Technical Review

of

2014 Draft

Nunavut Land Use Plan

Prepared by: **THE KIVALLIQ INUIT ASSOCIATION**

With support from: Hutchinson Environmental Sciences Ltd.

GeoVector Management Inc.

Aurora Wildlife Research

Prepared For: **NUNAVUT PLANNING COMMISSION**

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1. Introduction

The Kivalliq Inuit Association (KivIA) has completed a technical review of the 2014 Draft Nunavut Land Use Plan (DNLUP). The KivIA represents the Inuit beneficiaries of the Kivalliq Region at the territorial and regional levels, and supports sustainable economic development opportunities for Inuit beneficiaries.

The DNLUP was developed by the Nunavut Planning Commission (NPC) as mandated for the Nunavut Settlement Area under Article 11 of the Nunavut Land Claims Agreement (NLCA). The KivIA retained a team of consultants to complete a review of the most recent DNLUP and contribute to a submission to the NPC. This team consisted of Hutchinson Environmental Sciences Ltd. (HESL), Aurora Wildlife Research (Aurora) and GeoVector Management Inc. (Geovector).

The review mandate was carried out at a high level with the purpose of identifying shortcomings in the DNLUP that might deter its implementation without further revision. This mandate was meant to ensure that the scope of the proposed DNLUP was compatible with the KIVIA's mandate and responsibilities to the Inuit beneficiaries of the Kivalliq Region.

The specific areas reviewed under the KivIA's mandate, and the responsible reviewers, were:

1. Caribou protection measures (Aurora).
2. Freshwater environment interactions, especially in relation to drinking water supplies (HESL).
3. Evaluating coverage of marine areas to ensure they were adequately considered (HESL).
4. Evaluating coverage of migratory birds to ensure they were adequately considered (HESL).
5. Evaluating the Heritage River land use designation (HESL).
6. Evaluating whether the DNLUP reaches beyond what is scientifically defensible at the cost of potential resource development and subsequent economic benefits (HESL).
7. Evaluating the DNLUP impact on mineral potential (GeoVector).
8. Providing general comments on the overall approach of the DNLUP (HESL).

This report is a summary of the review findings. The detail on each of the specific areas is contained within the Appendices, which are attached to this report.

We also note that Land Use Planning as addressed by the DNLUP and the NPC is only one step of the permitting process for a proposed project in the Kivalliq. Permits for activities on Inuit Owned Land are also reviewed by the KivIA, and projects which may have larger scale or residual environmental impacts are subject to the Environmental Assessment process through the Nunavut Impact Review Board. This consideration has, in part, informed our review of the DNLUP.

2. Caribou Protection Measures

See Schedule B and C for more details.

The review by Aurora determined that management of caribou must be predicated on Inuit Qaujimajatuqangit (IQ) and scientific data related to caribou ecology and known or assumed vulnerability to disturbance, while acknowledging a balance between caribou protection and economic development opportunities. The following is a summary of the KivIA's positions and recommendations to the NPC regarding caribou issues for both mainland migratory and tundra wintering herds related to the DNLUP:

1. KivIA supports identification of **Core calving areas** using IQ, scientific survey and collar data, and temporal trends to identify the core areas used by calving and immediately post-calving caribou (the extent of calving is defined as the peak time of calving plus 3 weeks).
2. **Core calving areas** are those areas used by caribou from peak of calving through to 3 weeks of age and are mapped using IQ, aerial surveys and the most recent 10 years of satellite telemetry. Core calving areas should be assigned **Protected Area status**, which excludes exploration and development activity and protects habitat year-round.
3. However, Core calving areas that overlap **High Mineral Potential areas** should be assigned **Special Management Area status.** Within Special Management Areas, stringent measures based on the draft Kivalliq **Mobile Caribou Conservation Measures** should be applied for any exploration and development being proposed. These Measures apply to caribou presence to minimize disturbance when caribou are present, and should include requirements for minimal size of development footprint.
4. **Mobile Caribou Conservation Measures,** a rules-based approach to adaptively mitigate effects of industrial exploration on migratory barren-ground caribou, link monitoring and site-specific mitigation with the seasonal susceptibility of caribou to disturbance. Risk timing windows are developed based on differences in the predictability of caribou encounters, susceptibility and behaviour, with monitoring and mitigation scaled to risk category as well as season. This approach uses a) agreed-upon areas within which monitoring and mitigation is directed; b) monitoring of caribou distribution and movements to trigger the mitigation actions; and c) mitigation actions that apply to the land use operation to avoid or minimize (reduce) effects on caribou.
5. A **25-km buffer** around Core calving areas should be implemented and Mobile Caribou Conservation Measures applied within that area as per the draft Kivalliq MCCM.
6. The immediate area around **identified water crossings** should be placed within year-round Protected Area Status, with the size of the area tailored to traditional caribou approach characteristics based on IQ. Around the Protected Area of water crossings we recommend a 10 km radius zone within which Mobile Caribou Conservation Measures would be applied.
7. **For other seasonal ranges** (including post-calving/summer, late summer/pre-rut, fall migration/rut, winter and spring migration), Mobile Caribou Conservation Measures should be applied with different criteria and timing for different seasons within anticipated seasonal boundaries and types of exploration or development activities.
8. Major **transportation corridors** and **infrastructure** of significant economic importance to the Kivalliq Region (e.g., the proposed Nunavut-Manitoba Road or hydro corridor) should be granted Special Management Area status with appropriate (and if required, stringent) Mobile Caribou Conservation Measures applied.
9. For the purposes of caribou protection and conservation, hunting season designations and dates should be decided through a collaborative exercise which considers the practicality of management.
10. Only the most recent 10 years of collaring data should be used to address annual trends in seasonal ranges, especially for calving/post-calving areas. Weighting for core ranges should be equally applied among years and non-breeding cows should be screened out from mapping calving grounds.

There are a number of terms which have been used in different ways to describe calving grounds and other seasonal ranges in the Draft NLUP. These different uses can cause confusion. The following terminology was used in this review and is recommended for incorporation into the NLUP to improve clarity:

Seasonal range: The area used by caribou in any one season. A seasonal range may include different habitats (vegetation and terrain).The NPC refers to the seasonal ranges as polygons: a polygon is a shape enclosed by a line and is a quite general term. It is makes more sense to refer instead to seasonal ranges.

Annual range is the area used by caribou during the entire year, and is measured considering the most recent 10-year period.

Core: The Government of Nunavut (GN) uses the term ‘core’ to describe the area used by caribou for each of nine seasons based on a statistical analysis of the satellite-collared caribou, using a different estimate of core for spring and fall migrations (80% utilization distribution kernel) and a broader estimate for the other seasonal ranges (95% kernel). The GN needs to justify and provide biological reasoning behind defining core habitats based on these kernel areas. While these methods may be able to identify core seasonal ranges from collar data, the KivIA recommends that season designations and dates should be decided through a collaborative exercise among interested parties, while considering the practicality of management.

Extent of calving: This term, widely accepted among caribou biologists, is based on cow-calf behavior – the calf is completely dependent on nursing from the cow for approximately the first 3 weeks after birth. The extent of calving refers to the area used from the peak of calving and the following approximately 3 weeks. Depending on the timing of calving, the extent of calving often extends to the last week or 10 days of June. Movements in the first weeks subsequent to calving remain relatively low and increase after three weeks. This definition recognizes the time when calves are most sensitive to the maternal and environmental conditions that affect their growth and when they are most vulnerable to predation and disturbance. KivIA suggests that the area occupied during the extent of calving should be considered as equivalent to core calving areas.

Peak of calving: The GN does not identify the peak of calving. We have defined it as the date (or range of dates, depending on calculation method) when 50% of cows have calved. Compared to GN seasons, the extent of calving largely overlaps calving and immediate post-calving. For collared caribou, the approximate calving date (and location) can be estimated by determining the point of reduced daily distance moved by the cow.

3. Water Protection Measures

See Schedule D for more details.

3.1 Freshwater Resource Potential Concerns

The review completed by HESL highlighted three overarching concerns with the protection of freshwater resources in the DNLUP.

First, the NPC has not included freshwater quality, quantity or flow as one of the areas and issues pertinent to the goal of supporting and sustaining the environment. There is also concern that this disregards Article 20 of the Nunavut Land Claims Agreement and diminishes consideration for changes to water quality, quantity and flow in their own right resulting from either development or proposed protection measures.

The KivIA is further concerned that the DNLUP as written does not provide adequate, science-based protections for the drinking water supply of all Nunavut communities. Not all communities have designated special management areas for "Community Water Source Watershed" to ensure that their local freshwater supply is sufficient in quantity and adequately protected from local and upstream influences. Where "Community Water Source Watershed" special management areas have been designated for communities, they have not been scientifically derived using documented criteria or rationale. Therefore, the DNLUP provides no assurance that the communities of Nunavut have been afforded adequate long-term drinking water supply security, an essential component of planning for population growth and development.

Finally, no consideration has been given in the DNLUP for drinking water sources while Nunavummiut are on the land. This disregards a necessary component of many traditional Inuit land uses that requires access to freshwater while away from community drinking water treatment and distribution infrastructure for an extended period.

It is recommended that:

- additional consideration be given throughout the DNLUP to freshwater quality, quantity and flow;
- scientifically defensible freshwater resource protections are designated for all of Nunavut's communities in future drafts as sufficient information becomes available and that the rationale and criteria for designating these source water protection areas be documented; and
- protection of freshwater sources while on the land is expressly considered by the NPC and includes documentation of consideration of Inuit Qaujimajatuqangit.

3.2 Protection of Marine Areas

The DNLUP recognizes that key marine features, such as caribou sea crossings, Ecologically and Biologically Significant Areas (EBSAs), and polynyas are important for Nunavut biodiversity. These features, however, are all assigned a Mixed Use Land Use Designation, which is the least protective land use category under the DNLUP. In addition, sea ice is identified as important for polar bears, and susceptible to climate change, yet it receives no land use designation under the DNLUP.

These key marine features are dynamic in their location and duration. Although identifying and monitoring these features may be challenging, protecting them is important for Nunavut biodiversity, especially in the face of climate change and increasing marine shipping activity.

It is recommended that the DNLUP should provide greater protection for these key marine features by defining them with recognition that they are dynamic features and designating them as Special Management Areas. As such, restrictions including clearly defined setbacks should be considered on some access and uses in and around these features (e.g., relating to oil and gas exploration and production, commercial shipping). Furthermore, identification and monitoring of these features should be documented as a research priority in the DNLUP.

4. Heritage River Land use Designation

See Schedule D for more details.

