,000	247,900,000
Consumables			
Diamond #1	13,100	13,100	17,000
Gold #1	17,100	17,100	17,100
Diamond # 2	13,000	13,000	13,000
Base Metal #1	9,000	9,000	9,000
Diamond #3	-	11,300	11,300
Gold #2	-	8,700	8,700
Base Metal #2	-	-	6,000
Sub-Total	52,200	72,200	82,100
Supplies			
Diamond #1	1,200	1,200	1,000
Gold #1	1,300	1,300	1,300
Diamond # 2	800	800	800
Base Metal #1	600	600	600
Diamond #3	-	500	500
Gold #2	-	600	600
Base Metal #2	-	-	400
Sub-Total	3,900	5,000	5,200
TOTAL INBOUND			
Fuel (litres)	150,700,000	205,700,000	247,900,000
Consumables/Goods (tonnes)	56,100	77,200	87,300
OUTBOUND			
Concentrate			
Diamond #1	-	-	-
Gold #1	-	-	-
Diamond # 2	-	-	-
Base Metal #1	320,000	320,000	320,000
Diamond #3	-	-	-
Gold #2	-	-	-
Base Metal #2	-	-	240,000
Sub-Total	320,000	320,000	560,000

Toll Rates

The projected tariff rates per kilometre (whether per tonne kilometre or per 1,000 litres per kilometre) were derived, in part, from the Nuna Logistics report. In particular, we have acknowledged the approximate $0.10 per litre fuel savings which could potentially accrue to users with the construction of a port facility and have sought to recapture a portion of these savings through the setting of tariffs. Our assumed fuel transport cost, $0.10 per 1,000 litres, per kilometre, therefore equates to a total cost of $0.02 per litre across the 200km distance. Given that this report states that as much as a $0.10 per litre savings could arise, we therefore believe this estimate is somewhat conservative.

Tariff rates for goods, consumables and concentrate are assumed at $0.125 per tonne per kilometre, or $25 per tonne in total, across the 200km.

Transport Costs	Toll ($ per kilometre)
Fuel	$0.10 per 1,000 litres
Goods/Consumables	$0.125 per tonne
Concentrate	$0.125 per tonne

We have utilized the toll estimates as our starting point due to the linkage between the operation of the road and our assumed relationship between the overall economic viability of various mines and their ability to pay to utilize the road. Increasing these charges may at some point constrain the financial performance of the mine to the point that the charges are no longer feasible.

Distances

As stated above, we assume that the entire length of the roadway is approximately 600 kilometres, divided between that section which lies within Nunavut (estimated at 200 kilometres in total length), and that section which lies within NWT (estimated at 400 kilometres in total length). We should also note that we have assumed that all shipping/delivery points will be located at precisely the border between Nunavut and NWT. Actual traffic will, however, be dispersed throughout the corridor, and/or some traffic will traverse from NWT into Nunavut (or vice-versa). Therefore actual distances may prove to be less than assumed in the following table, and potential revenues from both inbound and outbound traffic could be misrepresented. Given that we cannot predict, with certainty where such points of origin or destination will ultimately occur, we have nonetheless assumed the middle point of the corridor.

Roadway Section	**Assumed Distance**
Yellowknife – Contwoyto Lake	400 kilometres
Contwoyto Lake – Bathurst Inlet	200 kilometres
Total	***600 kilometres***

It should again be noted that this analysis assumes that each mine / deposit would be responsible for constructing any necessary infrastructure required to connect it to the main transportation corridor. For example, for the Izok Lake deposit, the costs associated with a spur from Contwoyto Lake to the deposit and the barge / winter road operations on Contwoyto Lake are not included within this analysis. It has therefore been assumed that these costs would be borne by the mine developer.

Roadway Revenues

Based on the foregoing, our analysis indicates that the proposed roadway would be capable of generating gross annual revenues of approximately $10.8 million between 2001 and 2005, $11.8 million annually between 2006 and 2010, and $24.0 million annually, thereafter (see Figure 5.3 following).

Figure 5.3

	Annual Revenue Projections		
	2001-2005	2006-2010	2011-2020
Northern Section	$ 10,761,825	$ 11,773,700	$ 18,264,125
Southern Section	-	-	5,752,750
TOTAL	$ 10,761,825	$ 11,773,700	$ 24,016,875

Projected All-Weather Roadway Revenues

Note: Figures shown in Figure 5.4 identify revenues which are projected to accrue annually during each year of the projection period.

Port Fees

Our assumptions concerning revenues, which could be generated by the port facility, were derived through consultations with Nuna Logistics, and are based on our assumptions regarding the amount of outbound traffic which could be assumed to take place over the projection period. Pricing for the handling goods (both inbound and outbound) was derived from a study prepared by Nuna. A detailed breakdown of the goods handled by the port, and the corresponding fees is presented in Figure 5.4, following.

**Figure 5.4
Projected Port Revenues**

	Breakdown of Goods Movements at Port		
	2001-2005	2006-2010	2011-2020
Fuel (litres)	120,560,000	164,560,000	185,925,000
Consumables/Supplies (tonnes)	14,025	19,300	21,825
Aggregate/Concentrates (tonnes)	320,000	320,000	560,000
	Annual Revenue Projections		
	2001-2005	**2006-2010**	**2011-2020**
Fuel	$ 1,205,600	$ 1,645,600	$ 1,859,250
Consumables/Supplies	112,200	154,400	174,600
Aggregate/Concentrates	2,560,000	2,560,000	4,480,000
TOTAL	$ 3,877,800	$ 4,360,000	$ 6,513,850

Note: Figures shown in Figure 5.4 identify revenues which are projected to accrue annually during each year of the projection period.

Financing Assumptions

As stated above, our pro-forma cash flow model has been designed to generate the likely equity contributions required in order for the project to operate on a break-even basis. As presented previously, two distinct models have been prepared, the first of which assumes that both the road and the port will be owned by the government (although we have also assumed that their respective operations will be outsourced to a private operator), while the second assumes some sort of public-private partnership. The main difference between the two models is the cost of financing, since a government guarantee is likely to result in an interest rate similar to that of a bond or other general obligation debt instrument, while a private sector firm providing capital in a public-private partnership would typically require a higher return on their investment. The simplicity of this model is such that other assumptions are not necessary; however, in the future, more detailed assessments will need to be undertaken to ensure that equity and debt levels have been appropriately determined, and that debt coverage ratios which a lender would be comfortable with, can be maintained throughout the amortization period.

Cost of Financing

The cost of financing is based on an interest rate that would likely be associated with a project of this type. Generally, if a government entity provides its guarantee on the debt that is ultimately secured, an interest rate could be obtained at or about 50 basis points above a Government of Canada bond of a similar time frame as that of the amortization period of the loan. In our model depicting public ownership of the roadway, we have assumed that government sponsored financing would be available and monies would be provided at an interest rate approximating 5.50%.

In the case of an alternative ownership structure involving private investment, we have assumed that these investors are likely to require a significantly higher return, and therefore we have assumed that monies provided would bear an interest rate of 12.50%. While this assumed interest rate would appear to be excessive, we have assumed that this rate could constitute a blended rate for both debt and equity (with debt being placed at a rate below this figure, and return on equity expectation well in excess of this figure). We further assume that this debt would be non-recourse to the GNWT or other government sponsor of the roadway, and would be taken out based on the strength of the corporate covenant of the private partner.

Debt/Equity Levels

The amount of debt (under the government ownership scenario) and debt and equity (under the public-private partnership scenario) which the roadway could support was determined by discounting the annual net revenues of the roadway (gross revenues less operating costs) at our assumed interest rates. Determined in this manner, we have assumed that 100% of all revenues remaining after the payment of operating costs would be applied to pay down debt, and therefore we have inherently assumed that the project would achieve a break-even operating position on an annual basis. Additionally, we have also assumed that a lender would accept a progressive repayment schedule, with fixed payments made for the initial five years, and higher, but again fixed payments made for the remaining years of the projection period.

The difference between the amount of debt which the road and port could support and the total capital cost of the Project therefore identifies the amount which must be contributed or bought down by the government in order achieve minimum financial viability (the "funding gap"). Annual debt service obligations have therefore been derived from the maximum amount of debt which the project could support (total capital costs less equity contributions), and is based on our assumed cost of capital (5.50% for government debt, 12.50% for privately placed debt).

Project Income Statement

Based on our above noted assumptions regarding the operations of the proposed SGPTC, we developed a model to depict the likely financial performance of the system over a 20-year projection period. Generally, a longer term pro-forma analysis would be undertaken (for example, 35 to as much as 50 years); however, accurately predicting future usage of the roadway will be dependent upon a number of factors, including forecasting trends in world commodity prices and their respective impact on mining activity in the SGP – elements which are outside the scope of this preliminary assessment, but are nonetheless critical to accurately predicting the financial viability of the project from a lender's perspective. Such work will constitute a necessary component of any follow-on work. The analysis which follows is based on those assumptions set out in the foregoing, and describes the financial viability of the roadway separately for each of the northern (i.e., that portion of the roadway which lies within Nunavut) and southern (i.e., the portion of the road which lies within NWT) sections.

Northern Section, Government Ownership

Our initial analysis, or base scenario of operations for the northern section of the roadway indicates that the proposed roadway and port would be capable of supporting debt financing of $177.5 million, or an amount of between $12.5 million and $78.5 million in excess of the projected capital cost. As such, the above described analysis indicates that the northern section of the roadway and port facility would be capable of standing on its own, and not require any influx of government capital to realize full construction.

In addition, we tested the sensitivity of our model to measure the impact of changes in road usage on the magnitude of the funding gap. In this regard, we measured the impact of a 20% increase in traffic (assuming that the roadway would cause some mining companies to increase their exploration and mining activity in the area). We also measured the impact of a 20% decrease in traffic.

Should the construction of the northern road-port network allow more mines to be brought into active production, we estimate that the road would be capable of supporting its entire cost of construction, and generate an operating surplus, on a net present value basis, of between $48.0 million and $114.0 million. The effect of a reduction in road revenues of 20% is similarly profound. Depending on the capital cost of the project, we estimate that the roadway could require a $17.1 million contribution in order to fund the difference between the total cost of the project and the level of debt which the roadway would support at a cost of $600,000 per kilometre. Assuming project capital costs at the lower end of the range (i.e., $300,000 per kilometre), the roadway is projected to be capable of supporting its entire cost of construction, and generate an operating surplus of $48.9 million.

We should note that an underlying assumption inherent in the foregoing is that the government would be wholly and solely responsible for any shortfalls in operating revenues, and wholly and solely responsible for any increases in project operating costs. Thus, for example, if the project was financed based on the operating pro-forma depicted under the base scenario, but operated pursuant to the scenario where revenues were, say, 10% less than this amount, it would be responsible for funding the $1.5 million shortfall in revenues. Similarly, if annual operating costs were substantially higher than the $6.0 million assumed for this portion of the road, it too would be responsible for funding any difference.

The opposite is also true, for example, if revenues prove greater than those depicted in our base scenario, or if operating costs prove less than $6.0 million (i.e., the government would receive all monetary benefit should such events occur).

Figure 5.5, following, summarizes the base model, and the effects of both an increase and reduction in road traffic on supportable debt and equity contributions for the Northern Section of the roadway.

Figure 5.5
Project Income Statement – Northern Section

PROJECT CAPITAL COST	BASE SCENARIO Low Cost	BASE SCENARIO High Cost	INCREASED REVENUES Low Cost	INCREASED REVENUES High Cost	DECREASED REVENUES Low Cost	DECREASED REVENUES High Cost
Road Length	200	200	200	200	200	200
Development Cost	$ 60,000,000	$ 120,000,000	$ 60,000,000	$ 120,000,000	$ 60,000,000	$ 120,000,000
Port	30,000,000	30,000,000	30,000,000	30,000,000	30,000,000	30,000,000
Contingency	9,000,000	15,000,000	9,000,000	15,000,000	9,000,000	15,000,000
TOTAL CAPITAL COST	$ 99,000,000	$ 165,000,000	$ 99,000,000	$ 165,000,000	$ 99,000,000	$ 165,000,000
NPV of NET CASH FLOW FROM OPERATIONS						
Assumed Government Ownership	$ 177,490,160	$ 177,490,160	$ 212,988,191	$ 212,988,191	$ 147,908,466	$ 147,908,466
Assumed Private Ownership	$ 92,440,999	$ 92,440,999	$ 110,929,199	$ 110,929,199	$ 77,034,166	$ 77,034,166
FUNDING GAP						
Government Ownership	$ 78,490,160	$ 12,490,160	$ 113,988,191	$ 47,988,191	$ 48,908,466	$ (17,091,534)
Private Ownership	$ (6,559,001)	$ (72,559,001)	$ 11,929,199	$ (54,070,801)	$ (21,965,834)	$ (87,965,834)
PROPORTION OF PROJECT CAPITAL COSTS ABLE TO BE FINANCED						
Government Ownership	179.3%	107.6%	215.1%	129.1%	149.4%	89.6%
Private Ownership	93.4%	56.0%	112.0%	67.2%	77.8%	46.7%

Northern Section, Public-Private Partnership

Our analysis of an alternative ownership structure, wherein the project is "owned" and operated by a private sector partner for a defined period of time, utilizes similar assumptions as the public ownership model presented previously. However, the sole difference between this model and the former model, lies in our assumed interest rate, or return expectation assumption. This model assumes that a private partner would be willing to assume all responsibility for operating the road and port, on a non-recourse basis to the government. In exchange, the cost of financing charged would be significantly greater than the 5.50% assumed under the public ownership model. Under this revised structure, we have assumed that a private partner would finance a portion of the capital cost of the project and provide an equity contribution such that the combination of debt financed and return expectations of the private partner would average 12.50%.

Under this revised scenario, and using those assumptions set out previously, we estimate that the northern section of the proposed roadway and port would be capable of supporting debt and equity financing of $92.4 million, or between 56% and 93% of the total cost of the project (depending on capital cost assumptions). As such, a funding gap ranging from $6.6 million to as much as $72.6 million would be required in order to realize the full construction of this project. The presence of a "funding gap" in this ownership version can be explained solely by the higher interest rate assumed under this scenario.

Once again, we tested the sensitivity of this model to measure the impact on the amount of debt and private sector equity the road could support if traffic was increased by 20% or alternatively decreased by 20%. The effect of a 20% jump in road revenues increases the amount of supportable private sector debt and equity from $92.4 million to $110.9 million, and accordingly reduces the funding gap by an equivalent amount (from $72.6 million to $54.1 million under the higher construction cost scenario, and turns the funding gap of $6.6 million under the lower construction cost scenario into an operating surplus, on a net present value basis, of $11.9 million). A decrease in traffic by 20% would reduce the amount of supportable private sector debt and equity by $15.4 million from $92.4 million to $77.0 million (and thereby increase the size of the funding gap under the higher construction cost scenario to $88.0 million and to $22.0 million under the lower construction cost scenario).