Nunavut contains three designated Heritage Rivers (the Kazan, Thelon and Soper rivers) and one nominated Heritage River (the Coppermine River). The Kazan and Thelon rivers are located within the Kivalliq Region. As per guidance provided by the Canadian Heritage Rivers Secretariat, these water resources should be protected from environmental degradation while still providing the opportunity for economic and social benefits to the Canadian population. The DNLUP as currently written does not provide adequate environmental protections to Nunavut's Heritage River systems nor does it include sufficient rationale for the guidance that has been provided. This lack of rationale is particularly evident in the conflicting direction provided in the DNLUP for protection of the Kazan and Thelon rivers, and for potential alternative energy development projects. These shortcomings likely result from the fact that the NPC has not considered available documentation and management plans applicable to the protection and responsible development of these Heritage Rivers.

It is recommended that the DNLUP apply the mixed land use designation to the Kazan and Thelon Heritage Rivers, and expand the scope of managing these river systems to their entire watersheds. These protections should be rooted in science and IQ-based decision making, include consideration of available and applicable management plans, and ongoing environmental monitoring.

5. Migratory Birds

See Schedule D for more details.

Key Migratory Bird Habitat Sites are assigned either Protected Area or Special Management Area Land Use Designations, while Migratory Bird Sanctuaries are assigned a Protected Area Land Use Designation under the DNLUP. National Wildlife Areas (designated as Protected Areas) also provide habitat for migratory birds. The Plan provides setback requirements that regulatory authorities must follow when issuing permits, licenses and authorizations for activity in, or in the vicinity of, these areas, in order to protect migratory birds during the breeding season.

The terrestrial setbacks established for all migratory birds, sea-level coastal nesting birds, all seabirds, Northern Fulmars, Ivory Gulls and coastal waterfowl and seaducks are seasonal, only applying when birds are present (i.e. in breeding bird colonies or moulting areas). Setbacks during only part of the year could lead to destruction or disturbance of breeding habitat when the birds are not present, resulting in loss or degradation of habitat necessary for birds when they return to breed.

Furthermore, the 300 m seasonal terrestrial setback from concentrations of birds may not be sufficient for all types of activities. The North Yukon Regional Land Use Plan (Vontut Gwitchin Government and Yukon Government, 2009) has adopted land use zoning based on intensity rather than type of use. In this approach, the direct surface disturbance and linear density of proposed human activities are used to determine the overall intensity of a proposed project. Similar metrics could be used to evaluate appropriate setback distances for different activities affecting migratory birds in the DNLUP.

It is recommended that the DNLUP require year-round terrestrial setbacks around migratory bird habitat to ensure breeding habitat is not lost or degraded during all periods of the year. It is also recommend that the intensity of proposed activities in, or in the vicinity of, migratory bird habitat be factored into the calculation of setback distance (e.g. consider the amount of area physically disturbed and the total length of linear features such as roads, access trails etc.).

6. Concerns with Overall Approach in DNLUP

See Appendix D for more details.

Several concerns were identified with the overall approach taken in the DNLUP. In particular, insufficient explanation is provided on the decision-making process guiding land use designations, and no framework exists for the periodic review and evaluation of how the DNLUP is performing over time.

The DNLUP fails to explain the rationale used to establish the various land use designations throughout the territory. Furthermore, it is not clear whether land use designations can change with new information (e.g., an area currently designated as Protected Area might be identified in future as an Area of High Mineral Potential - would this alter the level of Protection?). In addition, there are land use designations that currently overlap in the DNLUP (e.g., High Mineral Potential and Community Area of Interest), but no clarification is provided on how potentially conflicting designations are balanced.

The DNLUP acknowledges that there are gaps in information, knowledge and expert advice that have restricted the consideration of land use options, but that this absence of information cannot impede the land use planning process. While it is recognized that the development of the DNLUP cannot wait until all information gaps have been filled, it should strive to incorporate the best available information on an ongoing basis. The DNLUP, however, does not explain how new information will be considered and integrated into the Plan in a timely and consistent manner. Furthermore, it is not clear whether the Precautionary Principle is used when making decisions in the absence of information under the DNLUP.

The lack of clarity on the decision-making process structuring the DNLUP, as well as the absence of any framework to ensure ongoing or periodic review and update of the Plan, creates considerable uncertainty with regard to land use planning options in the territory. It is recommended that the DNLUP:

- provide rationale and relevant background information used to establish the land use designations, including a discussion of the rules applied to categorize areas under different designations, and to delineate the size and shape of areas;
- clarify whether new information can change land use designations (and the process for doing so);
- explain how overlapping land use designations are currently managed and potential conflicts avoided;
- adopt the Precautionary Principle in all decision-making as it is currently enshrined in the 1999 Canadian Environmental Protection Act (CEPA 1999): *"Whereas the Government of Canada is committed to implementing the precautionary principle that, where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."*
- include a summary of data/knowledge gaps identified in its development, as well as a strategy for addressing them in future updates;
- establish a mandated and regular process for review and update to reflect the most recent information and current needs of the territory.

7. Mineral Potential

See Schedule E for more details.

7.1 Mineral Potential

The KivIA concerns are related mainly to the lack of consensus on what uses should be prohibited or restricted within areas of High Mineral Potential. This reflects the minimal use of existing public domain geoscience data, which limited the areas that were defined as having high mineral potential. In addition, input from professional geoscientists with the expertise in using this data to define areas of high mineral potential that occur outside the currently identified areas on IOL's and Crown land is required. The recent new discoveries of the Amaruq gold deposit north of Baker Lake and the North Quest gold project west of Whale Cove are very good examples of how the effective use of public geoscience data can help outline areas of high mineral potential.

The KivIA proposes that the following options for refinement to the DNLUP be implemented:

1. The mineral potential outside areas of existing rights on Crown Lands and all IOL's should have more research to better categorize the location of low to high mineral potential corridors;
2. The DNLUP should be revised to recognize that the surface IOLs were selected predominantly for their sub-surface mineral potential and to ensure access corridors to those lands;
3. All IOL parcels of High Mineral Potential should be designated "Mixed Use";
4. A clearly defined process that outlines how flexible the DNLUP will be in changing land use designation boundaries and definitions as new information becomes available going forward (see also Section 6);
5. Evaluation of the future mineral potential must be viewed through both the "mineral exploration and mining industry lens" and a "government lens". This is best achieved by compiling all the

current public geoscience into a single database. Once in place a systematic review of this data using existing mineral deposit and mineral potential models should be completed.;

6. The geoscience data in the public domain must be given much more consideration when defining areas of low to high mineral potential;
7. Tourism facilities and mineral exploration / mining infrastructure are often beneficial to each other so excluding tourism facilities that do not interfere with the development of the mineral potential should be re-considered.

7.2 Existing Rights

The KivIA agrees with the Government of Canada position of a broad exemption for activities where there are any existing surface rights with sub-surface mineral potential. In addition, these existing areas should have access routes that allow for future development. Therefore, the KivIA supports the federal position on grandfathering existing rights to the extent that the federal position is legally viable.

7.3 Transboundary Considerations

The KivIA concerns relate to the potential negative economic and social impacts of Protected and Special Management Areas that share a common boundary between Nunavut and the adjoining jurisdictions of Manitoba, the NWT and Saskatchewan in areas of high mineral potential corridors on both IOLs and Crown Land.

The current options for refinement in the DNLUP do not appear to address these concerns because there is no clear process on how “general guidance” or “retaining references to identify priorities” would be done or even what these terms mean.

The KivIA proposes that the following options for refinement to the DNLUP be implemented:

1. More research to better define the potential negative economic and social impacts associated with Protected and Special Management Areas in the adjoining jurisdictions.
2. More research to better determine if *Mixed Use* and *High Mineral Potential* designations should be expanded while *Protected* and *Special Management Area* designations are contracted along the common boundaries between Nunavut and the adjoining jurisdictions.
3. More inclusive data from all public sources of geoscientific information.
4. Interpretation and a larger scale view of the geoscience data once it is captured.
5. Consultation with all transboundary jurisdictions on the potential negative economic and social impacts that could arise in these jurisdictions from the DNLUP.

8. Linear Infrastructure Corridor

See Schedule A for more details.

Transportation is key to accessing resources and building healthier communities. The KivIA recommends that transportation corridors related to existing, planned and potential development projects should be included on the land use base of the DNLUP. This would add certainty to future plans. In addition, these corridors should be exempted from the prohibition on all-weather roads, subject to the requirements of the NIRB review process for planned development. The transportation corridors to consider within the Kivalliq are:

- Manitoba to Kivalliq Corridor (Schedule A, Appendix 1 to 7);
- Baker Lake to Meadowbank Corridor;
- Meadowbank to Amaruq Corridor.

9. Closing

We thank the NPC for this opportunity to provide feedback on the 2014 DNLUP. However, we wish to clarify that this submission does not limit the KivIA from providing further submissions on any matter related to the 2014 DNLUP and the land use planning process.

Schedule A. Nunavut-Manitoba Preferred All-Weather Road Selection Study

Kivalliq Inuit Association
Lands Department

Evidence of the polygons for the corridor alignment for the all-weather road and hydro for the Kivalliq-Manitoba corridor to the Nunavut Planning Commission.

Background

The Kivalliq Inuit Association (KIA), together with the governments of Nunavut (NU) and Manitoba (MB), retained Nishi-Khon/SNC-Lavalin (NKSL) to carry out a two-year multidisciplinary study to determine the best location for a road route linking the community of Rankin Inlet to the Port of Churchill and the existing all-weather road transportation network in Manitoba, and thence to the National Highway System. This study was commissioned under the auspices of the Nunavut-Manitoba Transportation Memorandum of Understanding (MoU), signed in December 2001 between the two jurisdictions, of which a key objective was collaboration on the road initiative This study established that a road connection between Manitoba and Nunavut is a critical requirement to providing communities in the Kivalliq Region of Nunavut with access to Manitoba and the rest of North America. And a joint in effort to implement the Keewatin Land Use plan approved by Cabinet Chapter 6, section 5, Schedule J (Marine and terrestrial transportation/communication corridor guidelines, pg. 103).

The development strategy for the new route, including the link to Churchill, is based on initial staging as a winter road, followed in time by possible construction of a single-lane, all-weather road, then finally, construction of a two-lane, all-weather road. The respective governments see implementation of the new road as a means of supporting the objectives of healthy communities, simplicity and unity, sovereignty, self-reliance and continued learning. Furthermore, it has been determined that the road should enhance opportunities for resource development such as eco-tourism and mining; benefit employment, small business development and standard of living; and increase capital investment by reducing the cost of transporting people and goods between the Kivalliq Region and urban centers in Manitoba (Appendix 1 – Final Report.)

During the study was also taken into account the benefits of consider locating the road route between Churchill and Kivalliq in close proximity to hydro-electric generation sites and transmission line corridors.

Hydro-Electric and Utilities Development analysis

Transmission Lines: In 1999, a “Transmission Pre-Feasibility Study” was completed under the Canada-Manitoba Economic Development Partnership Agreement to evaluate the viability of constructing transmission line from Manitoba into the Kivalliq Region of Nunavut. The study was based on a transmission line originating at Churchill and terminating at Rankin Inlet for supplying hydroelectric power to the Kivalliq communities. The transmission line corridors would generally follow the coast line along the western shore of Hudson Bay, with a nominal length of 640 km from Churchill to Rankin Inlet.

Hydro-electric generation sites: There are a number of rivers in Kivalliq that have the potential to generate electricity such as the Ferguson, Maguse, Tha-anne and Thlewiaza Rivers (see Figure 5-4), all crossed by the preferred Nunavut-Manitoba road route. If these rivers were to be used to produce electricity, the road would clearly be useful in accessing the generation sites.

Oil and gas: If, in the future, there is a need to bring northern oil or gas to southern Canada by pipeline through Kivalliq, portions of the right-of-way of the road corridor could be considered for the pipeline location.

It was concluded that since the road will have a generally linear impact on the natural environment, as do power transmission lines, there would be a benefit in the future to locate both the road and a transmission line alongside each other.

Development of route alternatives

For the Route Selection Study, an arterial road classification (RAU 80-100) is proposed for initial capital budgeting and to tie in to Manitoba’s existing all weather road system in the north (i.e. PR 290, 280 and 391 from Sundance near Gillam to Thompson, and PR 394 east of Kinoosao, then PR 391 from Lynn Lake to Thompson). To allow for the future National Highway System (NHS) design standard, design and construction will be staged such that the corridor footprint will be established and protected for the ultimate standard.

Geometric criteria are proposed for the new all-weather road assuming a gravelled top width of 8 m (26 ft), an average embankment height in the range of 1 to 1.5 m (3-5 ft), and 4.3 m (14 ft) wide single-lane bridge structures (see Section 3.1 of Appendix 2 - Milestone Report A).

In considering route location options, it was decided to select the best alternative all-weather road route from Rankin Inlet to the Port of Churchill (the Northern Common Route), then select the best alternative all weather routes to the three destinations on the existing Manitoba highway system; and subsequently address the issue of winter road travel. The design approach for the winter roads is to route them overland along the eventual all-weather route. This enables permanent bridges to be built over critical streams and rivers during the winter road phase.

The criteria used to generate and locate feasible route alternatives for the proposed all-weather road within the northern, western, central and eastern corridors were as follow:

- Selecting a direct route between communities, to the extent possible and practical
- Selecting a smooth, firm and thaw-stable road foundation
- Avoiding wildlife concerns to the extent possible
- Selection a route accessible to road construction materials
- Selecting gentle terrain to the extent possible (i.e. avoid rolling and rugged terrain if possible)
- Minimizing construction and maintenance costs
- Minimizing length of river crossing; avoid rapids; consider future hydro-electric power generation potential
- Avoiding protected areas where feasible

Consultants use the criteria above to generate terrain analysis and route location alternatives, several options were generated and they were grouped in three alternatives: Western Route Alternative (WRA), Central Route Alternative (CRA) and Eastern Route Alternative (ERA). Each of the route alternatives within Manitoba were interconnected with route alternatives between Northern Manitoba and Kivalliq (Appendix 1).

Public consultation

Two public consultations were provided.

During the first public consultation the three groups of all-weather route alternatives (western, central, and eastern corridors, including the northern corridor form Rankin Inlet to the South) generated by the engineering, socio-economic and environmental scoping analysis were shown to the Project Advisory Council and the communities in Northern Manitoba and Kivalliq Region of Nunavut, consultations were also held with First Nations, government/regulatory agencies and other non-government organizations to understand and discuss the issues and opportunities associated with each group of the alternatives identified[1] (See Appendix 3 – Initial Public consultation Summary Report).

[1] NISHI-KHON/SNC-LAVALIN. Nunavut Manitoba Route Selection Study Final Report, Pp. 6-9.

The feedback from these consultations enable the consultants to eliminate all route sub options in the western, central, eastern and northern corridors (see Figure 2-1), and focus on the best route in each corridor in terms of its engineering feasibility; the directness of its connectivity to population centres; and its avoidance, where possible, of parks and environmentally sensitive areas[2] (P. 9)

Together with the Northern Route Alternative or Common Route, the three alternatives short-listed for the *Multiple Account Evaluation* (MAE) to select the preferred road were defined as follows:

• Western Alternative (NRA+WRA)

• Central Alternative (NRA+CRA)

• Eastern Alternative (NRA+ERA)

The second Public consultation was conducted in February 2007 (Appendix 4) to present the results of the MAE and the selection of the preferred all-weather route (Appendix 5) to the affected stakeholders and communities of the study area. The goals of this consultation was to find out if there was concurrence with the preferred route; to find out if the consultant team had overlooked any crucial information; to ascertain whether any refinements to the preferred route were needed; and to learn of any other northern transportation issues that needed to be bought to the attention of the governments[3].

Route selection

For the selection of the preferred route a Multiple Account Evaluation (MAE) (see appendix 5) framework was developed, which evaluates the three route alternatives for an all-weather Nunavut-Manitoba Road. Each of the alternatives were evaluating under five accounts:

1. Financial Account
2. Transportation Benefits account
3. Social/Community Account
4. Natural Environment Account
5. Economy/National Interest Account

The general approach of the MAE was to establish weights for each account and scores for each route alternative. The sum of weighted scores for each alternative was used to rank the alternatives[4]. The results of MAE show that in overall ranking, the Eastern Alternative comes out as the best option (Appendix 5)

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[2] NISHI-KHON/SNC-LAVALIN. Nunavut Manitoba Route Selection Study Final Report, P. 9
[3] NISHI-KHON/SNC-LAVALIN. Nunavut Manitoba Route Selection Study Final Report, P. 15-17
[4] NISHI-KHON/SNC-LAVALIN. Nunavut Manitoba Route Selection Study Final Report, Pp. 11-14

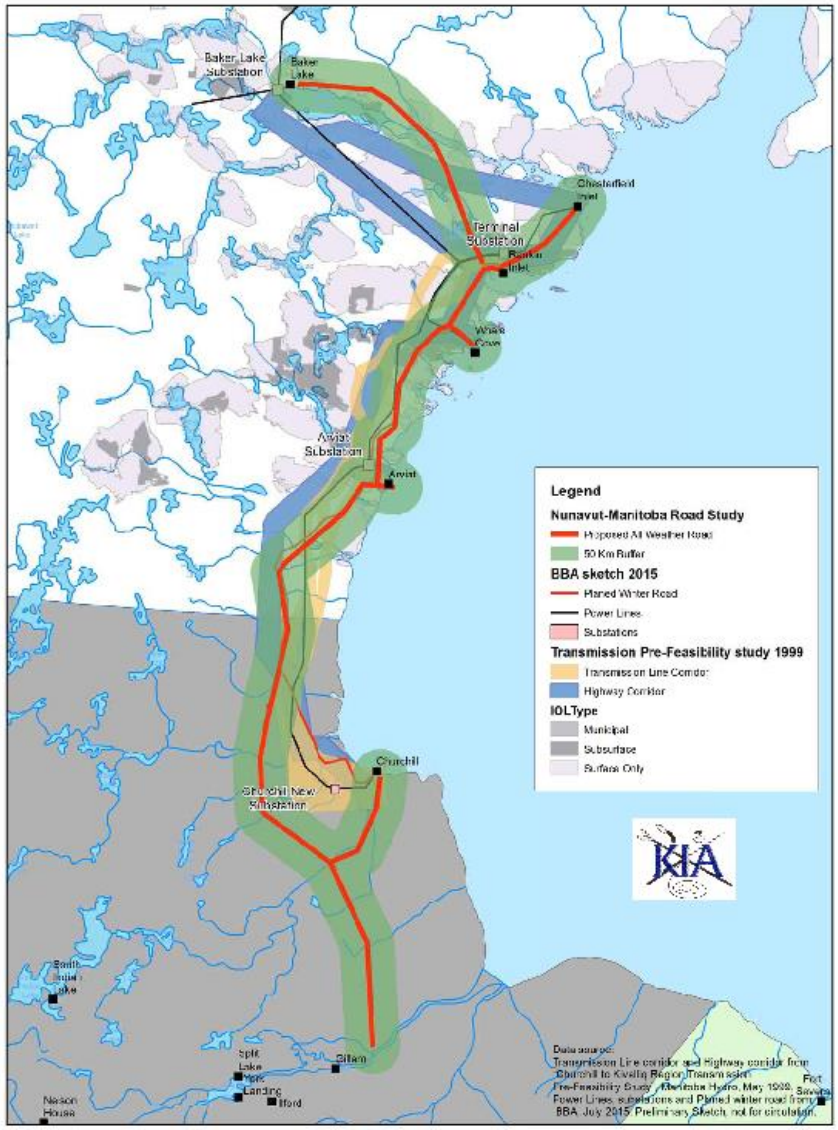
Business Case for Nunavut-Manitoba All-Weather Road

After the completion of the Route Selection Study to determine the best location for an all-weather road (AWR) linking the communities of Rankin Inlet and Churchill to the existing all-weather surface transportation network in northern Manitoba, NKSL was asked to submit a proposal for Business Case for the Nunavut Manitoba All-Weather Road (Appendix 6)

Conclusion

The methodology used for this study was intended to provide the respective governments with a route selection that will support the realization of the wants and desires of those who live and work in this region, while at the same time minimizing detrimental impacts on the natural environment. The study process take into account a technical process (in which collected and synthetized topographic, physiographic, geological, social, economic and natural environmental data; generated and evaluated route options from a context-sensitive transportation engineering perspective; made capital and operating cost estimates; and prepared technical analysis for the recommendation of a preferred route. And the Consultation Process in which meetings with the general public and government/non-Government and First Nations Organizations were taken place.

KivIA would like to present this technical document as evidence for NPC to include the alignment and recommendation of the Nunavut-Manitoba Road study, the recommendation of the Nunavut-Manitoba hydro corridor and to amend the actual proposed Land Use Plan sections 4.2, 4.2.1 and 4.2.3 to clearly incorporate this corridors under Special Management Designations for future development, and establish a management for caribou as the Mobile Caribou Protection Measures, detailed in the document submitted by KivIA: "Proposed Mobile Caribou Conservation Measures for the Kivalliq Region" (see Schedule B of the Technical Review of 2014 Draft Nunavut Land Use Plan).