We should again note that an underlying assumption inherent in the foregoing is that the government, in this instance, would not be responsible for any shortfalls in operating revenues, nor for any increases in project operating costs. Thus, for example, if the project was financed based on the operating pro-forma depicted under the base scenario, but operated pursuant to the scenario where revenues were, say, 10% less than this amount, the private partner, not the government, would be responsible for funding the $1.5 million shortfall in revenues. Similarly, if operating costs were substantially higher than the $6.0 million assumed for this portion of the road, the private partner would be responsible for funding any difference. The opposite is again true, for example, if revenues prove greater than those depicted in our base scenario, or if operating costs prove less than $6.0 million (i.e., only the private partner would share in the up-side if such were to occur).

Summary

The conclusion we draw from the foregoing is that the construction of the northern section of the roadway, from the NWT/Nunavut border to Bathurst Inlet, and including the construction of the port on Bathurst Inlet, could be constructed with minimal and perhaps no, direct outlay from the government. More importantly, it is possible that the roadway could generate a sizable surplus which could be banked and used to assist in offsetting the construction of other portions of this roadway.

Southern Section, Government Ownership

Our base scenario of operations for the southern section of the roadway, the portion of the all-weather road which lies exclusively in the NWT, indicates that the proposed roadway would be capable of supporting debt financing of only $10.5 million, significantly less than the $132 million to $264 million which this section of roadway is expected to cost. At such a level, the southern portion of the road is expected to finance only 4.0% to 8.0% of the total cost of the project. As such, our analysis indicates that the southern section of the roadway would not be capable of standing on its own, and would require a significant influx of government capital to realize full construction.

We likewise tested the sensitivity of our model to measure the impact of changes in road usage on the magnitude of the funding gap. In this regard, we measured the impact of a 20% increase in traffic (assuming that the roadway would cause some mining companies to increase their exploration and mining activity in the area). We also measured the impact of a 20% decrease in traffic. As could be expected, however, such increases will have little impact on the ability of this section of the roadway to support significant additional debt.

Figure 5.6, following, summarizes the base model, and the effects of both an increase and reduction in road traffic on supportable debt and equity contributions for the southern section of the roadway.

Figure 5.6
Project Income Statement – Southern Section

	BASE SCENARIO		INCREASED REVENUES		DECREASED REVENUES	
	Low Cost	High Cost	Low Cost	High Cost	Low Cost	High Cost
PROJECT CAPITAL COST						
Road Length	400	400	400	400	400	400
Development Cost	$ 120,000,000	$ 240,000,000	$ 120,000,000	$ 240,000,000	$ 120,000,000	$ 240,000,000
Contingency	12,000,000	24,000,000	12,000,000	24,000,000	12,000,000	24,000,000
TOTAL CAPITAL COST	$ 132,000,000	$ 264,000,000	$ 132,000,000	$ 264,000,000	$ 132,000,000	$ 264,000,000
CAPITALIZED NET CASH FLOW FROM OPERATIONS						
Assumed Government Ownership	$ 10,548,500	$ 10,548,500	$ 12,658,200	$ 12,658,200	$ 8,790,417	$ 8,790,417
Assumed Private Ownership	$ 4,641,340	$ 4,641,340	$ 5,569,608	$ 5,569,608	$ 3,867,783	$ 3,867,783
FUNDING GAP						
Government Ownership	$ (121,451,500)	$ (253,451,500)	$ (119,341,800)	$ (251,341,800)	$ (123,209,583)	$ (255,209,583)
Private Ownership	$ (127,358,660)	$ (259,358,660)	$ (126,430,392)	$ (258,430,392)	$ (128,132,217)	$ (260,132,217)
PROPORTION OF PROJECT CAPITAL COSTS ABLE TO BE FINANCED						
Government Ownership	8.0%	4.0%	9.6%	4.8%	6.7%	3.3%
Private Ownership	3.5%	1.8%	4.2%	2.1%	2.9%	1.5%

Note: The analysis assumes that the southern section of the roadway would be constructed in 2011.

Southern Section, Public-Private Partnership

Our analysis of an alternative ownership structure, wherein the project is "owned" and operated by a private sector partner for a defined period of time, again utilizes similar assumptions as the public ownership model presented previously, and assumes that a private partner would be willing to assume all responsibility for operating the road and port, on a non-recourse basis to the government.

Under this revised scenario, and using those assumptions set out previously, we estimate that the southern section of the proposed roadway would be capable of supporting debt and equity financing of only $4.6 million, or roughly 1.8% to 3.5% of the total cost of the project. As such, a funding gap ranging from $127.4 million to as much as $259.4 million would be required in order to realize the full construction of this project.

We again tested the sensitivity of this model to measure the impact on the amount of debt and private sector equity the road could support if traffic was increased by 20% or alternatively decreased by 20%. The effect of a 20% jump in road revenues increases the amount of supportable private sector debt and equity from $4.6 million to $5.6 million, and accordingly reduces the funding gap by an equivalent amount. A decrease in traffic by 20% would reduce the amount of supportable private sector debt and equity by $774,000, from $4.6 million to $3.9 million.

Summary

The conclusion we draw from the foregoing is that the southern section of the roadway, from Yellowknife to the NWT/ Nunavut border, could only be realized with the direct and on-going support of the government, whereas the northern section would appear to be viable with only minimal government support (due primarily to the projected volumes of the northern section versus the southern section of the roadway). It is also likely, given the limited revenue potential of the southern section of the roadway (particularly because of our assumption that all concentrate would be transported north to the port on Bathurst Inlet as opposed to south to Yellowknife), that a private partner would not be willing to participate financially in this project. Figure 5.7, following, illustrates a consolidated income statement for the entire roadway.

Figure 5.7
Project Income Statement – Entire Roadway

	BASE SCENARIO		INCREASED REVENUES		DECREASED REVENUES	
	Low Cost	High Cost	Low Cost	High Cost	Low Cost	High Cost
PROJECT CAPITAL COST						
Road Length	600	600	600	600	600	600
Development Cost	$ 180,000,000	$ 360,000,000	$ 180,000,000	$ 360,000,000	$ 180,000,000	$ 360,000,000
Port	30,000,000	30,000,000	30,000,000	30,000,000	30,000,000	30,000,000
Contingency	21,000,000	36,000,000	21,000,000	36,000,000	21,000,000	36,000,000
TOTAL CAPITAL COST	$ 231,000,000	$ 426,000,000	$ 231,000,000	$ 426,000,000	$ 231,000,000	$ 426,000,000
CAPITALIZED NET CASH FLOW FROM OPERATIONS						
Assumed Government Ownership	$ 188,038,660	$ 188,038,660	$ 225,646,391	$ 225,646,391	$ 156,698,883	$ 156,698,883
Assumed Private Ownership	$ 97,082,339	$ 97,082,339	$ 116,498,807	$ 116,498,807	$ 80,901,949	$ 80,901,949
FUNDING GAP						
Government Ownership	$ (42,961,340)	$ (237,961,340)	$ (5,353,609)	$ (200,353,609)	$ (74,301,117)	$ (269,301,117)
Private Ownership	$ (133,917,661)	$ (328,917,661)	$ (114,501,193)	$ (309,501,193)	$ (150,098,051)	$ (345,098,051)
PROPORTION OF PROJECT CAPITAL COSTS ABLE TO BE FINANCED						
Government Ownership	81.4%	44.1%	97.7%	53.0%	67.8%	36.8%
Private Ownership	42.0%	22.8%	50.4%	27.3%	35.0%	19.0%

Note: The analysis assumes that the northern section of roadway is constructed in 2001, and the southern section in 2011.

PROJECT RISKS

As can be inferred from the above analysis, a number of external forces will impact the overall financial viability of the proposed roadway, and directly impact its ability to attract financing and financial partners. These project risks were generally discussed above, and include the following:

- construction risk (the risk associated with completing the project on-time and on-budget);
- traffic volume risk (the risk associated with the project being able to support sufficient traffic volumes at a certain tariff level to support a quantifiable and reliable minimum revenue stream);
- business risk (the risk associated with the project being able to generate other revenues to further supplement its cost of operation);
- financing risk (the risk associated with the project being able to support its debt obligations and provide investors with a return on equity);
- interest rate risk (the risk that the interest rate at a future date will be significantly different from its initial offering rate, should the project need to be refinanced – this risk can be minimized or eliminated with the provision of a government guarantee);
- political risk (the risk that political authorities in the area will interfere with the timely development and/or longer-term economic viability of the project, for example, through the imposition of burdensome taxes or onerous legal restrictions regarding mineral exploration and mining, and potential federal and aboriginal land/ownership issues); and
- world economic risk (the risk that world price of gold, diamonds, copper, etc., will fall and undermine the continued economic viability of the various mines in the Slave Geologic Province, and therefore negatively impact the amount of traffic which would be capable of using the road).

Of perhaps greatest concern from an overall financial perspective, is the impact of world commodity prices on the operational viability of individual mines and hence on the operational viability of the proposed roadway. Clearly, the operational success of the roadway, from a pure financial perspective, will be intrinsically linked to its ability to service a large number of mining companies operating in proximity to its right-of-way. As presented in our previous report, the mere presence of improved transportation infrastructure will serve to reduce the costs associated with exploration and increase the probability of some of these properties being put into production.

However, and irrespective of the foregoing, world commodity prices will ultimately dictate whether an individual mine is operationally viable. If world commodity prices are such that a mine would only be marginally viable, the mine's ability to pay an appropriate amount for using the proposed roadway will be restricted, and thus achievable tariffs for using the roadway may be less than that assumed in our analysis. If world commodity prices are such that a mine would not be economically viable, the mere presence of a permanent transportation corridor will have no effect on existing or spawning new mining activity.

As presented in Exhibit 3.5 in Section 3.0 of our report, 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 SGPTC 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 these projects to proceed to more advanced stages. As a result, it is our opinion that 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 GNWT 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.

POTENTIAL IMPLEMENTATION STRUCTURES

As discussed above, it is clear that the ultimate financing of the proposed Slave Geologic Province Transportation Corridor will be highly dependent upon a number of elements, including its potential usage and its ability to generate a sustainable revenue stream and positive cash flow. The preliminary findings from previous work undertaken as part of this overall study, in addition to the above analysis, allude to the project being capable of generating a quantifiable revenue stream. However, and despite our preliminary view of the operational viability of the northern section of the roadway, the surety of this revenue stream in the longer-term will greatly impact the return expectations of individual investors, and hence impact the amount of debt which the project would ultimately be able to support, and how the project should be financially structured.

Stated again, a number of implementation structures are possible, each of which will ultimately depend on the overall viability of the project, as confirmed through an "investment grade" financial review of the project to confirm traffic volumes and toll revenues.

Traditional Government Financing

The project could be developed similar to a traditional government infrastructure project, where the GNWT would be responsible for 100% of the construction and operating costs of the project. The government would be able to retain all of the revenue which the project would generate (through the payment of tolls or usage fees) and therefore realize all monetary benefit which the roadway could produce.

As concluded above, the majority of these costs have been identified as fully financable through project revenues, with only a small funding gap identified as part of our base scenario. This financing model assumes, however, that the debt holders would have recourse to the GNWT (or other project sponsors as the case may be) should the project not generate sufficient revenues to cover annual debt obligations.

It may be possible to circumvent this possibility through the issuance of "revenue bonds". Subscribers to this offering would essentially be purchasing the future revenue stream which the roadway is projected to generate, and would not be able to look to the government sponsor should revenues in a particular year prove insufficient. In this instance, the government would still be provided with full ownership of the project, but the "coupon rate" of the bonds (i.e., the interest rate) would likely be substantially higher (greater than our assumed 5.50%, but less than the 12.50% assumed under the public-private partnership scenario).

It may also be possible for the government to secure up-front capital contributions from each of the mining and other operating concerns along its right-of-way, in an attempt to reduce (buy-down) its up-front capital exposure. Based on the comments provided to us during our stakeholder consultations, we believe that there is some opportunity for a proportion of the project's capital cost to be provided by such parties, with such contributions used to offset the funding gap identified previously.

Examples of potential sources of funding include:

- the Department of Indian and Northern Affairs;
- the new Government of Nunavut, particularly with regard to that portion of the road which would traverse Nunavut, along with the port (negotiations would be necessary in order to come to a revenue sharing agreement for use of the road between the NWT and Nunavut);
- individual mining companies (discussions and consultations with such parties indicated, however, little interest in providing such funds; should funding be made available, it is likely that such parties would require free or reduced tariff usage of the roadway and/or port);
- major transport companies operating in the NWT (Nuna Logistics Ltd., for example, has expressed a strong interest in developing the portion of the roadway north from Contwoyto Lake, or at a minimum, providing a significant up-front capital contribution provided it is also offered the right to operate the road and port);
- NWT Power Corporation (NWT-PC have indicated that a new, permanent road, particularly one which is connected to a deep-sea port, would lower their fuel supply costs, which would in turn "free up" monies for other purposes; presumably such savings could be

reallocated directly to this project with no impact on the operations of NWT-PC);

- Aboriginal Groups, particularly the Metis Nations who are "strongly interested in being involved with providing financing and partnerships for the development" (while such overtures have been made by this particular group, it is unlikely that significant contributions could be sourced from these parties until outstanding land claims have been settled).

  At this point, significant discussion/negotiation are still required to precisely quantify the exact magnitude of funds which could be expected from the above noted parties, and as a result, we are unable to accurately depict such contributions in the above pro-forma cash flow models (given that additional assumptions would have to be made with respect to donation amounts and repayment requirements and/or tariff reductions).

Public-Private Partnership

The project could also be developed pursuant to some form of public private partnership, wherein the GNWT would allow a third party to design, build, finance, operate and maintain the roadway. Depending on the economic characteristics of the project, the private partner may either own the roadway outright, or lease it for a defined period of time (generally tied to the length of time required to retire project debt and earn a fair rate of return). Structured in this fashion, the private operator would be responsible for all costs associated with operating and maintaining the road, and would be responsible for collecting all revenues which the roadway and port would generate.

Depending on how the financing is ultimately structured, the private operator would then pay back project investors, earn a project management fee for operating and maintaining the project, and provide all parties, including possibly the GNWT, with a return on equity. Our analysis shows that under such a scenario, a funding gap of approximately 50% of the cost of the entire roadway would likely result (although in exchange for this up-front contribution, the roadway could be operated on a non-recourse basis to the government sponsor).