Baker Lake Substation
Baker Lake
Chesterfield Inlet
Terminal Substation
Rankin Inlet
Whale Cove
Arviat Substation
Arviat
Churchill
Churchill New Substation
Gillam
Split Lake
Landing
Ilford
Nelson House
Fort Severn
Legend
Nunavut-Manitoba Road Study
Proposed All Weather Road
50 Km Buffer
BBA sketch 2015
Planed Winter Road
Power Lines
Substations
Transmission Pre-Feasibility study 1999
Transmission Line Corridor
Highway Corridor
IOLType
Municipal
Subsurface
Surface Only
KIA
Data source:
Transmission Line corridor and Highway corridor from Churchill to Kivalliq Region Transmission Pre-Feasibility Study , Manitoba Hydro, May 1999.
Power Lines, substations and Planed winter road from BBA July 2015 Preliminary Sketch, not for circulation.

Appendix 1: Nunavut-Manitoba Route Selection Study: Final Report

NISHI-KHON/SNC◆LAVALIN

November 14, 2007

BY EMAIL

Kivalliq Inuit Association
P.O. Box 340
Rankin Inlet, NU
X0C 0G0

016259-30RA

Attention: Melodie Sammurtok, Project Manager

Dear Ms. Sammurtok:

Re: Nunavut-Manitoba Route Selection Study: Final Report

We are pleased to submit the final documentation of the Nunavut-Manitoba Route Selection Study as a concluding deliverable of this two-year multi-disciplinary study. An electronic copy of the Final Report is submitted initially via email. One hard-copy report will be subsequently provided to each member of the Project Working Group, along with a CD containing the electronic copies of the Final and Milestone Reports, along with all the associated Appendices.

On behalf of the Nishi-Khon/SNC-Lavlin Consultant Team, we would like to thank you, members of the Project Working Group and the Project Steering Committee, for your guidance and valuable contributions to this study. It has been our pleasure to work with KIA, Nunavut, Manitoba and Transport Canada on this challenging project. We look forward to continuing working with you over the next few years on the business case development, more detailed engineering and environmental studies necessary to bring this important project to fruition.

Yours truly,

SNC◆LAVALIN INC.

T. Stevens

Tim Stevens, P. Eng.
Project Manager

Enclosures

DISTRIBUTION LIST

Project Steering Committee:	
Methusalah Kunuk	Assistant Deputy Minister, Transportation, Nunavut Department of Economic Development & Transportation
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NKSL Central Filing	

NISHI-KHON/SNC◆LAVALIN	FINAL REPORT	Date: November 14, 2007
	DOCUMENT NO.: 016259-0000-30RA-0006	Revision No.: 0

CLIENT: **KIVALLIQ INUIT ASSOCIATION**

PROJECT: **NUNAVUT-MANITOBA ROUTE SELECTION STUDY**

	Name	Title	Signature
Prepared by:	Phoebe Cheung, P.Eng.	Project Engineer	
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REVISION INDEX

Revision No.	Prepared Date	Reviewed Date	Approved Date	Pages Revised	Remarks
PA	April 26, 2007	April 26, 2007	April 26, 2007	N/A	1st Client Submission
PB	Aug 22, 2007	Aug 22, 2007	Aug 22, 2007	Sections 4.1, 4.2, 4.3, 4.4, 6.0, 7.3 and 9.1	Revised for review by Project working Group
0	Nov 9, 2007	Nov 14, 2007	Nov 14, 2007	Section 6	Issued as Final

NUNAVUT-MANITOBA ROUTE SELECTION STUDY

FINAL REPORT

List of Figures:

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1.0 INTRODUCTION

1.1 Background

The Kivalliq Inuit Association (KIA), together with the governments of Nunavut (NU) and Manitoba (MB), retained Nishi-Khon/SNC-Lavalin (NKSL) to carry out a two-year multidisciplinary study to determine the best location for a road route linking the community of Rankin Inlet to the Port of Churchill and the existing all-weather road transportation network in Manitoba, and thence to the National Highway System. This study was commissioned under the auspices of the Nunavut-Manitoba Transportation Memorandum of Understanding (MoU), signed in December 2001 between the two jurisdictions, of which a key objective was collaboration on the road initiative. Throughout 1999 and 2000, a "Manitoba Nunavut Transportation Assessment"[1] was undertaken jointly by the Governments of Canada, Nunavut and Manitoba. This study established that a road connection between Manitoba and Nunavut is a critical requirement to providing communities in the Kivalliq Region of Nunavut with access to Manitoba and the rest of North America. In 2001, the Nunavut Transportation Strategy further identified the need for a road between Manitoba and the Kivalliq region. The current study is undertaken to identify a preferred route for this road link. There are three possible locations within Manitoba for the southern terminus of the new route: Lynn Lake, Thompson and Gillam.

The development strategy for the new route, including the link to Churchill, is based on initial staging as a winter road, followed in time by possible construction of a single-lane, all-weather road, then finally, construction of a two-lane, all-weather road. The respective governments see implementation of the new road as a means of supporting the objectives of healthy communities, simplicity and unity, self-reliance and continued learning[2]. Furthermore, it has been determined that the road should enhance opportunities for resource development such as eco-tourism and mining; benefit employment, small business development and standard of living; and increase capital investment by reducing the cost of transporting people and goods between the Kivalliq Region and urban centres in Manitoba.

As specified in the Proposal for this Route Selection Study, this study was carried out under four task headings:

- Task A: Initial public consultations[3], social, economic, transportation and environmental analysis of corridors, and preparation of road development standards
- Task B: Route selection
- Task C: Refinement of preferred route
- Task D Final reporting

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[1] "Manitoba-Nunavut Transportation Assessment Report" (Prolog, 2000) and "Manitoba-Nunavut Transportation Assessment: Road Corridor Sub-Study Report" (DS-Lea Consultants, 2000).

[2] These are priorities specified in the Bathurst Mandate, on which the Nunavut Transportation Strategy 2001 is based.

[3] In this study, the term "consultation" is used to refer to the communication sessions and meetings conducted by the Consultant Team and the Project Working Group with the project stakeholders and the general public for providing project information and receiving feedback for the selection of the preferred route. The term should not be confused with the formal consultation process with the First Nations involving a vote from members of the communities.

Since this study has extended over two years to accommodate public consultation windows, it was felt advantageous to prepare reports at the end of each major milestone in addition to the required Final Report. Two Milestone Reports have been issued documenting the work completed to date:

- Milestone Report A: First draft submitted on December 20, 2006 to summarize the work completed under Task A (Input stage and generation of alternative routes).
- Milestone Report B: First draft submitted on March 23, 2007 to summarize the work completed under Tasks B and C (Selection and refinement of the preferred route).

This Final Report concludes the work undertaken during this two-year study, consolidates and summarizes the key findings from Milestone Reports A and B, and documents the outstanding issues not previously addressed, including:

- mining interests and activities in the study area
- hydro-electric and utilities development along the preferred route
- work staging and preliminary implementation strategy
- business case and project funding opportunities
- next phases of road development project.

1.2 Notice to Readers

This document contains an expression of the professional opinion of NKSL as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the agreement (the “Agreement”) between NKSL and KIA (the “Client”) on behalf of the Project Working Group, the methodology, procedures and techniques used, NKSL’s assumptions, and the circumstances and constrains under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, including content of Milestone Reports A and B, thus sections or parts thereof should not be read or relied upon out of context.

NKSL has, in preparing cost estimates, followed methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care. NKSL is thus of the opinion that there is a high probability that actual costs will fall within the specified error margin. However, no warranty should be implied as to the accuracy of estimates. Unless expressly stated otherwise, assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.), upon which NKSL’s opinion as set out herein is based, has not been verified by NKSL, NKSL makes no representation as to its accuracy and disclaims all liability with respect thereto.

1.3 Study Goals

The primary goal of the current Nunavut-Manitoba Route Selection Study has been to answer the following questions:

- Is it feasible to link Rankin Inlet, NU and Churchill, MB by an all-weather road to the National Highway System in MB?
- What is the likely scope of the social and economic benefits and impacts of an all-weather road on northern communities?
- What are the potential natural environment impacts associated with an all-weather road?
- What is the range of construction and maintenance costs for such a road?
- Can an all-weather road be staged initially as a winter road?
- Where is the best route for an all-weather road, taking into account engineering, the natural and social environment, the regional economy and national interests?
- How strong is the business case for a new road?

1.4 Study Organization

The study was carried out by a multi-disciplinary team managed by the NKSL Consultant Team. As illustrated in the Study Organization Chart (Figure 1-1), the Project Steering Committee and Project Working Group represented the interests of the Nunavut, Manitoba and Canadian governments who were co-sponsors of this study. The Project Advisory Council was made up of representatives from municipalities, First Nations and other major stakeholders with an interest in the location of the Nunavut-Manitoba road link. The Project Working Group consisted of representatives from the respective governments and provided technical and administrative advice to the Consultant Team.

The methodology used for this study was intended to provide the respective governments with a route selection that will support the realization of the wants and desires of those who live and work in this region, while at the same time minimizing detrimental impacts on the natural environment. The study processes were broken into two main streams – Technical Process and Consultation Process. The former refers generally to the technical work of the consultant team which, in conjunction with the Project Working Group, collected and synthesized topographic, physiographic, geological, social, economic and natural environmental data; generated and evaluated route options from a context-sensitive transportation engineering perspective; made capital and operating cost estimates; and prepared technical analysis for the recommendation of a preferred route for the Nunavut-Manitoba road. The Consultation Process refers to meetings with the Project Advisory Council, the general public and other government/non-government and First Nations organizations. Newsletters, along with the project website, informed the stakeholders and the public of the results of the technical deliberations, and also the ongoing information being gained by the public consultation process. Two newsletters have been issued (one in December 2005 and one in February 2007), both including a questionnaire for public feedback and input. The public consultation for this study ends with the issuance of a final newsletter to communicate the results of the study, including the refinement of the preferred route.

Figure 1-1: Study Organization Chart

NU-MB Transport MoU Steering Committee

A. Campbell	Deputy Minister, Nunavut Department of Economic Development & Transportation
A. Horosko	Deputy Minister, Manitoba Infrastructure & Transportation

Project Steering Committee

M. Kunuk	Assistant Deputy Minister, Transportation, Nunavut Department of Economic Development & Transportation
T. Sandy	President, Kivalliq Inuit Association
J. Spacek	Assistant Deputy Minister, Transportation Policy & Regulation, Manitoba Infrastructure and Transportation
K. Vipond	Agreements Coordinator, Manitoba Aboriginal & Northern Affairs

Project Advisory Council

Project Working Group

A. Chadha	Director, Transportation Systems Planning & Development, Manitoba Infrastructure and Transportation
A. Johnson	Manager, Transportation Planning, Nunavut Department of Economic Development & Transportation
M. Sammurtok	Project Manager, Kivalliq Inuit Association
L. Sourisseau	Regional Manager, Coordination Initiatives, Transport Canada

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C. Ganguly	Transportation Engineer
S. Kai	Transportation Engineer
B. Hubert	Environmental Planning/Public Consultation
D. Highway	Manitoba Liaison
J. Hickes	Nunavut Liaison
J.D. Mollard	Route Engineering/Airphoto Interpretation
G. Mollard	Route Engineering/Airphoto Interpretation
D. Witty	Social, Economic & Community Planning
P. Lyall	Transportation Economics
C. Baker	Value Analysis
D. Kuryk	Cost Estimating & Work Staging
J. Dornicak	Quality Assurance

2.0 INPUT STAGE

2.1 Development of Route Alternatives

The proposed all-weather road will, when completed, provide the sole overland fixed link between Nunavut and the rest of Canada, and will therefore likely qualify for National Highway status (similar to the status of PTH6, which connects Thompson to the Trans-Canada Highway at Winnipeg). Assuming that the Nunavut-Manitoba road route will become part of Canada's National Highway System (NHS), the ultimate design standard for this road will conform to NHS standards (i.e. RAD 90-100). For the Route Selection Study, an arterial road classification (RAU 80-100) is proposed for initial capital budgeting and to tie in to Manitoba's existing all-weather road system in the north (i.e. PR 290, 280 and 391 from Sundance near Gillam to Thompson, and PR 394 east of Kinoosao, then PR 391 from Lynn Lake to Thompson). To allow for the future NHS design standard, design and construction will be staged such that the corridor footprint will be established and protected for the ultimate standard. Initial construction of the all-weather road will be based on a pioneer arterial classification with allowance for future upgrades to NHS standard later.

Geometric criteria are proposed for the new all-weather road assuming a gravelled top width of 8 m (26 ft), an average embankment height in the range of 1 to 1.5 m (3-5 ft), and 4.3 m (14 ft) wide single-lane bridge structures (see Section 3.1 of Milestone Report A). In considering route location options, it was decided to select the best alternative all-weather road route from Rankin Inlet to the Port of Churchill (the Northern Common Route), then select the best alternative all-weather routes to the three destinations on the existing Manitoba highway system; and subsequently address the issue of winter road travel. The design approach for the winter roads is to route them overland along the eventual all-weather route. This enables permanent bridges to be built over critical streams and rivers during the winter road phase. It can help overcome the problem of early break-up of ice bridges over lakes and fast flowing rivers and streams, thus enabling longer operation of the winter road, reducing the risk of vehicles breaking through the ice, endangering the life of the vehicle operator and releasing pollutants into fishery-sensitive waters. Furthermore, placing the winter road overland on the ultimate all-weather alignment where possible, can reduce the need for future disturbances and environmental impacts outside an established right of way.

The following criteria were used to generate and locate feasible route alternatives for the proposed all-weather road within the previously referenced northern, western, central and eastern corridors:

- Selecting a direct route between communities, to the extent possible and practical;
- Selecting a smooth, firm and thaw-stable road foundation;
- Avoiding wildlife concerns to the extent possible;
- Selection a route accessible to road construction materials;
- Selecting gentle terrain to the extent possible (i.e. avoid rolling and rugged terrain if possible);
- Minimizing construction and maintenance costs;
- Minimizing length of river crossings; avoid rapids; consider future hydro-electric power generation potential;

- Avoiding protected areas where feasible.

Using the above criteria for terrain analysis and route location, a significant number of route alternatives was generated by the consultant team in the route engineering and analysis process. In order to facilitate the subsequent evaluation of route alternatives, it was beneficial to break the routes to be studied and evaluated into a number of groups providing an all-weather connection between Rankin Inlet and the all-weather system in Manitoba, together with a cross link to Churchill. We felt this grouping of the routes would reduce the overall analysis workload, and also be an aid to simplifying the public consultation requirements. The groups consisted of western route alternatives (WRA), central route alternatives (CRA) and eastern route alternatives (ERA). Each of the route alternatives (WRA, CRA and ERA) within Manitoba were interconnected with route alternatives between northern Manitoba and Kivalliq to provide a continuous link from Rankin Inlet to Churchill and Manitoba's all-weather road system. These route alternatives were presented to the project stakeholders and the general public in the first round of public consultation starting in early 2006 (see Appendix 8 of Milestone Report A for a description of these alternatives and the associated exhibits).

2.2 First public consultation

Three groups of all-weather route alternatives (western, central and eastern corridors, all including a northern corridor from Rankin Inlet to the south[4]) were initially generated in the route engineering, socio-economic and environmental scoping analysis. These groups of alternatives were shown to the Project Advisory Council and the communities in Northern Manitoba and the Kivalliq Region of Nunavut during the first round of public consultations and information sessions in 2006[5] (See Table 2-1 for the first public consultation communities and schedule). Consultations were also held with First Nations, government/regulatory agencies and other non-government organizations to understand and discuss the issues and opportunities associated with each group of route alternatives identified for further studies.

Table 2-1: First Public Consultation Meetings and Schedule

A. Project Advisory Council	
First Meeting: Rankin Inlet, NU	November 1, 2005
Second Meeting: Thompson, MB	November 3, 2005
B. Communities in Nunavut and Manitoba:	
Tadoule Lake, MB	January 31, 2006
Lac Brochet, MB	February 2, 2006
Brochet, MB	February 3, 2006
Lynn Lake, MB	February 6, 2006
South Indian Lake, MB	February 7, 2006
Thompson, MB	February 8, 2006
Nelson House, MB	February 9, 2006

[4] The northern corridor refers to the corridor encompassing route alternatives in the Kivalliq portion of the project study area and connecting into Manitoba in the vicinity of Caribou River Provincial Park.
[5] See Note 3 on page 1.

Split Lake, MB	February 10, 2006
Gillam/Fox Lake/Bird, MB	February 11, 2006
Baker Lake, NU	February 27, 2006
Rankin Inlet, NU	March 1, 2006
Arviat, NU	March 3, 2006
Churchill, MB	March 4, 2006
Chesterfield Inlet, NU	April 10, 2006
Whale Cove, NU	October 18, 2006
C. Government/Non-Government Organizations and First Nations:	
Nunavut Day	Winnipeg, MB, April 27, 2005
Hudson Bay Neighbours Regional Round Table (HBNRRT)	Rankin Inlet, NU, May 18, 2005; Gillam, MB, October 5, 2005
Beverly and Qamanirjuaq Caribou Management Board (BQCMB)	Rankin Inlet, NU, May 27, 2005; Winnipeg, MB, Nov 24, 2005 and Nov 7, 2006
NorMan Regional Development Corporation (NMRDC)	Flin Flon, MB, September 9, 2005; Winnipeg, MB, November 24, 2005; Snow Lake, MB, February 24, 2006
MB Conservation	Thompson, MB, November 3, 2005; Winnipeg, MB, November 4, 2005
Thompson Unlimited	Thompson, MB, February 8, 2006
Keewatin Tribal Council	The Pas, MB, February 14, 2006
Kivalliq Chamber of Commerce	Rankin Inlet, NU, March 28, 2006

The results and feedback from the stakeholders and general public during the first public consultations are summarized below.

A. Project Advisory Council

Members of the Project Advisory Council indicated that the overall study process should be clear and transparent, and that public consultation is very important in the regulatory approval phase of the project. Major issues related to the route selection raised at these meetings included: caribou protection, current land claims in the region, environmental impacts, regional land use, connection to communities, resource extraction, cost of goods/standard of living in remote communities, construction costs and project funding. Some of the First Nations representatives expressed the need for resources to participate in the study and undertook to write a letter to Indian and Northern Affairs Canada (INAC) regarding funding for Dene participation with the study group.

B. Community Consultations

After meeting with the Project Advisory Council, the NKSL consultant team scheduled and conducted consultations in the previously referenced 15 communities within the study area. In the Kivalliq region, community liaison officers were used as a resource to arrange the consultation meetings and to provide advice with respect to local customs, meeting venues and appropriate community officials to be consulted. Members of the NKSL consultant team facilitated the consultation process with the help of local interpreters as required to ensure that the presentation materials were understood by uni-lingual residents. Consultation with the First Nations and community elders was conducted with sensitivity, to elicit Traditional Knowledge, and to flag cultural and environmental issues at the initial round of the consultation process.

As documented in the Social and Economic Scoping Findings Report (see Appendix 6 of Milestone Report A), a review of the community feedback during the first round of public consultation indicated that the communities had identified a number of positive and negative effects resulting from a fixed link connection to the Manitoba road network. Overall, there appeared to be a neutral to positive view by community members of the Nunavut-Manitoba route proposal. There is widespread agreement that a fixed link would bring economic benefits, but there were some concerns about the social issues (principally an expected increase in drugs and alcohol use) that might arise. Community concerns about the environment were generally negative (impacts on caribou and increasing hunting), resulting in a negative impression of the fixed link upon the environment.

The Social and Economic Scoping Study confirmed that the majority of communities supported a fixed link connection, but that the greatest support existed in five communities: Arviat, Churchill, Gillam/Bird, Lynn Lake, and Rankin Inlet. Potential for increased drug and alcohol use and detrimental effects upon caribou were common concerns in most communities. Tadoule Lake expressed particular vulnerability to issues around social and environmental considerations. The communities of Brochet and Lac Brochet expressed cautious support for a fixed link. In all communities, there was considerable recognition that a fixed link would reduce cost of goods and provide greater flexibility for construction of houses and other buildings. The findings of this work were key to the evaluation of the route alternatives within the overall Route Selection Study.

Regarding the location of route alternatives, the responses from the general public could be summarized as follows:

- Nunavut communities were looking for the most direct route to the south, to Churchill and to Manitoba's all-weather road system. They did not express a preference as to whether the road should be closer or further away from the coast in situations where such sub-options were shown.

- Manitoba communities in the northwest stated a preference for the routes in the western corridor; people who attended the public meetings in Tadoule Lake, Lac Brochet and Brochet indicated their primary interest was in a direct route to the south. Communities in northeast Manitoba preferred routes in the eastern corridor. However, the public who attended the community meetings in Manitoba did not express a preference for one sub-option over another within the western or eastern corridors.