Several potential structures may be applicable under such a PPP structure, including:

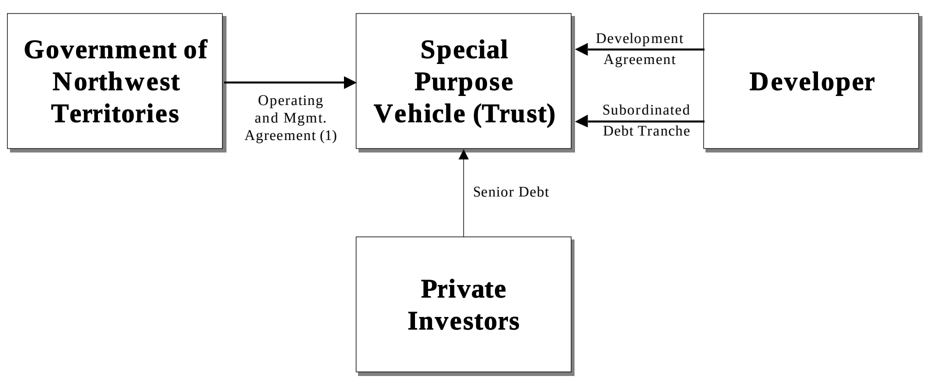
- ***Operating and Management Agreement ("OMA").*** Under this model, a private partner is retained to operate and manage a publicly owned facility or provide a public service under a contract from a sponsoring government agency. OMAs are generally entered into in situations where it can be proven that private operation may result in improved service, increased efficiencies and / or lower costs, and are applicable to projects where a business case exists for the project to operate on a break-even basis within the first two years of operation. OMAs can also be structured to allow a private partner to be responsible for ensuring that annual project revenues are greater than those forecasted. Under an OMA, however, the project will likely remain under the ownership of the government sponsor, and the responsibility for financing or obtaining financing would similarly remain with the government.

  OMAs have been utilized to provide municipal services such as residential waste collection (for example, in Halton Region), as well as for infrastructure facilities such as water and waste water treatment plants (for example, in Hamilton-Wentworth).

- ***Special Purpose Vehicles ("SPV").*** A SPV is a purposely created entity designed to own and manage a particular project under a form of OMA with a government sponsor. Depending on how this entity is established, it may be granted ownership rights over the project, and therefore be wholly responsible for all debt associated with the project. The SPV would also contract with a third party entity to construct the project. This third party entity may also be a source of debt financing; however it is likely that funds provided by this group would be subordinate (i.e., take a lower payment priority ranking) to the more senior debt of other equity investors (see Figure 5.8, following).

SPVs have successfully been used in numerous infrastructure projects in Canada, including the Highway 104 project in Nova Scotia. As we understand it, a similar structure has been set up in Alaska in regard to the DeLong Mountain Transportation System ("DMTS"). In this case, the Alaska Industrial Development and Export Authority (in effect the SPV of the Alaskan Government) has raised through the issuance of revenue bonds, monies to construct and expand facilities within the DMTS. In providing bondholders with a return on their invested capital, DMTS has entered into an operating agreement with a third party organization to construct, use, operate and maintain the system. This third party operator provides AIDEA with a "toll" as payment for their non-exclusive right to use the system.

Figure 5.8
Special Purpose Vehicles



(1) Could also take the form of either a Conditional Sales Agreement or an Operating Lease.

We suggest that a similar arrangement may be applicable to the SGPTC, with the GNWT entering into a longer-term contract with an operator who would essentially establish the SPV, raise the required funds to construct the roadway (i.e., the proportion of project capital costs which are capable of being debt financed), and then operate and maintain the roadway such that equity investors are provided with an appropriate rate of return.

Depending on actual roadway cash flows, it may be possible for this debt to be structured on a non-recourse basis to the GNWT.

However, it may also be possible that some level of government guarantee on the debt, buy-down of the amount to be financed, or a combination of the two, will be required to ensure the longer-term viability of the roadway.

Private Ownership

A third implementing structure which we presented previously is the pure private ownership and operation of the facility. However, the overall applicability of this structure will ultimately be dependent on the GNWT's desire to distance itself from the on-going operation and management of the facility and the desire of the private sector in taking on full responsibility and authority in this project. It is likely, and indeed highly probable that potential investors would view such a structure with some degree of trepidation, and demand a rate of return significantly higher than if a government guarantee was available. In this regard, it is likely that the higher return requirements of investors would place increased pressures on available cash flow, and therefore decrease the amount of debt that the project could support (and as a result, increase the size of the funding gap). Given the multitude of issues presented immediately above, we do not believe such a course to be desirable.

In addition, it is likely that federal and aboriginal land / ownership issues may be more problematic under a structure which envisions the private ownership of the roadway, versus other structures where the GNWT retains an on-going presence. Given the already tenuous position of the project, particularly the southern section, from a debt financing perspective, it is highly likely that this structure could not be adopted.

CONCLUSION AND NEXT STEPS

Based on the foregoing preliminary analysis, we conclude that the northern section of the proposed roadway, from the NWT/Nunavut border to Bathurst Inlet, would constitute the most financially viable and prudent course for realizing a permanent all-weather road in the Slave Geologic Province. This section of the proposed roadway is concluded as being able to support considerable traffic volumes, which in turn would generate considerable revenues to support the operations of the roadway, and contribute positively to the repayment of the Project's total capital cost. The southern section of the Roadway, however, is not projected to support significant traffic volumes, particularly given an inherent assumption that all mine output would be shipped to the northern port, and, given the current locations of existing and potential deposits, would only be required to travel on this section of the roadway (and therefore incur a tariff) for a short distance.

As part of the process of finalizing the financial and operational analysis necessary to provide the GNWT with an appropriate level of due diligence with respect to understanding the opportunities for completing this roadway, we recommend that the GNWT complete a detailed, "investment caliber" analysis of the anticipated costs and potential revenue streams which the roadway would be capable of supporting. Such a study would include the following elements, all in an effort to more precisely define the magnitude of traffic flows which could confidently be expected over time, the maximum tariff level which could be charged, such that total roadway revenues are maximized, and finally to more fully document the risks associated with, for example, changes in world prices for mined product, their impact on the operational viability of individual mine sites, and their potential impact on the operational viability of the proposed roadway. A study of this magnitude will likely be critical to support any debt offering which is linked, either directly or indirectly to project revenues, and therefore critical to the government (whether GNWT or the Government of Nunavut) in pursuing opportunities of involving the private sector (whether on a cash flow guarantee basis, or on a non-recourse financing basis).

SECTION 6.0 – ECONOMIC IMPACTS

This section provides an overview of the potential economic impacts associated with improved transportation infrastructure within the Slave Geologic Province. Specifically, it provides a scoping and qualitative review of the types of impacts, including benefits and dis-benefits, which are expected to occur during the construction and operation phases of the transportation infrastructure for the SGP. As a detailed benefit-cost analysis is planned as a follow-up to this present study, it is the intent that this section provide an initial scoping of potential economic effects and identify areas for further investigation.

Issues

A number of key questions need to be addressed in assessing the impact of any major proposed development on a local or regional economy. These include:

- What will be the overall magnitude of economic impacts associated with the project? What will be the direct, indirect, induced and spin-off effects?
- How will economic impacts be distributed geographically?
- What will be the duration of these effects? What will be the short-term and long-term effects?
- What are the likely dis-benefits of the project or of its spin-off effects? How will this affect the local and regional economies in the short and longer terms?

Types of Economic Impacts

The introduction of all-weather transportation infrastructure into the Slave Geologic Province will result in a number of economic impacts. Specifically, development of the infrastructure will result in:

- direct impacts, such as direct expenditures of the project including construction salaries and purchase of materials;
- indirect impacts resulting from the supply of materials or services to support direct economic activity;

- induced impacts, which relate to the jobs and production required to fulfill the additional demand resulting from the direct and indirect impacts; and
- spin-off economic effects by encouraging/facilitating economic activity in other sectors such as tourism and resource sectors.

Construction Impacts

The overall magnitude and distribution of the economic impacts associated with construction of the transportation corridor cannot be determined until more detailed cost estimates are prepared in follow-up studies and decisions are made regarding the level of infrastructure development (all-weather road for the whole corridor versus winter road for specific sections), routing, timing and phasing. The construction of the all-weather road through the SGP and the deep-sea vessel port at Bathurst Inlet, however, as envisioned in this study, will have a substantial economic impact. Based on preliminary estimates of capital cost outlined in Section 5.0, the direct impact alone is estimated to range from $231 million to $429 million in construction value.

A relatively high portion of the economic impacts associated with the construction of the SGP transportation corridor and port will be felt outside of the Northwest Territories and Nunavut. This is because a large portion of the labour force and construction supplies will need to be 'imported', principally from the provinces of Alberta, Ontario, Quebec, and British Columbia.

A significant impact during the construction phase will be the influx of workers to build the transportation infrastructure. This will result in the need for supporting infrastructure (such as housing) and will result in spin-off spending in local communities by these workers. The influx of workers to established aboriginal communities may also have a number of social impacts. As part of overall planning for construction, it will be important to develop measures to minimize adverse social impacts.

Other potential dis-benefits during construction relate to impacts on the natural environment, such as:

- destruction and degradation of the pristine natural environment;
- disruption of caribou migration;
- loss of habitat and potential subsequent need to relocate wildlife;
- withdrawal of aggregate from eskers, disrupting the use of the eskers by wildlife and denning habitat available for grizzly bears;
- point source pollution;
- disruption to hunting/fishing areas.

The above impacts may have economic as well as social consequences; however, these types of impacts are not easily quantified. To minimize adverse socio-economic effects, while maximizing benefits, it will be critical that, as part of the construction-planning phase, efforts are made for upgrading and training of the local labour force to maximize the use of local versus 'imported' labour for construction work. A construction impact management plan should also be prepared to identify requirements for support infrastructure and measures to mitigate adverse social and environmental impacts.

Increased Mining Activity

It is expected that the key economic benefit associated with the development of the all-weather road and port will be increased exploration and development of mines within the SGP, as the development of the transportation corridor may act as a catalyst for new mining activity. While the presence of transportation infrastructure does not guarantee economic development, it may facilitate mining activity. Access to specific types of infrastructure such as a port for base metal operations, is absolutely essential for the viability of such operations. The development of permanent transportation infrastructure is considered in this study, as well as previous studies, to be a key factor in realizing the mineral potential of the SGP.

The Conference Board of Canada in 1994 estimated the economic impacts of mining development in the SGP as follows, based on the assumption of one base metal mine, two gold mines, and two diamond mines.* It was projected that over a twenty-year period, this could generate:

- $32 billion in new Canadian GDP;
- $25 billion in new mineral development;
- 212,000 person years of employment;
- $8 billion in employment income.

It was estimated that about 30% of the GDP and over 70% of employment impacts would accrue to other provinces such as Alberta, Ontario, Quebec, and British Columbia. The benefits for different areas were identified as follows:

Northwest Territories/Nunavut

- 3,000 new jobs;
- a stronger economy;
- increased taxation revenues and reduced fiscal dependence on Canada;
- business and investment opportunities;
- infrastructure investments.

Provinces

- 7,000 new jobs;
- taxation revenues;
- exports to meet import demands related to mining in the SGP;
- business and investment opportunities in construction, manufacturing, transportation and service sectors.

Canada

- taxation and royalty revenues;
- reduced costs for transfer payments, social assistance and unemployment;
- mineral exports.

* *This level of mining activity is slightly lower than the level identified in this port for Phase 3 (2005-2015) of mining development in the SGP.*

Recent economic impact studies have been more optimistic concerning the local employment benefits associated with increased mining activity that would be facilitated as a result of the port and road infrastructure. For example, in the Metall Mining Corporation 1994 report "Izok Project – Creating the Opportunity", it is stated that within two years of development, at least 25% of jobs at the Izok mine could be filled by Inuit, and that with proper training, 45% of the positions could be filled by Inuit – with over $100 million in salaries and benefits paid out to Nunavut residents over the life of the project. An important aspect of the follow-up studies for the SGP Transportation Corridor will be to determine the allocation of employment benefits, and what specific training programs are needed to maximize benefits to residents of Nunavut and the Northwest Territories. There is also a need to update the different scenarios used in the previous economic impact analysis studies based on the phasing of mining activity outlined in this current study and the recommended routing.

Tourism

In the 1995 "Benefit-Cost Analysis for the Slave Geologic Province Transportation Corridor", undertaken by the Conference Board of Canada, it assumed that a new all-weather road from the Yellowknife to the Arctic coast will encourage tourists to explore these regions, and therefore result in significant tourist activity.

While the potential benefits to tourism should not be understated, it should be noted that tourism levels are affected by a number of factors including the product-market mix, level of tourism infrastructure available, ease of travel and access to tourism attractions, and competition elsewhere. The transportation system is only one of many factors affecting tourism demand. 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. Improved access, particularly to scenic areas could benefit tourism by providing opportunities for further development of trails, parks and eco-tourism opportunities. Ultimately the level of economic benefits from tourism that would be 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.

The analysis of whether the road will increase the overall level and length of tourist visitation to the NWT and Nunavut is critical in assessing the value of the road from a tourism perspective. This level of analysis is beyond the scope of the Need / Feasibility Study. 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 for the SPG Transportation Corridor. In particular, an assessment should be undertaken of whether the availability of a transportation corridor would encourage visitors to parts of the Northwest Territories, such as Yellowknife, to extend their length of stay and visit parts of Nunavut, such as areas along the Arctic coast, via the SGP transportation corridor, and vice versa. Both positive and negative effects to the tourism industry in the Northwest Territories and Nunavut should be evaluated. While it is very likely that the availability of the corridor would result in some increased visitation by recreational vehicle based visitors, the scale and overall level of net economic benefits need to be determined. Consideration should also be given to the need and demand for additional tourism infrastructure along specific areas of the SPG, and near the port at Bathurst Inlet. Finally, consideration should be given to the impact and opportunities for tourism associated with the presence of a port facility at Bathurst Inlet.

Other Impacts During Operation

Other benefits during operation of the transportation corridor include:

- greater transportation efficiency and safety;
- reduction in the vehicle operating costs;
- a reduction in re-supply costs for coastal communities located near the port;
- increased accessibility for aboriginal communities;
- increased government revenues.

Dis-benefits of the project during operation may include:

- disruption to outfitter/tourist hunting and fishing areas;
- likely increased harvesting of fish and wildlife due to increased access, which may adversely affect the supply of certain wildlife;
- disruption of caribou migration through traffic on the road.

These impacts, although not easily quantified, will have specific economic and social effects.

The above discussed benefits and dis-benefits should be elaborated upon and quantified to the extent possible in the benefit-cost analysis study to be completed for the SGP corridor at a later stage.

SECTION 7.0 – CONCLUSIONS

The key findings and conclusions of this Need / Feasibility Study for the Slave Geologic Province Transportation Corridor Study are as follows:

Role of Transportation in Mineral Development and Exploration in the SGP

- The level of transportation infrastructure in the SGP is able to meet the current needs of mining industries and there are no compelling reasons for providing additional transport infrastructure facilities in the immediate term. However, development of all-weather transportation infrastructure is expected to facilitate further mineral activity in the SGP.

- 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.

- 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 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, the availability of cheaper transportation infrastructure elsewhere may be the deciding factor in where the mining companies invest.

- 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. It is expected that 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.

Forecast of Mineral Development Scenarios and their Transportation Needs

The forecasted mineral development scenarios and associated transport needs are 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.

- **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 developed in order for the base metal mine to be put into production. An Arctic port accessed by 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.

- **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. 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.

Tourism

- 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

- The northern section of the proposed roadway, from the NWT/Nunavut border to Bathurst Inlet, would constitute the most financially viable and prudent course for realizing a permanent all-weather road in the Slave Geologic Province. This section of the proposed roadway is concluded as being able to support considerable traffic volumes, which in turn would generate considerable revenues to support the operations of the roadway, and contribute positively to the repayment of the Project's total capital cost. The southern section of the Roadway, however, is not projected to support significant traffic volumes, particularly given an inherent assumption that all mine output would be shipped to the northern port, and, given the current locations of existing and potential deposits, would only be required to travel on this section of the roadway (and therefore incur a tariff) for a short distance.

- 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 Yellowknife, and benefit the Western NWT economy.

Routing

- A corridor area of high economic activity potential has been identified based on the work undertaken in this study (this corridor is delineated in Exhibit 4.6).

- Further analysis of optimal routing should be undertaken based on input from the environmental scoping study, and a further investigation of areas of tourism potential. Further consultation should also be undertaken with mining and tourism industry representatives during the refinement of routing.

- The recommended port site is a deep-sea port on Bathurst Inlet connected by an all-weather road to a point on the south end of Contwoyto Lake.

- 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.

- A number of socio-economic, environmental and cost factors will need to be considered in determining the optimal route for the transport corridor.

Recommended Follow-Up Studies

- 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.).

APPENDIX 1

STAKEHOLDER CONSULTATIONS

APPENDIX 1
Stakeholder Consultations

1. OUTLINE FOR STAKEHOLDER INTERVIEWS

A. BACKGROUND INFORMATION *(all stakeholders)*

Provide overview of the study purpose and reason for interview:

- Strategic assessment of the need and feasibility of a transportation corridor in the Slave Geologic Province;
- This study is separate from the environmental assessment study which is being conducted over the same time frame and will consider environmental issues;
- Consultation with a wide range of stakeholders to solicit their input on key issues and concerns related to the need, feasibility, or the development of a transportation route in the SGP. Stakeholders being consulted include representatives of aboriginal groups; mining groups; economic development, tourism, and land use planning agencies; and transportation associations.

Obtain background information on the group / agency (mandate, members, etc.); obtain business cards.

B. ABORIGINAL GROUPS

B.1. Issues/concerns related to a transportation corridor in the SGP

- Land claims issues;
- Effect on Aboriginal tourism / economic development;
- Hunting grounds;
- Other.

Environmental issues to be considered as part of the environmental assessment study, not this study.

B.2. Level of usage of SGP by the Aboriginal Group? Significance of region from the Group's perspective.

B.3. Preferred routing of the transportation corridor through the SGP?

B.4. Obtain relevant background data such as mapping of land claims/hunting grounds, etc.

B.5. Level of interest in Project

- Do they see a "fit" with their area of interest (from an economic development perspective or tourism perspective; from an access to their community perspective, etc.)?

- Do they see a direct or indirect "benefit" of the proposed highway? What type of direct or indirect benefit?

- What is the projected frequency of use?

B.6. Past/Present/Future Transportation Infrastructure Expenditures

- Has the group previously committed to improving the transportation infrastructure?

- Who were the principal contributors?

- How was their contribution level determined?

- Indication of the current level of expenditure on transportation projects (Are partners involved? How was the entity's contribution determined?).

- Are any additional expenditures projected?

B.7. Interest in Partnering to see the earlier completion of this Transportation Corridor

- Was previous participation in infrastructure projects done on a partnership basis?

- What is their level of interest in partnering in this project? What role do they want to have?

- If structured as a "toll" or "concession" facility, what is the impact on their projected frequency of use?

- How much would they be willing to contribute (either up-front or on-going or both)?

- What requirements would need to be in place to ensure their contribution?

C. MINING GROUPS

C.1. Obtain information on existing mine operations in the SGP, including:

- Specific location and land holdings under active mining;
- Commodity;
- Throughput (tpd or tpy);
- Resource estimate;
- Ore grade;
- Current estimate of mine life;
- Underground / open-pit;
- Total capital cost (19__ dollars);
- Estimate of material brought in during construction
- (if possible a breakdown by commodity);
- Method of transportation (estimate of quantity transported by the Air, Ice Road, All Weather Road, and other methods);
- Operating Information:
    - Power cost / Power load;
    - Operating supplies – quantity / cost / cost of transportation:
        - Grinding media,
        - Reagents,
        - Maintenance supplies,
        - Mining supplies (tires, etc.),
        - Other operating supplies;
    - Fuel – consumption / cost / cost of transportation:
        - Power,
        - Equipment;
- Transportation Costs:
    - Road usage fee;
    - Road maintenance costs;
    - Operating costs ($ / t-km, $ / t, etc.);

- Number of employees during construction / operation;
- Sensitivity of ore reserves to changes in operating cost and market value of commodity;
- Sensitivity of their operation to changes in operating costs and market value of commodity;
- Transportation as a percentage of operating cost.

C.2. Obtain information on mining projects:

- Specific geographic area in the SGP;
- Commodity;
- Status of Project (exploration, pre-feasibility, feasibility);

If at feasibility stage:

- ♦ Estimated throughput (tpd or tpy):
  - Current resource Estimate,
  - Ore grade,
  - Current estimate of mine life,
  - Underground / open-pit,
  - Estimated capital cost (19___ dollars);

- ♦ Method of transportation:
  - Air;
  - Ice Road;
  - All Weather Road;
  - Other;

- ♦ Operating Information:
  - Power cost / power load;
  - Operating supplies – quantity / cost / cost of transportation:
    – Grinding media,
    – Reagents,
    – Maintenance supplies,
    – Mining supplies (tires, etc.),
    – Other operating supplies,
  - Fuel – consumption / cost / cost of transportation:
    – Power,
    – Equipment;

- Estimated transportation costs:
    - Road usage fee;
    - Road maintenance costs;
    - Operating costs ($/t-km, $/t, etc.);
- Number of employees during construction/operations;
- Expected schedule for mine development;
- Sensitivity of ore reserves to changes in operating cost and market value of commodity;
- Sensitivity of projects to operating costs and market value of commodity;
- Transportation as a percentage of operating cost ;

If project is at exploration or pre-feasibility stage:

- Commodity;
- Current estimate of reserves/resources;
- Grade;
- Exploration dollars spent to-date on project;
- Exploration plans.

C.3. Impediments to existing operations or projects – i.e., low grade, infrastructure, tonnes, etc?

C.4. Level of interest in a SGP Transportation Corridor:

- Do they see a "fit" with their operations?
- What type of transportation corridor would best serve their needs (shipping vs. road) and why?
- Do they see a "benefit" of the proposed highway for their operations?
- What is the projected frequency of use?

C.5. Past/Present/Future Transportation Infrastructure Expenditures

- Indication of the level of expenditure which the company has previously committed to improving transportation infrastructure for their business.
- What type of project?
- Were they the sole participant / contributor to this project, or was it developed jointly with other entities (if the latter, who led)?
- Indication of the current level of expenditure and type of project.
- Indication of planned level of expenditure in the future and type of project.
- Indication of potential longer-term expenditure and type of project.
- Do they see the proposed highway adjusting their planned and potential longer-term expenditures?

C.6. Interest in Partnering to see the earlier completion of this highway

- Previous partnering participation in infrastructure projects.
- Level of interest in partnering in this project.
- If structured as a "toll" or "concession" facility, how would this impact on their likely frequency of use?
- How much would they be willing to contribute to this project (either up-front or on-going or both)?
- What requirements would need to be in place to ensure their contribution?

D. TOURISM/ECONOMIC DEVELOPMENT

D.1. Broader economic development/tourism initiatives:

- What is the overall tourism strategy / plan for the SGP?
- What is the role of the area relative to other areas in the NWT for tourism – existing and future?

D. 2. Level of economic/tourism activity and resources in the study area

- Obtain relevant reports, tourism guides, etc.

D.3. Key economic development/tourism issues:

- What are the issues for the SGP?
- How do these differ from other regions in the SGP?

D.4. Effect of the absence of a transportation corridor on economic development/transportation/land use within the SGP:

- What are the positive and negative effects on tourism?
- What are the positive and negative effects on economic development?

D.5. Effect of transportation corridor in the SGP:

- What is the effect of improved access on future economic development and activity? Specific sectors?

- What is the effect of the transportation corridor on tourism (by tourism sector)?

D.6. Level of interest in Project

- Do they see a "fit" with their area of interest (from an economic development perspective)?

- Do they see a direct or indirect "benefit" of the proposed highway? What type of direct or indirect benefit?

- What is the projected frequency of use?

D.7. Past/Present/Future Transportation Infrastructure Expenditures

- Information pertaining to levels of expenditure which the entity has previously committed to improving the transportation infrastructure.

- Who were the principal contributors?

- How was their contribution level determined?

- Indication of the current level of expenditure on transportation projects (Are partners involved? How was the entity's contribution determined)?

- Are any additional expenditures projected?

D.8. Interest in Partnering to see the earlier completion of this Highway

- Previous participation in infrastructure projects done on a partnership basis.

- Level of interest in partnering in this project.

- If structured as a "toll" or "concession" facility, impact on their projected frequency of use?

- How much would they be willing to contribute (either up-front or on-going or both)?

- What requirements would need to be in place to ensure their contribution?

2. STAKEHOLDERS INTERVIEWED

Hay River Chamber of Commerce
Jeanette Hinz, Executive Director

Town of Hay River
Jack Rowe, Mayor

City of Yellowknife, Economic Development
Peter Neugebauer, Director
Chester Spray, EDO

City of Yellowknife, Planning Department
Bob McKinnon, Director, Planning & Lands

Yellowknife Chamber of Commerce
Cheryl Best, Executive Director (also Councilor for the City of Yellowknife)

NWT Resources, Wildlife, and Economic Development Parks and Tourism
Vaughan del Valle, Coordinator Facilities and Assets

NWT Arctic Tourism
Eric Yaxley

Nunavut Tourism
Madeline Redfern, Executive Director

Indian and Northern Affairs Canada
Operations Dept., Northwest Territories Region

Floyd Adlem, Director, Operations

Wildlife and Economic Development
Trade and Investment
Department of Resources

Otto Olah, Director
Garry Singer, Manager, Investment Development Trade and Investment

Department of Indian and Northern Affairs
Minerals Section

Dave Natter

BHP Mines

Ian Goodwin, Project Planner

Snare Lakes
Dogrib Rae Band

Rae Lakes, Wha Ti
John Ivey, Band Manager
Hugo Halley, Band Manager
Lana Paulsen, Band Manager
Laura Duncan, Band Manager

North Slave Metis Alliance

Clem Paul, President
Bob Dowdal, Executive Director

Treaty 11 Council

John B. Zoe, Chief Negotiator
Henry Zoe, Chief Negotiator
Noel Drybones, Elder

Metis Nation

Judy Farrows, Officer

Kitikmeot Corporation

Charlie Lyall

Yellowknives Dene Band

Patti Pocko, Band Manager

Echo Bay Mines

Jerry McCrank & Kirk Mclelland

Etruscan Enterprises Ltd.

Richard Gordon and Don Burton

Inmet Mining Corporation

Ken Hill

Quest International

Rick Russell

Rhonda Mining Corporation

Peter Gummer

Royal Oak

Ross Burns

NWT Power Corporation

Dan Roberts, Director, Central Operations

Northern Transportation Co. Ltd.

Rick Connors, Director, Western Arctic
Terry Camsell, Director, Eastern Arctic
Lynette Storoz, Director, Marketing

Nuna Logistics Ltd.

John Zigarlik, Chairman and CEO
Mervyn Hempenstall, President and COO
Court Smith, Vice President
Brian Tice, Operations Manager

Robinson Enterprises Ltd.

Marvin Robinson

RaiLink Ltd.

Gordon Clanachan, President & CEO

Fednav Limited

Thomas Paterson, Assistant Vice President - Business Development

APPENDIX 2

ROLE OF TRANSPORTATION IN MINERAL DEVELOPMENT

APPENDIX 2
Role of Transportation in Mineral Development

The accessibility of transportation infrastructure is an important aspect in all phases of a mining project, from initial grassroots exploration through to operations. The benefits include easier project planning, potentially significant reductions in capital and operating costs and reduction in project risks. The following section outlines some of the benefits for each of the phases of a mining project.

Exploration

Initial exploration endeavors, such as claim staking, soil sampling and geophysics do not need road access. These tasks are just as easily completed using helicopters or other forms of transportation from the nearest centre. However, as the projects progress from grass roots exploration to the pre-feasibility and feasibility study stages, the benefits of access to transportation infrastructure begin to increase.

During the advanced exploration phase of the project, the project operators will carry out extensive geological and geotechnical drilling programs, environmental base line studies and metallurgical test work. In the case of diamond exploration, the testing of a bulk sample will require the establishment of either a pilot plant on-site or transportation of a bulk sample to a metallurgical laboratory.

Typically, an exploration camp will be built to accommodate between 10 to 100 people, depending upon the scope of the project. This camp will require supply of materials, food, drilling supplies and fuel. Presently, most of the exploration camps in the Northwest Territories are supported by air transport and overland during the winter. This significantly increases the cost of any exploration efforts.

Construction

The construction phases for a mining project can entail pre-stripping of waste material for an open-pit or underground development activities and site preparation and construction of the processing, power plant and ancillary facilities. Capital costs typically range from $350 million to $1,000 million and the construction schedule is from 24 to 36 months.

Construction materials can only be transported to the site by trucks over ice roads during a limited time period ranging from 10 to 12 weeks. During the remainder of the year, air freight is necessary, at about 1.6 times the cost. As a result, year round road access can have a significant impact on the capital cost of a project. More specifically, given limited seasonal access, project capital costs increase due to:

- Increased storage requirements for fuel, ammonium nitrate and supplies.
- Increased concentrate storage requirements for a base metal project.

- Capital funding curve is erratic because most of the consumables will be purchased in the fall in order to travel to site on the ice road. This can impact financing costs.
- Increased freight costs due to limitations of travel on ice roads and additional costs for shipping materials by air.
- Potential extensions of construction schedule due to timing of delivery of equipment and access to site.

In addition to the higher capital costs, the construction risks are greater. Risks such as weather, supplier delivery problems or poor quality of supplies requiring replacement, pose much greater consequences to the project schedule and cost if access is limited.