C. Government/Non-Government Organizations and First Nations

The NKSL consultant team received several invitations to attend meetings of government/non-government organizations (NGOs) and First Nations organizations to brief them on the status of the study. During these meetings, exhibits on the proposed route alternatives were provided and a powerpoint presentation was made to the meeting attendees. The presentations made to these organizations were similar to those made to the communities to ensure that all consultations were based on the same information about the study. The presentations were generally well received and generated a high level of interest among all meeting participants. Many participants were in favour of the new road and would like it to service their communities.

The issues raised at these meetings were largely similar to those at the Project Advisory Council and Community Consultation meetings. Specific questions were asked about the decision-making process for the route selection, as well as the scope, funding and timing of the road construction.

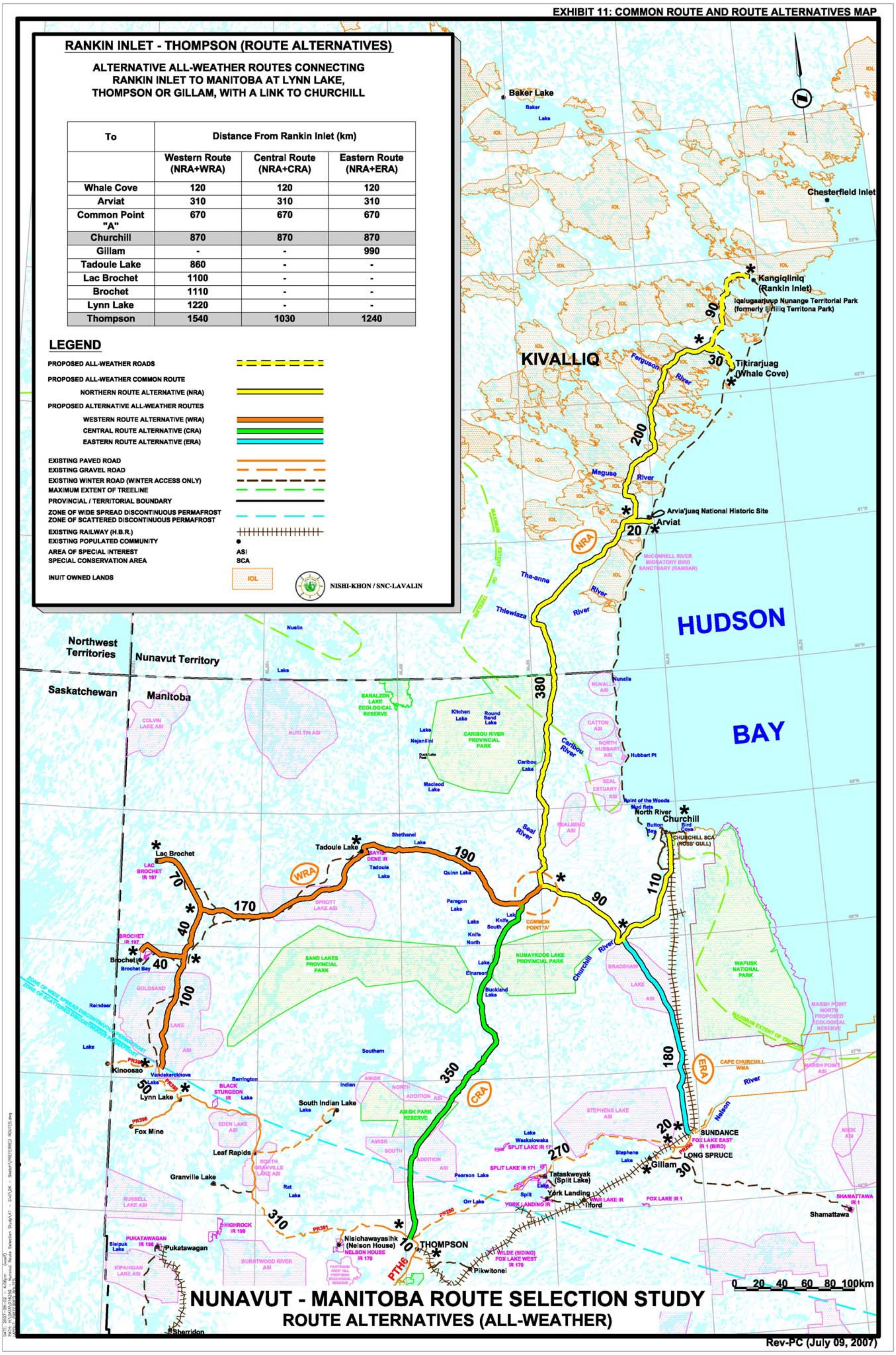
A resolution letter was received from the Keewatin Tribal Council Chiefs giving support for an all-weather and permanent road through the northwest region of Manitoba to Nunavut (a western route alternative) to service the Barren Land, Northlands and Sayisi Dene First Nations. We also note that prior to the Project Advisory Council held in Thompson on November 3, 2005, the Consultant Team received a letter from the Sayisi Dene expressing their interest in a swath of territory between the boundary of Manitoba and Saskatchewan and the west shore of Hudson Bay. This area of interest also extended into southern Nunavut. Since all route alternatives connecting Rankin Inlet to Churchill and Manitoba's all-weather road system passed through this area of interest, we did not feel that it was a factor in favouring one route alternative over another.

The study team also asked to meet with Manitoba Conservation and did so in Thompson on November 3, 2005, with regional staff, and in Winnipeg on November 4, 2005 with head office staff. Manitoba Conservation followed up with a letter on February 17, 2006. Their main concern was to avoid all provincial parks, reserves and areas of special interest. They indicated a preference for an eastern route alternative as long as it could bypass the Bradshaw Lake Area of Special Interest. The Beverly and Qamanirjuaq Caribou Management Board (BQCMB) had concerns with the impacts of a new road and asked for a rail option to be studied. Their concerns are documented in a letter dated November 14, 2006. The written responses from these stakeholders are provided in Appendices 11 to 13 of Milestone Report A.

The feedback from these consultations enabled us to eliminate all route sub-options in the western, central, eastern and northern corridors (see Figure 2-1), and focus on the best route in each corridor in terms of its engineering feasibility; the directness of its connectivity to population centres; and its avoidance, where possible, of parks and environmentally sensitive areas. For the Kivalliq portion of the corridor, it was evident that an important objective for the road was to provide the shortest and most direct route between the communities of Rankin Inlet, Whale Cove, Arviat and the Port of Churchill. The preferred location for the northern corridor was therefore considered to be the route to the east of the Caribou River Provincial Park and this northern route alternative (NRA) is identified to be the Common Route for all route alternatives. For the Manitoba portion of the proposed road south of the Common Route, three alternatives were identified to be the most feasible of all the sub-options developed earlier in the study. These alternatives (WRA, CRA and ERA) would connect to Manitoba's all-weather road system at Lynn Lake, Thompson and Sundance/PR290 near Gillam respectively. Together with the Northern Route Alternative or Common Route, the three alternatives short-listed for the Multiple Account Evaluation were defined as follows:

- Western Alternative (NRA+WRA)
- Central Alternative (NRA+CRA)
- Eastern Alternative (NRA+ERA)

Figure 2-1: Common Route (NRA) and Route Alternatives (WRA, CRA and ERA) Map



3.0 ROUTE SELECTION

3.1 Evaluation and Selection of Preferred Route

For the selection of the preferred route, a Multiple Account Evaluation (MAE) framework was developed to evaluate the three route alternatives for an all-weather Nunavut-Manitoba road. Each of the route alternatives were evaluated under five accounts:

I) <u>Financial Account</u>
- This is the present value of the capital, maintenance and rehabilitation costs and salvage values over a 25-year project life at a discount rate of 6% for each route alternative.

II) <u>Transportation Benefits Account</u>
- This includes project benefits (in time and vehicle operating costs) in passenger travel and freight transport, as well as safety benefits calculated as a present value over a 25-year project life for each option.

III) <u>Social/Community Account</u>
- This documents the external effects of the proposed Nunavut-Manitoba road on the communities and their social values as perceived by the communities. Evaluation criteria include the impacts of the all-weather road access to communities (positive and negative); impacts in terms of employment, costs of living, quality of life, health care, education and land use; and impacts on water quality and wildlife;[6] and the protection of archaeological and cultural artifacts.

IV) <u>Natural Environment Account</u>
- This account is intended to provide an overview assessment of the project impacts on the natural environment. Criteria under this account include habitat protection, wildlife populations, watershed values, fish populations, heritage values and protected areas.

V) <u>Economy/National Interest Account</u>
- This is intended to evaluate the route alternatives in meeting the strategic functions of the proposed Nunavut-Manitoba road. Criteria under this account include regional economy/resource use, sovereignty and security, staging, regional network (population served), reliability, Port of Churchill and enhanced inter-jurisdictional trade.

The general approach of the MAE was to establish weights for each account and scores for each route alternative. The sum of weighted scores for each alternative was used to rank the alternatives such that a preferred route could be identified. An MAE workshop was held on October 11-12, 2006, with representatives from the Project Working Group and the Consultant Team, to conduct the MAE of these alternatives for the selection of a preferred route. Based on the technical analysis and consultation findings of the route alternatives, the Working Group and Consultant Team agreed on the definition and relative weights for each account and criteria within each account, and scored each route alternative against the defined criteria in terms of how each

[6] It is noted that typically with aboriginal populations, there is considerable overlap between social, economic and natural environment issues, since the livelihood of a considerable portion of the population directly depends on harvesting wildlife and fisheries resources.

alternative met the project goals (see Section 2.0 of Milestone Report B for a fuller account of the MAE of the three route alternatives).

The results of the MAE are shown in Table 3-1a and described qualitatively in Table 3-1b in the following pages. Based on the overall ranking of the three route alternatives, the Eastern Alternative (NRA+ERA) is considered the preferred route for the proposed Nunavut-Manitoba road. Although the overall benefits of the Eastern Alternative at $367.8 million are 6% less than those for the Central Alternative (NRA+CRA) at $392.7 million (due to the shortest route from Rankin Inlet to Thompson), and 4% less than those for the Western Alternative (NRA+WRA) at $381.9 million (because the Western Alternative also serves the northwestern communities in Manitoba), it has the highest benefit to cost ratio (0.33, as compared to 0.30 and 0.26 for the Central and Western Alternatives respectively) due to the lowest construction cost and the shortest length of new road construction. It is the most favourable from a social/community perspective due to the strong support from the affected communities (weighted score of 0.20, as compared to 0.18 and 0.14 for the Central and Western Alternatives respectively). In terms of potential impacts on the natural environment, it is ranked second (weighted score of -0.25) after the Western Alternative (weighted score of –0.24), but more favourable than the Central Alternative (weighted score of –0.28). From the economy/national interest perspective, it is ranked significantly higher than the other two alternatives (weighted score of 0.33, as compared to 0.15 and 0.17 for the Central and Western Alternatives respectively). In terms of the overall ranking, the Eastern Alternative comes out at 0.42, well ahead of the Central and Western Alternatives at 0.18 and 0.17 respectively.