Operation

For this discussion, three types of operations are reviewed: diamonds, gold and base metals. Each are impacted differently by access to year-round transportation infrastructure.

For a *diamond operation*, the process is relatively simple compared to gold and base metal operations. The process is based on size reduction and separation of the diamonds from the gangue (or waste) on the basis of specific gravity and x-ray fluorescence. The major supplies that are transported in by road include:

- Fuel for power generation;
- Fuel for the mine equipment;
- Ammonium nitrate for blasting;
- Cement for backfill in an underground operation;
- Fuel for heating water which is used in the process;
- Ferro-silicon for use in the process.

Miscellaneous maintenance and operating supplies also are transported by road, however the volumes are small in comparison to the other commodities. Fuel is the major commodity transported, followed by either ammonium nitrate for an open-pit mine, or cement, for an underground mine. Fuel is primarily for power generation. The power requirements for a diamond operation range from 15 MW to 22 MW for a 1.0 to 2.0 million tonne per year operation. Fuel is also used to operate mining equipment and for heating of the process water. The fuel for the mine equipment comprises approximately 15% of the mine operating cost. The fuel costs for power generation and heating of the process water comprises about 41% process operating costs.

The *gold process* entails size reduction by both crushing and grinding, followed by gold recovery processes which are a combination of chemical and mechanical processes. The amount of consumables, such as grinding media and reagents is greater than for diamond operations.

However, the mining supplies, specifically ammonium nitrate tend to be less than with a diamond operation due to the much lower volumes of material moved. As with diamonds, the main transportation requirement is in-bound supplies because the product can be easily flown out. For a gold operation the supplies that are transported by road include:

- Fuel for power generation;
- Fuel for open pit equipment;
- Ammonium nitrate for blasting;
- Cement for backfill in an underground operation;
- Grinding media;
- Process consumables such as sodium cyanide, carbon, lime and soda ash.
- Maintenance and operating supplies

Typically, the fuel costs make up about 15% of the mining costs for an open pit operation. With respect to the process, the costs for grinding media and reagents make up about 67% of the total process costs.

Base metal operations rely heavily on the transportation infrastructure including both roads and ports. The primary reason is that these types of operations require the infrastructure to bring in operating supplies as well as take out their products. Most of the potential base metal mines in the Slave Geologic Province are poly-metallic producing zinc, copper and / or lead concentrates. The major consumables are:

Inbound

- Fuel for power generation;
- Fuel for open pit equipment;
- Ammonium nitrate for blasting;
- Cement for backfill in an underground operation;
- Grinding media;
- Process reagents including xanthates, copper sulphate, sodium cyanide, soda ash, lime and flocculent;
- Maintenance and operating supplies.

Outbound

- Zinc concentrate;
- Lead concentrate;
- Copper concentrate.

For many of the mines, the costs for these supplies will be higher due to the limited buying period plus the transportation costs. The limited access will also increase the working capital requirements for the mines. For example, Izok Lake have estimated that their working capital requirements will be between $50.0 and $90.0 million[1]. A similar mine (i.e., 3,000 tpd poly-metallic mine) located near good transportation infrastructure will have working capital requirements of only $10.0 to $15.0 million. This increase in working capital places a significant strain on the cash flow of an operation.

The preceding discussion illustrates the importance of transportation to the economics of a mining project. Without access, only the richest of gold and diamond ore bodies will be developed and the development of any base metal operations is unlikely. One can conclude that the high cost of the current transportation network and the lack of transportation infrastructure are the greatest deterrents to the further development of mineral resources in the SGP.

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[1] Izok Project, Creating The Opportunity, Metall Mining Corporation, September 1994.

APPENDIX 3

OVERVIEW OF ICE ROADS

APPENDIX 3
Overview of Ice Roads

1.0 Introduction

The lack of permanent roadways to transport materials to and from the base metal mines has been the hindrance on mineral development throughout the Northwest Territories. The mines rely solely on seasonal roadways which are constructed over frozen lakes and portages as their only method of transport. Travelling time on these ice roads is extremely slow where the speed limit is set at 30 km/hr in order to reduce ice breakup and improve road safety. The ice roads can only bear moderately heavy loads - in the range of 70 tonnes until it reaches its maximum thickness, after which the ice will start to breakup. The ice matrix must be allowed to refreeze, or heal, in between heavy loads. The limitations of ice roads have a less significant effect on precious mineral mines than base metals mines which must transport large volumes of materials.

2.0 Requirements for Northern Mineral Development

The start-up of construction opens the mine site up to the highest volume of traffic to which the mine will ever be exposed. Construction materials, fuel, consumables and machinery are delivered to the site on ice roads and stored for use for an entire year when the area is not accessible by truck. When materials can not be transported via the ice roads, they must be delivered by air, at a much higher cost. Similar to a design/build project, mine construction is generally completed over a relatively short time frame, and thus requires a constant supply of materials. To accommodate the short construction schedule, supply lines are created year round by means of ice road delivery and airfreight. Air transport cost is approximately 60% higher than ice road transport but is essential in meeting the construction schedules.

Operation

Completion of construction starts the operation phase of the mine and the supply of materials is generally constant throughout its lifespan. The highest volume of trucked material is fuel. However, with base metal mines, outbound traffic is significantly higher compared to precious mineral mines due to the heavy weight volume of the concentrate which must shipped out of the base metal mines.

During the operation stage, annual supply requirements can be accurately estimated based on previous years'consumption. In this stage of remote site mining, the demand for air transport is greatly reduced, except for the supply of personnel and consumables. Occasionally demand for supplies will increase to accommodate mine expansion, or reconstruction.

Closure

Closure of a mine site results in large volumes of materials being salvaged and shipped out of the site to southern locations. Transportation of salvaged materials is carried out in the most economical manner and may spread out over several years. Since there is generally not an aggressive schedule to follow, air transport is avoided.

3.0 Ice Road Construction and Maintenance

Ice road construction is a cost efficient solution to remote site access in Northern Canada. Generally construction and maintenance can be completed for approximately $10,000/kilometer. However, this cost fluctuates when the roads are constructed on frozen lakes. Ice roads can be constructed on frozen lakes or on land. To construct an ice road on land (called a portage), the process involves the clearing of snow to freeze the ground, hauling of snow, flooding the snow with water and grading to construct a smooth and hard surface. Construction on frozen lakes simply involves plowing to clear the snow and therefore is much less expensive than construction over overland portages. The greater the proportion of the ice road that is constructed on ice, the cheaper the construction and maintenance becomes.

Heavy Loads

The cheaper construction over the frozen lakes becomes the downfall of the ice roads. Frequent exposure to heavy loads creates fatigue cracks and weakens the ice matrix resulting in unsafe ice. The ice must be allowed to refreeze, or heal, after heavy loads. The healing time is a function of ambient temperature and averages between one and two hours.

Truck Speed

The load-sensitive ice roads affect the speed that the trucks can travel and thus increase trip time. Truck loads deflect the ice and as the load travels, a pressure wave propagates due to the load. The speed limit of the trucks is set, and enforced, at 30 km/hr over all ice roads in the NWT. When trucks travel at speeds greater than 30 km/hr, the ice becomes stressed as the truck actually begins to drive over its own pressure wave and the ice starts to break up. This results in unsafe ice conditions, increased maintenance costs and even closure of the ice road. In an attempt to reduce ice road failures, a departure schedule is set so that only 2 or 3 trucks travel on the ice road every 15 minutes. It is this staggered departure schedule, the speed limit enforcement and the duration of the ice road that control the number of loads on the ice road in a season.

4.0 Ice Road Construction Guidelines

The planning and construction of an ice road can be completed to produce the best quality for the facility's designed use, while reducing the construction costs and maintenance. General construction guidelines should consider the results of terrain analysis to reduce maintenance and extend the life of the facility.

Reduce Damage Caused by Pressure Waves

Degradation of ice is generally caused when a truck's speed exceeds the speed of the propagating pressure wave that it generates under the deflecting ice, which is approximately 30 km/hr. The maintenance should include policing the speed of truck traffic.

Ice damage also occurs when the pressure wave rebounds off shallow areas of the lake bottom. When the pressure wave encounters a shoreline or shallow ledge under the ice, the wave rebounds off the ridge and damage is caused when it encounters the truck. These are areas where you will see ice breaking out of the traveling surface and witness significant cracking. Trucks generally reduce their speed when approaching a portage; however when the route chosen crosses over shallow ridges, these portions of the ice road generally break up and cause unsafe ice and increased maintenance. Routes over lakes with a minimum depth of 3 metres should be selected to minimize this damage. The same cracking and breakouts are experienced when two heavy trucks approach each other traveling in opposite directions. Drivers should be trained to reduce their speed when approaching on-coming traffic on ice roads.

The energy exerted by the pressure ridge was evident when heavy loads, 65 tonnes payload, were hauled to BHP during the winter of 1997/98. Inspections of the ice road showed that at shallow areas, where ridges under the ice came up at sharp angles with rocks protruding through the ice, the ice exploded around the protruding rocks. In another instance, a fisherman in a collapsible tent, while ice fishing beside the ice road on a shallow ridge, had water blow out of his fishing hole like a fountain, knocking his tent over, as a heavy truck passed near his fishing hole.

Ice Road Width

Ice Road alignments over lakes are plowed to a minimum width of 40 meters. This extra wide traveling area reduces the road closures from blowing snow, provides a wider thickened ice structure and allows the trucks a greater distance between them to pass each other, thereby reducing the effects of the two pressure waves.

When there is heavy snow drifting, the roadway narrows and the trucks must pass closer to each other; this breaks up the traveling surface and increases maintenance. Recently some ice roads have been constructed with secondary paths plowed over the lakes parallel to the main ice road, roughly 50 meters from the ice road shoulder. The secondary path acts as a snow fence and reduces the drifting snow for a short period of time. The practice of plowing the secondary roads may be a good choice immediately after the ice road is completed as they will help keep the trucks apart when the ice is in its thinnest state.

Tree Land Portage Route Selection

Over land route selection can greatly reduce the cost of construction and maintenance of an ice road. Within the Treeline it is important to select portages which consist of relatively flat topography and which are not in a natural drainage route.

Portages require freezing the ground to stabilize the base and then building a grade out of snow and ice. When this is done the seasonal frost is driven deeper into the ground and this affects the ground water regime. Constructing Portages over areas where ground water moves under the seasonal frost zone may result in forcing the ground water to the surface causing flooding and higher maintenance.

A flat topography will reduce the amount of snow that must be hauled to produce a satisfactory grade. When it is necessary to build a portage over boulders and rough ground construction costs increase. The ideal route consists of flat terrain where the snow can be plowed to one side, to allow the ground to freeze, then back bladed and frozen by flooding with water.

Barren Land Portage Route Selection

Route selection over land in the Barrens must be planned to reduce the maintenance of snow removal. Blowing snow closes portages and can be a substantial maintenance cost given certain weather conditions. The blowing snow can be reduced by building along high eskers or by plowing the portages an exaggerated width. The main concept is to allow a smooth path for the blowing snow to migrate across the traveling surface. Disruption to the laminar flow of air will result in snow accumulation and drifting. The opposite concept is to construct a large snow bank on the side facing the prevailing wind to allow snow to accumulate directly behind the bank.

5.0 Efficiency of Ice Roads

The general consensus of the precious metal mining industry is that the ice road is an efficient method of delivering supplies to remote sites, however the reduced speed which the trucks must travel increases the truck demand and the trip timing. As discussed previously, the trucks must maintain a maximum speed of 30km/hr for safety and maintenance optimization.

Shallow Grade Construction & Benefits

The only area on an ice road that a truck could increase its speed would be over portages and even here the speed limit is only 80 km/h in order to prevent the frozen surface from breaking up. Many portages on the ice road to Colomac are constructed over a shallow grade of earth. Trucks can increase their speed to 80km/hr over these areas without any great damage to the traveling surface. In this discussion, the assumption will be made that a route could be selected such that 50% of it consists of over land routes in areas where borrow materials are readily available. An earth embankment of 10 meters wide and 0.5 meters deep could be placed on the portages to create a shallow grade. It is estimated that 1.3 million cubic meters of fill would be required to cover a 400 kilometer ice road since 30% of the fill would be lost. Assuming a load, haul and place cost of $10.00/m^3 and 15% contingency for culvert installation, the development cost would be $15 million.

The shallow grade on portages will significantly lower the cost of ice road construction since construction and maintenance is simply a snow plowing exercise. The fill placed on the portages would reduce the amount of work required to provide a smooth traveling surface. Without this embankment, snow would be pushed to one side to allow the ground to freeze, pushed back over to smooth out the surface, hauled in to fill depressions and the area would be flooded with water.

With the embankment, the only task required to open the portage is snow plowing. It is recommended that a small dresser cat be left on the major portages prior to freeze up in the fall so that it can smooth out the surface of the embankment .

Closures of ice roads occur when the portages begin to break up and melt in the spring as the sun begins to warm the ice on the darker colored portages. Lake ice melting occurs weeks after the melting of ice on portages. Embankments provide portages with stability thereby slowing down the melting process and extending the trucking season by about 2 weeks.

6.0 Geological Impacts to Highway Construction

In 1997, the Government of the Northwest Territories Department of Transportation completed the reconstruction of the south section of Highway No.3 leading to Rae. This highway has an 11.5 meter road top width and allows a speed of 110 km/hr. Recent newspaper articles have stated that this section of the highway cost an average of $250,000.00/km to build. This section of the highway was constructed on sporadic permafrost, clay to granular original ground and provides an excellent supply of borrow material and granular sources for base course materials for embankments. Rock excavation was required in some isolated areas but was soft and easy to drill and blast since the rocks consisted of limestone deposits.

Highway No.3 encounters an entirely different geological formation as soon as it reaches Rae. This terrain, known as the Precambrian Shield, is typical through to Yellowknife. The shield consists of discontinuous permafrost, extensive granite bedrock outcrops and no supply of granular sources. Isolated clay deposits are available; however these sources generally contain permafrost and ice lensing causing pit development difficulties and requires fill to dry before it is placed on the embankment. Highway construction requires extensive drilling/blasting to reach design grades. Base course fill material must be either crushed from blasted granite or hauled from a great distance. Sections of the roadway which are not on the bedrock are constructed on muskegs and will experience prolonged consolidation. Discontinuous permafrost/ice lensing may degrade the road, increasing maintenance costs. A higher embankment fill is necessary over these muskeg areas in order to consolidate the subsurface materials and compress the muskeg . Recent estimates show that this section of road, from Rae to Yellowknife, will cost $900,000/kilometer to build. This estimate is considered highly accurate since construction will commence this winter. This section will also carry a higher maintenance cost.