The rationale for selecting the Eastern Alternative (NRA+ERA) as the preferred route can be summarized as follows:

- Most effective, safe and reliable route from Rankin Inlet, Whale Cove and Arviat to Churchill and Thompson in light of its length, the terrain, the lowest construction and maintenance costs and ease of staging
- Strong support from directly affected communities along the route
- Moderate environmental impact due to shortest length of new road construction and avoidance of all protected areas except the Bradshaw Lake ASI (the width of the Great Beach on which the route is located through this protected area appears to be sufficient to allow for adequate mitigation of impacts along this feature).
- Greatest potential for early extension of the National Highway System to Churchill and Nunavut and in so doing, to address inter-jurisdictional trade opportunities, national sovereignty and security needs.

Table 3-1a: Multiple Account Evaluation – Nunavut-Manitoba Route Selection Study

Weights A (Account)	Weights B (Sub-Account)	ACCOUNT	NRA+WRA	NRA+CRA	NRA+ERA
		Winnipeg to Rankin Inlet (km)	*2,278*	*1,768*	*1,978*
		FINANCIAL ($millions)	**Quantitative Accounts**		
		Construction + Engrg.	$1,619	$1,390	$1,180
		Property	$10	$10	$10
		Maintenance	$80	$81	$70
		Salvage	($212)	($182)	($154)
		Total Costs ($millions)	$1,498	$1,300	$1,106
		TRANSPORTATION BENEFIT ($millions)			
		Kivalliq Freight	$328.9	$365.1	$346.8
		Manitoba Freight	$37.8	$0.0	$0.0
		Kivalliq Passenger	$8.0	$28.5	$15.7
		Manitoba Passenger	$7.5	$1.0	$1.0
		Accident Cost Savings	($6.7)	($5.9)	($5.9)
		Total Benefit ($millions)	$375.4	$388.7	$357.6
40%		Benefit/Cost Ratio	0.25	0.30	0.32
		A x Benefit Cost Ratio	**0.10**	**0.12**	**0.13**
20%		***SOCIAL/COMMUNITY***	**Qualitative Accounts**		
	15%	Tadoule Lake, MB	0	0	0
	15%	Lac Brochet, MB	0	0	0
	6%	Brochet, MB	1	0	0
	4%	Lynn Lake	2	0	0
	0%	Thompson, MB	1	1	1
	4%	Gillam/Bird, MB	0	0	2
	11%	Churchill, MB	2	2	2
	15%	Arviat, NU	1	2	2
	10%	Whale Cove, NU	0	0	0
	20%	Rankin Inlet/Chesterfield/Baker, NU	1	2	2
	100%	Sum (A x B x Score)	**0.14**	**0.18**	**0.20**
20%		***NATURAL ENVIRONMENT***			
	20%	Habitat Protection	-2	-2	-2
	20%	Wildlife Populations	-1	-1	-1
	15%	Watershed Values	-2	-1	-1
	10%	Fish Populations	-1	-1	-1
	10%	Heritage Values	-1	-1	-1
	20%	Protected Areas	0	-2	-1
	5%	Emmissions	-2	-1	-2
	100%	Sum (A x B x Score)	**-0.24**	**-0.28**	**-0.25**
20%		***ECONOMY/NATIONAL INTEREST***			
	20%	Regional Economy/Resource Use	1.0	0.8	0.8
	10%	Sovereignty and Security	1	2	1
	10%	Staging	1	0	2
	20%	Regional Network (population served)	2	0	2
	5%	Reliability	1	1	2
	15%	Churchill	0	1	2
	20%	Enhanced Interjurisdictional Trade (Natl Hwy System Connection)	0	1	2
	100%	Sum (A x B x Score)	**0.17**	**0.15**	**0.33**
100%		***OVERALL RANKING***	**0.17**	**0.18**	**0.41**

Where: +2 = Significantly better; +1 = better; 0 = neutral; -1 = worse and –2 = significantly worse.

Table 3-1b: MAE – Account Description and Route Evaluation

Evaluation Account	Evaluation Criteria	Western Alignment (NRA/WRA)	Central Alignment (NRA/CRA)	Eastern Alignment (NRA/ERA)
Financial Cost	• Life-cycle costs over 25 years of road construction (including structures), maintenance, rehabilitation and salvage values	○ Longest construction length and rugged terrain for new road west of Common Point A (i.e. WRA); highest cost	◎ Shorter construction length, rugged terrain for new road south of Common Point A (i.e. CRA); higher cost than ERA	● Shortest construction length, gentle terrain south of Common Point A (i.e. ERA); lowest cost
Transportation Savings	• Savings in freight and passenger transport costs to affected communities • Travel benefits to the road users	○ WRA serves 3 communities that now have only winter road land access, but is longest route from Rankin Inlet to Winnipeg	● Shortest distance between Rankin Inlet and Winnipeg but rugged terrain will reduce travel speed	◎ Less communities served than WRA but shorter distance from Rankin Inlet to Winnipeg
Social/ Community	• External effects of the new road on the communities', culture and social values including livelihoods, standard of living, education, use of drugs and/or alcohol	○ Mixed reaction to all-weather road from 3 MB communities that now have only winter road land access	◎ Least number of communities connected by new road	● Significant support from affected communities
Natural Environment	• Nature, degree and mitigation of the impacts to the natural environment (e.g. habitat protection, wildlife populations, watershed/fish values and protected areas)	◎ In same corridor as winter road in MB, but crosses 2 ASIs; concern with impacts on wildlife habitat, especially caribou	○ Impacts on park, park reserves and 2 ASIs	◎ Subject to acceptable mitigation through Bradshaw Lake ASI, modest environmental impact due to shortest length of new road construction
Economy/ National Interest	• Strategic interests served by the new road (e.g. national connectivity; benefits to resource use and inter-jurisdictional trade, Port of Churchill, and sovereignty/security issues)	○ Indirect connection (1070 km) between Churchill and NHS at Thompson; indirect connection (1530 km) between Rankin Inlet and Thompson	◎ Direct connection (560 km) between Churchill and NHS at Thompson but terrain is rugged; direct connection (1020 km) between Rankin Inlet and Thompson	● Direct connection (590 km) between Churchill and NHS at Thompson, gentle terrain; fairly direct connection (1230 km) between Rankin Inlet and Thompson; direct access to north from Nelson River hydro stations; completes reliable multi-modal surface access (road and rail) to Churchill at least cost of all options; shortest length (290 km) of construction from Churchill to Manitoba's all-weather road system
Overall		○	◎	●

Legend: ● = More Favourable; ◎ = Favourable; ○ = Less Favourable

ASI = Area of Special Interest; NHS = National Highway System

3.2 Second Public Consultation

The second and final round of public consultation for this study was conducted in February 2007 to present the results of the MAE and the selection of the preferred all-weather route to the affected stakeholders and communities of the study area. The goals of this round of consultation were to find out if there was concurrence with the preferred route; to find out if the Consultant Team had overlooked any crucial information; to ascertain whether any refinements to the preferred route were needed; and to learn of any other northern transportation issues that needed to be brought to the attention of the governments. Consultation meetings and information sessions were held by the NKSL Consultant Team, members of the Project Working Group and Project Steering Committee, with the Project Advisory Council, communities in Rankin Inlet, Whale Cove, Arviat, Churchill, and Thompson (with attendance by members of the public from Northern Manitoba communities); as well as other government/non-government stakeholder groups. The consultation meetings and schedules for the second public consultation are summarized in Table 3-2 below.

Table 3-2: Second Public Consultation Meetings and Schedule

A. Project Advisory Council	
First Meeting: Thompson, MB	February 8, 2007
Second Meeting: Rankin Inlet, NU	February 15, 2007
B. Communities in Nunavut and Manitoba:	
Thompson, MB	February 9, 2007
Rankin Inlet, NU	February 15, 2007
Whale Cove, NU	February 19, 2007
Churchill, MB	February 20, 2007
Arviat, NU	February 21, 2007
C. Government/Non-Government Organizations	
MB Conservation	Winnipeg, MB, February 7, 2007
Nunavut/Kivalliq/Manitoba Infrastructure Development Forum	Winnipeg, MB, February 12, 2007
Nunavut Mining Investment Pre-Conference	Winnipeg, MB, February 12, 2007
MB Hydro	Winnipeg, MB, February 13, 2007
Nunavut Water Board	Rankin Inlet, NU (teleconference), February 15, 2007
Nunavut Impact Review Board	Rankin Inlet, NU (teleconference), February 15, 2007
Nunavut Planning Commission	Arviat, NU, Feb 21, 2007

Feedback and discussion among members of the Project Advisory Council were largely focused on the selection of the preferred route. Representatives from First Nations stated that the First Nations communities have come to recognize the need for an all-weather road and would adapt to changes associated with the new road. They preferred to have the route go through the remote communities in northwestern Manitoba, providing a direct connection to the Port of Churchill from Tadoule Lake, and promoting partnership opportunities between the federal government and the First Nations. Furthermore, they would like to be better informed of the route selection decisions via a formal consultation process involving a vote from members of the communities.

Compared to the first round of public consultation in the communities, it was evident that there was much stronger support for the proposed Nunavut-Manitoba road and that the public recognized the social and economic benefits associated with the new road. There were concerns that the three remote communities in northwestern Manitoba (i.e. Brochet, Lac Brochet and Tadoule Lake) would not be connected by an all-weather road. It was suggested that the need for an all-weather road by the western communities (in addition to an all-weather connection from Nunavut and Churchill to Gillam) be documented even though it might not be a mandate of the Nunavut-Manitoba Route Selection Study.

In the Kivaliq communities, the public was pleased with the study progress and was very supportive of the new road as it was considered essential to public service. Some participants commented that small population should not be an issue for the new road as Canada's national rail and road system were built to low-populated areas initially. Most of the meeting participants were eager to see the road being constructed soon and expressed that inter-community connectivity and access to Churchill and the south were their primary concerns. Overall, the Kivalliq communities accepted the Eastern Alternative (NRA+ERA) as the preferred route and suggested to proceed to the implementation phase of the road project. In Churchill, the public showed strong support for the proposed road and expected it to provide significant economic benefits to the port. Regarding the existing rail operations in Churchill, it was expected that the road to Churchill would stimulate additional north-south imports and exports through the port, while grain and ore would still be best transported by rail.