The two cost estimates discussed above illustrate why it is imperative to design a highway that maximizes granular deposits and reduces the requirement to excavate bedrock. Permanent roadway corridor planning must consider the availability of fill, granular materials for base course production and minimize rock excavation in order to construct the most cost effective supply route.

APPENDIX 4

ARCTIC SHIPPING

APPENDIX 4
Arctic Shipping

THE ICE SEASON AT BATHURST INLET

The sea ice of Bathurst Inlet fractures and melts in the first week of July in most years, occurring as early as the third week of June (approximately 20 % of summers) in a warm summer and mid to late July in a cold summer (approximately 20% of summers). The Inlet is one of the first areas to fracture in the region and will always be completely clear of ice each year. The ice of the Inlet clears by a rapid fracture and *in situ* melt, likely caused by the rapid rise in temperature of the surrounding landmass in the early summer. Figure 1 is a satellite image from July 6, 1980, showing the early clearing of Bathurst Inlet compared to the regions to the north.

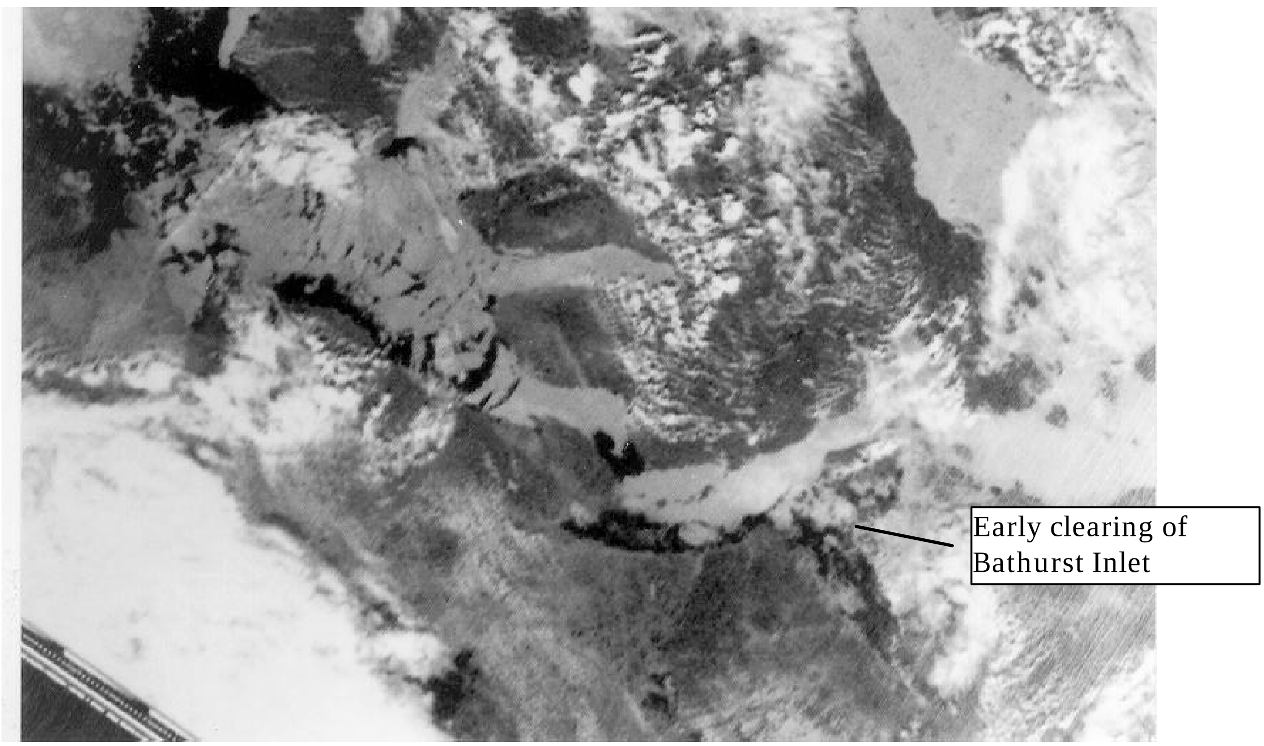

Figure 1: Satellite image July 6, 1980 showing early clearing of Bathurst Inlet

Sea ice freeze-up in Bathurst Inlet begins in early October with the development of new ice (ice less than 10 cm in thickness). This ice gradually thickens until consolidated young ice (ice that is between 10 and 20 cm in thickness and is frozen fast to the shorelines) develops in early November. Ice growth is rapid after this point with first year ice thickness of 50 cm being achieved by early December and a mean ice thickness of over 2 metres by the end of ice growth in late May. Some of the thickest first year ice to develop over the winter in the Canadian Arctic occurs in this region. Figure 2 is a graph of the ice thickness curve from Cambridge Bay, which is the closest ice thickness station to Bathurst Inlet. The sea ice that forms in Bathurst Inlet tends to be very level with few, if any, ridges, due to the relatively sheltered waters of the Inlet. Old ice does not occur in Bathurst Inlet.

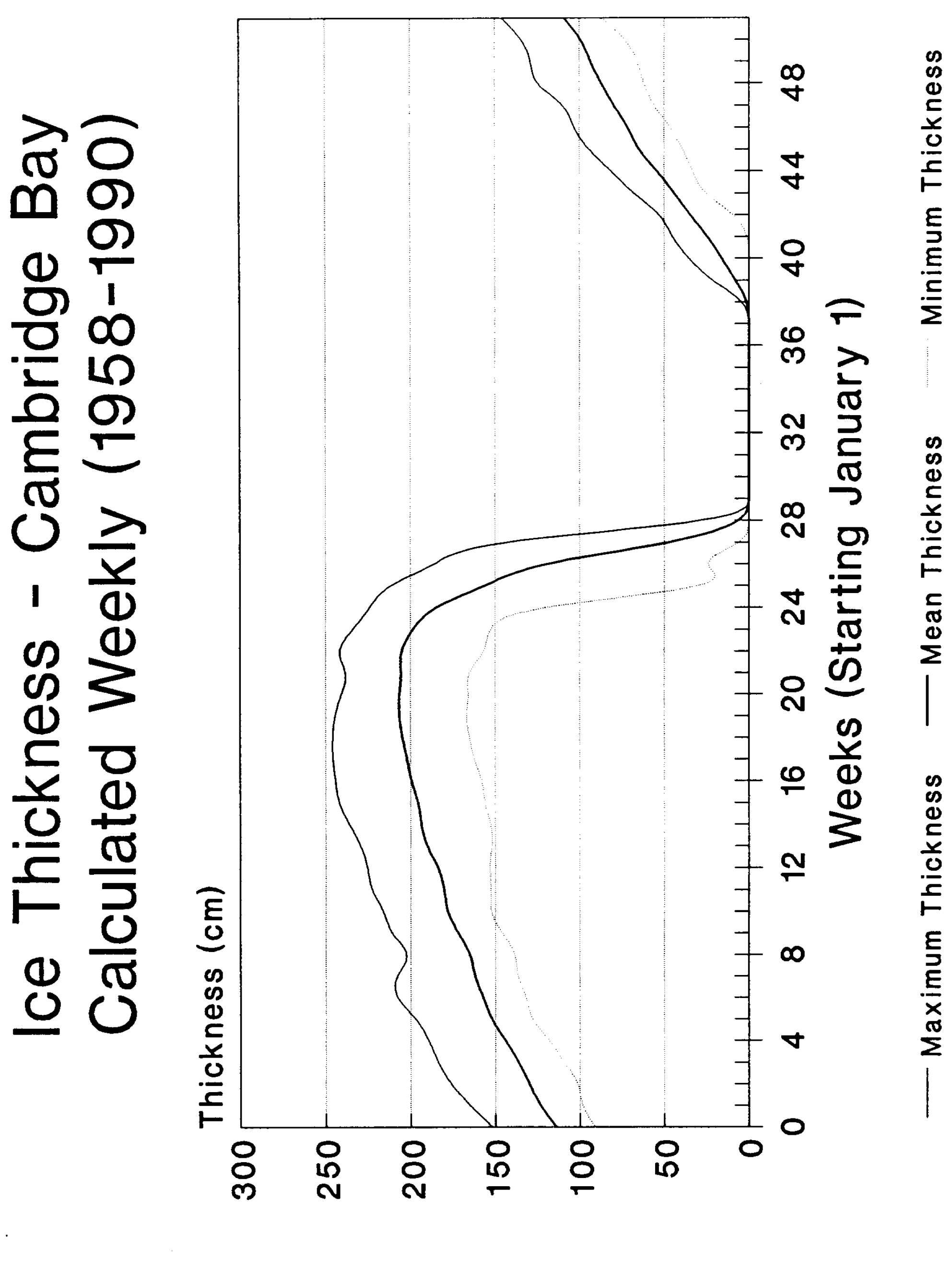

Figure 2: Ice thickness curves for Cambridge Bay, N.W.T

Bathurst Inlet has an open water season of more than three months and contains a placid and stable ice cover for the remainder of the year making it a good candidate water body for an Arctic port. However, the difficulties for marine transportation to Bathurst Inlet do not occur in the Inlet itself but in the access channels leading to the Inlet. There are two access channels leading to Bathurst Inlet:

1. From the Atlantic Ocean via Baffin Bay, Lancaster Sound, Peel and Larsen Sounds, Victoria Strait, Queen Maud Gulf and Dease Strait, also known as the Eastern Access.

2. From the Pacific Ocean via the Bering Strait, Chukchi and Beaufort Seas, Amundsen Gulf, Dolphin & Union Strait, Cache Point Channel and Coronation Gulf, also known as the Western Access.

Both of these access routes contain sea ice difficulties for marine transportation. In the Eastern Access, the difficulties occur in Larsen Sound and Victoria Strait. The winter fast ice of Larsen Sound usually contains high concentrations of old ice, up to 6 to 8/10 in many winters. This fast ice of Larsen Sound does not fracture until the end of July, even in a warm summer, and the fracture can be delayed until mid August in a cold summer. Even after fracture, Larsen Sound is rarely clear of sea ice in a typical summer, with an open water route developing in less than 25% of years. In a typical summer 7 to 9/10 ice will remain across the access channel, including 4 to 6/10 old ice, requiring a ship of good ice capability and/or dedicated icebreaker support for a lesser ice strengthened vessel. In a colder than normal summer, which occurs approximately 25% of summers, no clearing occurs after fracture in Larsen Sound, leaving 9/10 to 9+/10 concentrations of thick first year ice and old ice, requiring icebreaking vessels, such as Arctic Class (AC 2,3 or 4) or Canadian Arctic Category (CAC). Baltic ice class vessels have great difficulty transiting Larsen Sound in these summers, even with the assistance of icebreakers.

In the Western Access, the ice difficulties for shipping occur in the Beaufort Sea along the Alaskan coast between Point Barrow and Barter Island. In most summers, an open water route develops from the Pacific Ocean to Coronation Gulf by early August. However, in approximately 25% of summers, limited clearing occurs along the Alaskan Coast with the Arctic Ocean old ice pack remaining near the coast all summer. In these summers, icebreakers are needed to transit the region. For large cargo vessels, the problem is more acute due to the shallow water along the Alaskan coast, requiring these vessels to be further offshore and more likely to be in the old ice pack.

Figure 3 is a satellite image from July 15, 1990, showing open water in Bathurst Inlet while Larsen Sound to the east and Amundsen Gulf to the west remain heavily ice covered. Figure 4 is a satellite image from September 25, 1975, showing the total lack of clearing that occurred along the Alaskan Coast that summer. Because of the difficulty of conventional ships reaching the Coronation Gulf region, the marine re-supply operation is based on a tug and barges operating from the Mackenzie River each summer (see section 2.0 below). However, modern icebreaking technology now makes it possible to change this situation (see Section 3.0 below).

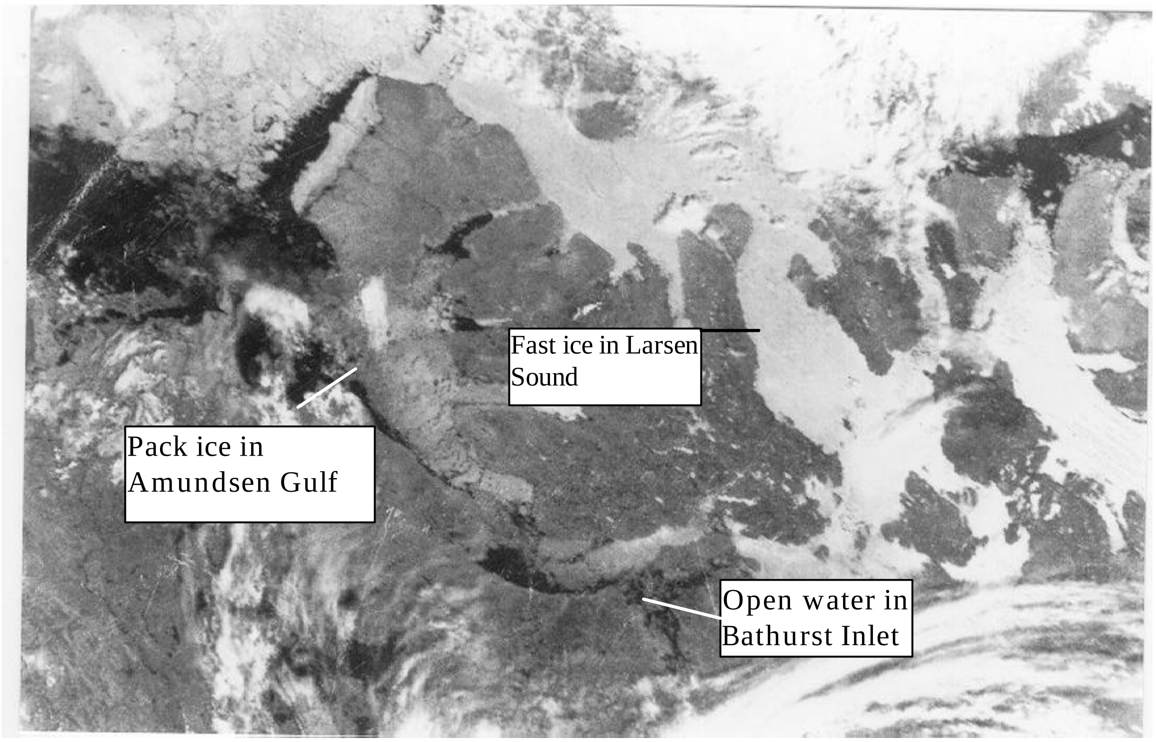

Figure 3: Satellite image from July 15, 1990 showing open water in Bathurst Inlet but fast ice in Larsen Sound to the east and pack ice in Amundsen Gulf to the west.

The potential shipping season to Bathurst Inlet using ice capable vessels is generally from early August to late October if ships that presently exist on the market (such as the M.V. Arctic, SA-15 class or Federal Baffin / Franklin) were used.

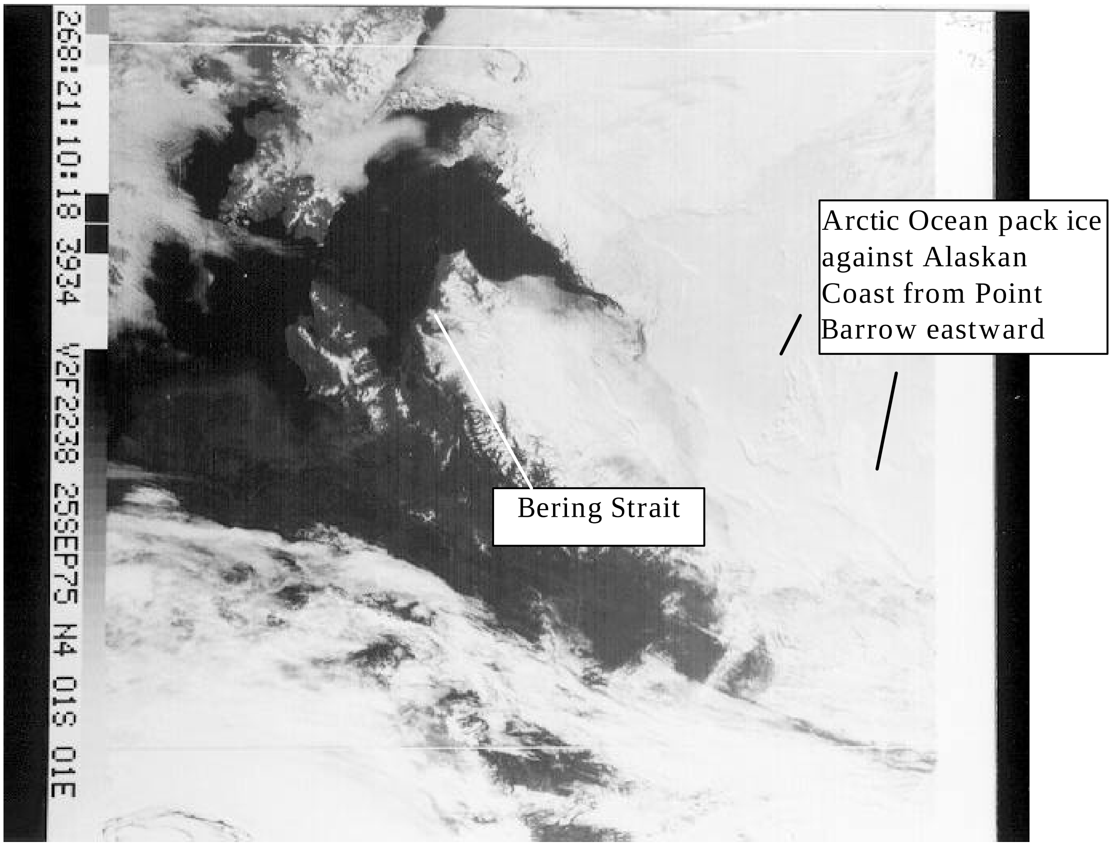

Figure 4: ***Satellite image from September 15, 1975, showing limited clearing along the Alaskan Coast that summer.***

VESSELS CURRENTLY SERVING THE CANADIAN ARCTIC

There are five types of vessels currently providing marine transportation services to the Canadian Arctic.

Canadian Coast Guard Icebreakers

The Canadian Coast Guard, a division of the Department of Fisheries and Oceans Canada, operates a fleet of icebreakers that provide icebreaking assistance to commercial marine traffic in Canada's Arctic as well as supporting marine research. Three classes of Canadian Coast Guard vessels are used in the Canadian Arctic; the heavy icebreaker class, 1200 series medium icebreaker and the 1100 series light icebreaker. The heavy icebreaker class consists of the CCGS Terry Fox, CCGS Louis St. Laurent, and the CCGS Henry Larsen, all of which are considered to be Arctic Class 4 vessels. The 1200 medium icebreakers used in the Canadian Arctic are the CCGS Des Groseilliers, CCGS Pierre Radisson and the CCGS Sir John Franklin, which are considered equivalent to Arctic Class 3 vessels. Examples of the 1100 series icebreakers used in the Canadian Arctic include the CCGS Martha L. Black, CCGS George R. Pearkes and the CCGS Sir Wilfred Laurier, which are considered to be Arctic Class 2 vessels.

From a commercial shipping perspective, the Canadian Coast Guard icebreakers assist commercial cargo vessels through ice. In the context of Bathurst Inlet, they could play a critical role in assisting ice-straightened vessels through the ice of Larsen Sound to reach Coronation Gulf. This same function can also be performed by private icebreakers with similar capability, such as the Swedish icebreaker Oden or the Arctic Kalvik, the sister ship to the CCGS Terry Fox, illustrated in Figure 5.

Figure 5: Arctic Kalvik

Large Commercial Bulk Carriers

There are two lead / zinc mines and one Nickel mine in operation in the eastern Canadian Arctic that rely totally on marine transportation to export their product to market; the Nanisivik Mine on northern Baffin Island, the Polaris Mine on Little Cornwallis Island north of Resolute Bay and the Raglan Mine in northern Quebec. These mines are served by a fleet of ice capable vessels operated by Canarctic Shipping, a Division of Fednav Limited of Montreal.

The highest of the ice class vessels used for this trade, and the highest ice class commercial cargo vessel in the world, is the M.V. Arctic. The M.V. Arctic is a Baltic 1A Super, ASPPR Arctic Class 4 (equivalent) 26,000 DWT icebreaking double hulled OBO (ore, bulk, oil) that carries inbound fuel supplies and outbound ore concentrates from late May to early November for the mines. The M.V. Arctic also operates throughout the winter months to the Raglan nickel mine in Hudson Strait in northern Quebec. The M.V. Arctic is the class of vessel that would be able to reliably navigate each year to Bathurst Inlet from late July to late October unassisted by icebreakers. Figure 6 is a photograph of the M.V. Arctic operating through fast winter ice to the Nanisivik Mine.

Figure 6: M.V. Arctic Transiting to the Nanisivik Mine through Winter Fast Ice

Figure 7: Federal Baffin

Additional cargo vessels used by Canarctic to service the eastern Arctic mine operations include the sister ships Federal Baffin and Federal Franklin. The Federal Baffin and Federal Franklin are 44,000 DWT ice capable bulk carriers built to Baltic Ice Class1A, ASPPR Class A, that operate to the mines from mid July to mid October. After the M.V. Arctic, these are the highest ice class commercial cargo vessels presently in use in the Canadian Arctic. The Federal Baffin and Federal Franklin class of vessel would also be capable of navigating to Bathurst Inlet from mid August to late September, although likely requiring the assistance of icebreakers in the heavier ice years (cooler than normal summers). Figure 7 is a photograph of the Federal Baffin.

Canarctic Shipping also uses the bulk carriers Federal Fuji, Federal Polaris and Federal Agno to carry ore concentrates from the Polaris and Nanisivik mines from late July to late September. These ships are 30,000 DWT Baltic Ice Class 1, ASPPR Class B vessels. These ships are not of sufficient ice class to reliably reach the Bathurst Inlet area each year, even if a supporting icebreaker were used.

Community Resupply Vessels

A number of small coastal trading vessels are used for general cargo in the eastern Arctic for the annual community resupply, also known as the Eastern Arctic Sea Lift. These include two ships owned by C.A. Crosbie Shipping of St. John's Newfound; the M.V. Lady Franklin, a 3,600 DWT Baltic Class 1, ASPPR Class B general cargo vessel and the M.V. Arctic Viking, a 2000 DWT general cargo vessel of the same ice class. Also used in the eastern Arctic is the M.V. Aivik, which is a 4,860 DWT Baltic III, ASPRR Type D, general cargo vessel owned by Transport Nanuk of Montreal. None of the community resupply vessels presently used in the eastern Arctic sea lift have sufficient ice capability to be capable of transiting to Bathurst Inlet each year, even if a supporting icebreaker were present. Figure 8 is a photograph of the M.V. Aivik.

Figure 8: M.V. Aivik

Product Tankers

Fuel products, such as heating oil, diesel fuel and gasoline, are delivered by product tankers to eastern Arctic communities located in the Foxe Basin and along Baffin Island as well as the high Arctic communities of Grise Fjord and Resolute Bay. In recent years this operation has been contracted to Northern Transportation Company Limited (NTCL) of Hay River, N.W.T. NTCL charters European tankers to bring in the product to the eastern Arctic, specifically the M.T. Maersk Biscay, M.T. Maersk Baltic and the M.T. Nataliesif, which are Baltic ice class double-hulled product tankers. These tankers are not of sufficient ice class to reliably transit to Bathurst Inlet each year, even with the assistance of an icebreaker. A photograph of one of the Maersk tankers is provided in Figure 9.

Figure 9: M.T. Maersk Baltic product tanker used in the eastern Canadian Arctic

Tug and Barge Operations

A significant component of the existing transportation infrastructure in the Canadian Arctic relies on the Tug and Barge operations of NTCL, including all of the cargo and oil shipments that occur in the Coronation Gulf/Bathurst Inlet region. NTCL owns and operates 15 tugs and the units used in the Arctic Sea Lift Operation include the M.V. Nunakuut, M.V. Pihurayaak, M.V Kitikmeot and the M.V. Henry Christofferson. These are shallow draft tugs, drawing less than seven feet, required to get close to many communities that do not have proper port or dock facilities. The Company owns over one hundred ice reinforced barges, typically measuring 200 feet long by 50 feet wide and drawing less than six feet of draft, that are capable of carrying bulk, containers, modules and oil cargoes. A photograph of one of the NTCL tugs is shown in Figure 10 and one of the barges in Figure 11.

Figure 10:   One of the NTCL tugs used in the western Arctic sealift

Figure 11:   Barges used by NTCL in the western Arctic sealift

Although the NTCL fleet contains ice reinforced tugs and barges, the system is not designed to transit through heavy sea ice conditions. Rather, the tug and barge transport system has been devised to take advantage of the early summer clearing of ice that occurs in several locations in the Canadian Arctic. For the western Arctic Sea Lift into Coronation Gulf, the tug and barges operate out of the Mackenzie River, where all fuel and cargo are transported by road to Hay River and barged to the Beaufort Sea then eastward to Coronation Gulf and westward to Alaska from mid July to late September. The ice clears much earlier and more completely in Coronation Gulf and the eastern Beaufort Sea then it goes west towards Point Barrow or east to Larsen Sound, enabling the tug and barge operation to reliably deliver cargoes when conventional ocean shipping cannot reach the region because of sea ice blockages. This system has been used successfully for decades and NTCL has been highly successful in securing business along the north slope of Alaska due to the uncertainty of American shipping being able to transit the sea ice of Point Barrow. The downside of this system is that the combination of interior land transport and tug and barges makes for much more expensive freight rates than that possible from ocean shipping.

RECENT TECHNOLOGICAL ADVANCES IN ARCTIC SHIPPING

Arctic shipping has been occurring for hundreds of years, advancing from the days of wooden sailing vessels to modern day steel-hulled icebreakers. In the context of icebreaking shipping, modern designs and ship-building capability can and has constructed vessels that can navigate in virtually any ice covered waterbody, including the Arctic Ocean to the North Pole.

Most of the significant advances in Arctic navigation have occurred in the past twenty years, when large and powerful icebreakers and icebreaking commercial cargo vessels have been built. In 1978 the M.V. Arctic became the first icebreaking cargo vessel to be built for the purpose of unescorted operations in polar waters. Based on more than ten years of research on the ship, the vessel was upgraded with a new bow in 1985 that greatly increased the performance of the ship in ice.

When the existing transportation infrastructure was established in the Canadian Arctic, vessels like the M.V. Arctic did not exist, which lead to the reliance on the tug and barge operation which is still in use today. However, when the mines began to open in the Arctic in the late 1970's, ice capable ocean going vessels were required and this is what which lead to the development of the M.V. Arctic and, in recent years, ships like the Federal Baffin and Federal Franklin. Now that ships such as these and the technology and knowledge to build new ones exist, it is possible for ocean going icebreaking ships to transit into Coronation Gulf to service a port site in Bathurst Inlet. It is not likely possible that these ocean-going ships would be able to directly service the communities in the area, due to the lack of port infrastructures and shallow drafts. However, a tug and barge operation working from the Bathurst port site could provide a much cheaper option to servicing the coastal communities than is the case today.

Along with icebreaking technology development, significant advancements in ice navigation technology using satellite imagery have been made, such as Enfotec's IceNav system. These ice navigation systems enable vessels to avoid heavy ice areas, greatly increasing ship performance in ice. Figure 12 is a photograph of the IceNav system in use onboard the M.V. Arctic.

Figure 12: IceNav in use onboard the M.V. Arctic

A more recent technology development in icebreaking ship design is the double acting ship design of Kvaerner Masa of Finland. The concept is based on the known fact that a ship outfitted with an efficient icebreaking bow performs poorly in open water, due to waves slamming the sloped bow. To counter act this effect, the double acting design uses a conventional bow on the front of the vessel for open water sea keeping and an icebreaking bow on the stern for icebreaking. Figure 13 illustrates the concept.

Figure 13: Kvaerner Masa double acting tanker concept

The key to the concept is that the ship has to go astern in ice. With a conventional design, the propeller of the ship would be jammed forward into the ice making the concept unworkable. This problem is dealt with in the Kvaerner Masa design with the use of Azipod thrusters. An Azipod essentially looks like the bottom of a very large outboard motor that can rotate 360^0 providing thrust in any direction for the ship. This design is being proposed for use in the Russian Arctic but has never been tried in the multi-year ice of the Canadian Arctic. The ships built with this design would likely be of a higher cost than the conventional icebreaking design, due to the need for two bows, and would likely not be required for a seasonal operation in Bathurst Inlet.

APPENDIX 5

FINANCING OPTIONS

SLAVE GEOLOGIC PROVINCE TRANSPORTATION CORRIDOR
FINANCING MODEL

		Phase 2					Phase 3				
		2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
INBOUND TRAFFIC	Diamond #1	52,400,000	52,400,000	52,400,000	52,400,000	52,400,000	52,400,000	52,400,000	52,400,000	52,400,000	52,400,000
Commodity	Gold #1	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000
Fuel	Diamond #2	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000
	Base Metal #1	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000
	Diamond #3	-	-	-	-	-	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000
	Gold #2	-	-	-	-	-	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000
	Base Metal #2	-	-	-	-	-	-	-	-	-	-
	Sub-Total	150,700,000	150,700,000	150,700,000	150,700,000	150,700,000	205,700,000	205,700,000	205,700,000	205,700,000	205,700,000
Consumables	Diamond #1	13,100	13,100	13,100	13,100	13,100	13,100	13,100	13,100	13,100	13,100
	Gold #1	17,100	17,100	17,100	17,100	17,100	17,100	17,100	17,100	17,100	17,100
	Diamond #2	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000
	Base Metal #1	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000
	Diamond #3	-	-	-	-	-	11,300	11,300	11,300	11,300	11,300
	Gold #2	-	-	-	-	-	8,700	8,700	8,700	8,700	8,700
	Base Metal #2	-	-	-	-	-	-	-	-	-	-
	Sub-Total	52,200	52,200	52,200	52,200	52,200	72,200	72,200	72,200	72,200	72,200
Supplies	Diamond #1	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
	Gold #1	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
	Diamond #2	800	800	800	800	800	800	800	800	800	800
	Base Metal #1	600	600	600	600	600	600	600	600	600	600
	Diamond #3	-	-	-	-	-	500	500	500	500	500
	Gold #2	-	-	-	-	-	600	600	600	600	600
	Base Metal #2	-	-	-	-	-	-	-	-	-	-
	Sub-Total	3,900	3,900	3,900	3,900	3,900	5,000	5,000	5,000	5,000	5,000
TOTAL INBOUND TRAFFIC - North											
Fuel		120,560,000	120,560,000	120,560,000	120,560,000	120,560,000	164,560,000	164,560,000	164,560,000	164,560,000	164,560,000
Goods		14,025	14,025	14,025	14,025	14,025	19,300	19,300	19,300	19,300	19,300
TOTAL INBOUND TRAFFIC - South											
Fuel		-	-	-	-	-	-	-	-	-	-
Goods		-	-	-	-	-	-	-	-	-	-

Source: Arthur Andersen LLP, Simons International Corporation

SLAVE GEOLOGIC PROVINCE TRANSPORTATION CORRIDOR
FINANCING MODEL

		Phase 4									
		2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
INBOUND TRAFFIC	Diamond #1	79,600,000	79,600,000	79,600,000	79,600,000	79,600,000	79,600,000	79,600,000	79,600,000	79,600,000	79,600,000
Commodity	Gold #1	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000	28,300,000
Fuel	Diamond #2	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000	48,000,000
	Base Metal #1	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000	22,000,000
	Diamond #3	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000	19,000,000
	Gold #2	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000
	Base Metal #2	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000	15,000,000
	Sub-Total	247,900,000	247,900,000	247,900,000	247,900,000	247,900,000	247,900,000	247,900,000	247,900,000	247,900,000	247,900,000
Consumables	Diamond #1	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000
	Gold #1	17,100	17,100	17,100	17,100	17,100	17,100	17,100	17,100	17,100	17,100
	Diamond #2	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000	13,000
	Base Metal #1	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000
	Diamond #3	11,300	11,300	11,300	11,300	11,300	11,300	11,300	11,300	11,300	11,300
	Gold #2	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700	8,700
	Base Metal #2	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
	Sub-Total	82,100	82,100	82,100	82,100	82,100	82,100	82,100	82,100	82,100	82,100
Supplies	Diamond #1	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
	Gold #1	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
	Diamond #2	800	800	800	800	800	800	800	800	800	800
	Base Metal #1	600	600	600	600	600	600	600	600	600	600
	Diamond #3	500	500	500	500	500	500	500	500	500	500
	Gold #2	600	600	600	600	600	600	600	600	600	600
	Base Metal #2	400	400	400	400	400	400	400	400	400	400
	Sub-Total	5,200	5,200	5,200	5,200	5,200	5,200	5,200	5,200	5,200	5,200
TOTAL INBOUND TRAFFIC - North											
Fuel		185,925,000	185,925,000	185,925,000	185,925,000	185,925,000	185,925,000	185,925,000	185,925,000	185,925,000	185,925,000
Goods		21,825	21,825	21,825	21,825	21,825	21,825	21,825	21,825	21,825	21,825
TOTAL INBOUND TRAFFIC - South											
Fuel		61,975,000	61,975,000	61,975,000	61,975,000	61,975,000	61,975,000	61,975,000	61,975,000	61,975,000	61,975,000
Goods		65,475	65,475	65,475	65,475	65,475	65,475	65,475	65,475	65,475	65,475

Source: Arthur Andersen LLP, Simons International Corporation

SLAVE GEOLOGIC PROVINCE TRANSPORTATION CORRIDOR
FINANCING MODEL

		Phase 2					Phase 3				
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
OUTBOUND	Diamond #1	-	-	-	-	-	-	-	-	-	-
	Gold #1	-	-	-	-	-	-	-	-	-	-
	Diamond #2	-	-	-	-	-	-	-	-	-	-
	Base Metal #1	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000
	Diamond #3	-	-	-	-	-	-	-	-	-	-
	Gold #2	-	-	-	-	-	-	-	-	-	-
	Base Metal #2	-	-	-	-	-	-	-	-	-	-
TOTAL OUTBOUND TRAFFIC		320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000
TOTAL OUTBOUND TRAFFIC - North											
Goods		320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000
TOTAL OUTBOUND TRAFFIC - South											
Goods		-	-	-	-	-	-	-	-	-	-
MATERIAL TRANSPORT COSTS											
Fuel per 1,000 litres		$0.100	$0.100	$0.100	$0.100	$0.100	$0.100	$0.100	$0.100	$0.100	$0.100
Consumable/Supplies per tonne		$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125
Aggregate/Concentrate per tonne		$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125
DISTANCES											
S/E Contwoyto Lake - Bathurst Inlet		200	200	200	200	200	200	200	200	200	200
Yellowknife - S/E Contwoyto Lake		400	400	400	400	400	400	400	400	400	400
REVENUES - NORTHERN SECTION											
Fuel (per 1,000 litres)		$2,411,200	$2,411,200	$2,411,200	$2,411,200	$2,411,200	$3,291,200	$3,291,200	$3,291,200	$3,291,200	$3,291,200
Consumable/Supplies		$350,625	$350,625	$350,625	$350,625	$350,625	$482,500	$482,500	$482,500	$482,500	$482,500
Aggregate/Concentrate		$8,000,000	$8,000,000	$8,000,000	$8,000,000	$8,000,000	$8,000,000	$8,000,000	$8,000,000	$8,000,000	$8,000,000
TOTAL ROAD REVENUES - NORTH		$10,761,825	$10,761,825	$10,761,825	$10,761,825	$10,761,825	$11,773,700	$11,773,700	$11,773,700	$11,773,700	$11,773,700
REVENUES - SOUTHERN SECTION											
Fuel (per 1,000 litres)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Consumable/Supplies		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Aggregate/Concentrate		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL ROAD REVENUES - SOUTH		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Source: Arthur Andersen LLP, Simons International Corporation

SLAVE GEOLOGIC PROVINCE TRANSPORTATION CORRIDOR
FINANCING MODEL

		Phase 4									
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
OUTBOUND	Diamond #1	-	-	-	-	-	-	-	-	-	-
	Gold #1	-	-	-	-	-	-	-	-	-	-
	Diamond #2	-	-	-	-	-	-	-	-	-	-
	Base Metal #1	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000
	Diamond #3	-	-	-	-	-	-	-	-	-	-
	Gold #2	-	-	-	-	-	-	-	-	-	-
	Base Metal #2	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
TOTAL OUTBOUND TRAFFIC		560,000	560,000	560,000	560,000	560,000	560,000	560,000	560,000	560,000	560,000
TOTAL OUTBOUND TRAFFIC - North											
Goods		560,000	560,000	560,000	560,000	560,000	560,000	560,000	560,000	560,000	560,000
TOTAL OUTBOUND TRAFFIC - South											
Goods		-	-	-	-	-	-	-	-	-	-
MATERIAL TRANSPORT COSTS											
Fuel per 1,000 litres		$0.100	$0.100	$0.100	$0.100	$0.100	$0.100	$0.100	$0.100	$0.100	$0.100
Consumable/Supplies per tonne		$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125
Aggregate/Concentrate per tonne		$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125	$0.125
DISTANCES											
S/E Contwoyto Lake - Bathurst Inlet		200	200	200	200	200	200	200	200	200	200
Yellowknife - S/E Contwoyto Lake		400	400	400	400	400	400	400	400	400	400
REVENUES - NORTHERN SECTION											
Fuel (per 1,000 litres)		$3,718,500	$3,718,500	$3,718,500	$3,718,500	$3,718,500	$3,718,500	$3,718,500	$3,718,500	$3,718,500	$3,718,500
Consumable/Supplies		$545,625	$545,625	$545,625	$545,625	$545,625	$545,625	$545,625	$545,625	$545,625	$545,625
Aggregate/Concentrate		$14,000,000	$14,000,000	$14,000,000	$14,000,000	$14,000,000	$14,000,000	$14,000,000	$14,000,000	$14,000,000	$14,000,000
TOTAL ROAD REVENUES - NORTH		$18,264,125	$18,264,125	$18,264,125	$18,264,125	$18,264,125	$18,264,125	$18,264,125	$18,264,125	$18,264,125	$18,264,125
REVENUES - SOUTHERN SECTION											
Fuel (per 1,000 litres)		$2,479,000	$2,479,000	$2,479,000	$2,479,000	$2,479,000	$2,479,000	$2,479,000	$2,479,000	$2,479,000	$2,479,000
Consumable/Supplies		$3,273,750	$3,273,750	$3,273,750	$3,273,750	$3,273,750	$3,273,750	$3,273,750	$3,273,750	$3,273,750	$3,273,750
Aggregate/Concentrate		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL ROAD REVENUES - SOUTH		$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750

Source: Arthur Andersen LLP, Simons International Corporation

SLAVE GEOLOGIC PROVINCE TRANSPORTATION CORRIDOR
FINANCING MODEL

			Phase 2					Phase 3		
	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
PORT HANDLING FEES										
Fuel (per 1,000 litres)	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000
Consumable/Supplies ($25/tonne)	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000
Aggregate/Concentrate	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000
PORT REVENUES										
Fuel	$1,205,600	$1,205,600	$1,205,600	$1,205,600	$1,205,600	$1,645,600	$1,645,600	$1,645,600	$1,645,600	$1,645,600
Consumable/Supplies	$112,200	$112,200	$112,200	$112,200	$112,200	$154,400	$154,400	$154,400	$154,400	$154,400
Aggregate/Concentrate	$2,560,000	$2,560,000	$2,560,000	$2,560,000	$2,560,000	$2,560,000	$2,560,000	$2,560,000	$2,560,000	$2,560,000
TOTAL PORT REVENUES	$3,877,800	$3,877,800	$3,877,800	$3,877,800	$3,877,800	$4,360,000	$4,360,000	$4,360,000	$4,360,000	$4,360,000
TOTAL REVENUES ROAD + PORT										
Northern Section	$14,639,625	$14,639,625	$14,639,625	$14,639,625	$14,639,625	$16,133,700	$16,133,700	$16,133,700	$16,133,700	$16,133,700
Southern Section	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL REVENUES	$14,639,625	$14,639,625	$14,639,625	$14,639,625	$14,639,625	$16,133,700	$16,133,700	$16,133,700	$16,133,700	$16,133,700
OPERATING COSTS - NORTH										
Road	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000
Port	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000
Management Fees	$439,189	$439,189	$439,189	$439,189	$439,189	$484,011	$484,011	$484,011	$484,011	$484,011
TOTAL OPERATING COSTS	$5,939,189	$5,939,189	$5,939,189	$5,939,189	$5,939,189	$5,984,011	$5,984,011	$5,984,011	$5,984,011	$5,984,011
NET CF AVAILABLE FOR DEBT SERVICE(1)	$8,700,436	$8,700,436	$8,700,436	$8,700,436	$8,700,436	$10,149,689	$10,149,689	$10,149,689	$10,149,689	$10,149,689
OPERATING COSTS - SOUTH										
Road	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Management Fee	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL OPERATING COSTS	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
NET CF AVAILABLE FOR DEBT SERVICE (2)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Source: Arthur Andersen LLP, Simons International Corporation

SLAVE GEOLOGIC PROVINCE TRANSPORTATION CORRIDOR
FINANCING MODEL

	Phase 4									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PORT HANDLING FEES										
Fuel (per 1,000 litres)	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000	$10.000
Consumable/Supplies ($25/tonne)	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000
Aggregate/Concentrate	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000	$8.000
PORT REVENUES										
Fuel	$1,859,250	$1,859,250	$1,859,250	$1,859,250	$1,859,250	$1,859,250	$1,859,250	$1,859,250	$1,859,250	$1,859,250
Consumable/Supplies	$174,600	$174,600	$174,600	$174,600	$174,600	$174,600	$174,600	$174,600	$174,600	$174,600
Aggregate/Concentrate	$4,480,000	$4,480,000	$4,480,000	$4,480,000	$4,480,000	$4,480,000	$4,480,000	$4,480,000	$4,480,000	$4,480,000
TOTAL PORT REVENUES	$6,513,850	$6,513,850	$6,513,850	$6,513,850	$6,513,850	$6,513,850	$6,513,850	$6,513,850	$6,513,850	$6,513,850
TOTAL REVENUES ROAD + PORT										
Northern Section	$24,777,975	$24,777,975	$24,777,975	$24,777,975	$24,777,975	$24,777,975	$24,777,975	$24,777,975	$24,777,975	$24,777,975
Southern Section	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750	$5,752,750
TOTAL REVENUES	$30,530,725	$30,530,725	$30,530,725	$30,530,725	$30,530,725	$30,530,725	$30,530,725	$30,530,725	$30,530,725	$30,530,725
OPERATING COSTS - NORTH										
Road	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000
Port	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000	$3,000,000
Management Fees	$743,339	$743,339	$743,339	$743,339	$743,339	$743,339	$743,339	$743,339	$743,339	$743,339
TOTAL OPERATING COSTS	$6,243,339	$6,243,339	$6,243,339	$6,243,339	$6,243,339	$6,243,339	$6,243,339	$6,243,339	$6,243,339	$6,243,339
NET CF AVAILABLE FOR DEBT SERVICE(1)	$24,287,386	$24,287,386	$24,287,386	$24,287,386	$24,287,386	$24,287,386	$24,287,386	$24,287,386	$24,287,386	$24,287,386
OPERATING COSTS - SOUTH										
Road	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000	$5,000,000
Management Fee	$172,583	$172,583	$172,583	$172,583	$172,583	$172,583	$172,583	$172,583	$172,583	$172,583
TOTAL OPERATING COSTS	$5,172,583	$5,172,583	$5,172,583	$5,172,583	$5,172,583	$5,172,583	$5,172,583	$5,172,583	$5,172,583	$5,172,583
NET CF AVAILABLE FOR DEBT SERVICE (2)	$580,168	$580,168	$580,168	$580,168	$580,168	$580,168	$580,168	$580,168	$580,168	$580,168

Source: Arthur Andersen LLP, Simons International Corporation

APPENDIX 6

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