Stakeholder feedback and inputs were received from a number of government/non-government organizations regarding the potential issues and opportunities associated with the preferred route in their respective jurisdictions. Manitoba Conservation discussed two "rare enduring features" along the great beach within the Bradshaw Lake ASI, but recognized that depending on the actual location of environmentally sensitive features within the beaches, there appeared to be sufficient flexibility to select a route that can avoid impacting unique features within the ASI. It was suggested that a detailed environmental impact assessment be conducted in the next phase of the project to further address these concerns. On July 6, 2007, an email was received from a Wildlife Manager with Manitoba Conservation in Thompson expressing the concern that "the entire migration of caribou may be along the road to Nunavut in certain years" and that "this is a real concern to the BQCMB".

Manitoba Hydro discussed their current plans in the study area in relation to the proposed Nunavut-Manitoba road. Even though Manitoba Hydro indicated no plans to extend transmission lines into Nunavut (any such plans would be the responsibility of Qulliq Energy, formerly Nunavut Power Corporation), they stated that there might be benefits locating the road route between Churchill and Kivalliq in close proximity to hydro-electric generation sites and transmission line corridors. Discussion was also held with representatives from the mining industry regarding the proposed road and there was general agreement that the proposed road would support exploration activities and that mining would address the under employment of the Kivalliq region. There was also strong support that the government and industry should work together in the development of the proposed road.

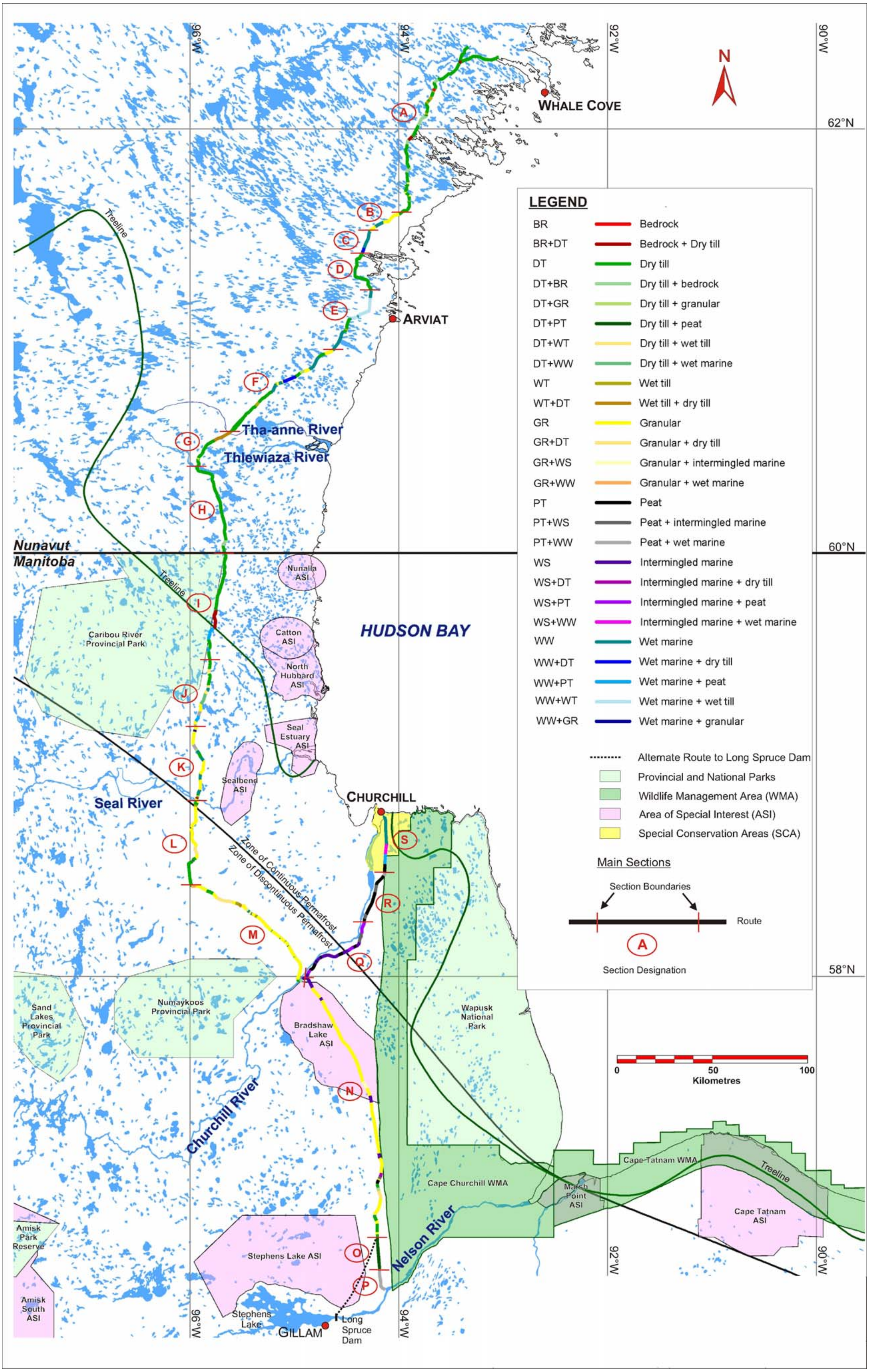
The Nunavut Impact Review Board (NIRB), Nunavut Water Board (NWB) and Nunavut Planning Commission (NPC) were consulted regarding the regulatory and permitting processes of the proposed road. The NIRB representative stated that the proposed road issues would likely include impacts on caribou and wildlife, access to communities, fishery characteristics, river crossings, global climate change, and impacts on Traditional Knowledge, and suggested that an eco-system study be conducted in the Environmental Impact Assessment phase of the project. Regarding land use regulations, the proposed road would provide impetus for land use changes which would need to be amended in the Regional Land Use Plan. The new road would benefit from the application of land use policy and associated access control within the preferred route corridor in order to preserve the functional integrity of the road as a component of the National Highway System. It was identified that the Kivalliq Inuit Association would be the proponent for the Environmental Impact Assessment process and that the affected communities be involved in the process.

4.0 REFINEMENT OF PREFERRED ROUTE

4.1 Terrain Classification and Capital Costs

Prior to and following the selection of the preferred route (NRA+ERA), a number of studies were conducted to confirm and refine the location of the proposed road. A variety of maps and airphotos were examined and interpreted such that the terrain along the road location could be described, classified and mapped to a level where roadbed conditions could be evaluated with some confidence and construction costs estimated. Right-of-way identification is critical because there are many long stretches of route location where moving the alignment laterally as little as 50 to 100 m would result in very different and significantly increased road construction and maintenance costs. As shown in Figure 4-1, most of the preferred route between Whale Cove and the Caribou River in northern Manitoba consists of long segments of relatively dry, smoothly rolling, bouldery sand-rich till, with a thin, seasonably saturated and active layer above continuous permafrost, separated by short, depressional segments of wet till or marine silt where the surface organic layer is thicker. South of the Caribou and Kirk River confluence to the north of the Sundance-Gillam area, the route follows intermittent, wave-reworked, granular deposits in esker ridges and the Great Beach ridge. Between Churchill River and the Port of Churchill and between the southern terminal of the Great Beach and the Sundance-Gillam area, the dominant terrain features are ice-lensed bog peat overlying marine silt and sand where thaw settlements and erosion problems, particularly those associated with global climate changes, need to be monitored more carefully.

Figure 4-1: Generalized Terrain Types of Preferred Route: Whale Cove to PR290 (Nelson River)



To determine the capital costs[7] of the preferred route from Rankin Inlet to Sundance/PR290, the road is classified into six homogeneous sections based on terrain analysis, soil conditions, embankment and material estimates (see Appendix 2 of Milestone Report B for a more detailed discussion of the project cost estimates). The location, length and cost estimates for these six segments are shown in Table 4-1 below.

Table 4-1: Capital Costs of Preferred Route (NRA+ERA) by Section
($ Million in 2006 Dollars)

	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Total
Location	Sundance to Churchill River	Churchill River to Common Point (including spur to Churchill)	Common Point to Caribou River	Caribou River to 60th Parallel	60th Parallel to Arviat Jct. (including Arviat spur)	Arviat Jct. to Rankin Inlet (including Whale Cove spur)	
Length (Km)	180	200	120	70	210	320	1,100
Mobilization & Road Clearing	18.2	20.2	12.1	7.1	21.2	32.3	111
Embankment & Materials	82.3	134.3	62.7	69.3	173.9	241.6	764
Bridges	2.1	30.1	34.6	1.8	37.8	44.4	151
Extra Work	1.5	1.7	1.0	0.6	1.7	2.6	9
Engineering	11.9	13.2	7.9	4.6	13.8	21.1	72
Contingency	11.9	13.2	7.9	4.6	13.8	21.1	72
Total Capital Cost ($ million)	127.8	212.6	126.3	87.9	262.2	363.2	1,180
Unit Cost ($ million/km)	0.71	1.06	1.05	1.26	1.25	1.13	1.073

4.2 Traffic Volumes on Preferred Route

With the proposed all-weather road from Rankin Inlet to Churchill and northern Manitoba, a portion of the existing freight from Winnipeg to the Kivalliq communities will be diverted to road transport by trucks. It is estimated that over half of the existing road/rail/barge and air freight will be diverted to trucks via the all-weather road. By 2031, it is estimated that 27,800 Tonnes of Kivalliq freight will be diverted to the all-weather road along the preferred route (NRA+ERA) per year. This is equivalent to 1,390 trucks one-way, or 2,780 trips per year (7.6 trips per day) assuming a carrying capacity of 20 Tonnes per truck one-way. For long distance passenger travel between Rankin Inlet and Winnipeg, it is assumed that 75% of the existing air travel is non-business[8] and that over half of this traffic will be diverted to the all-weather road along the preferred route, equivalent to an annual one-way traffic of 455 vehicles or 910 trips per year (2.5 trips per day). The long distance traffic volumes along the preferred route are shown in Table 4.2 below. Details in calculations and assumptions are documented in the Traffic Report in Appendix 3 of Milestone Report B.

[7] Capital cost estimates include engineering, mobilization, construction (roads and bridges) and contingency, excluding property acquisition, in 2006 Dollars.
[8] "Manitoba-Nunavut Transportation Assessment Report" (Prolog, 2000).

Table 4-2: Forecast Freight and Passenger Long Distance Travel Demand (NRA+ERA) - 2031

Modes	Long Distance Traffic on All-Weather Road		
	Freight (Tonnes/Yr)	Trucks/Yr	Passenger Veh/Yr
Annual Traffic Volume	27,800	2,780	910
AADT	-	7.6	2.5

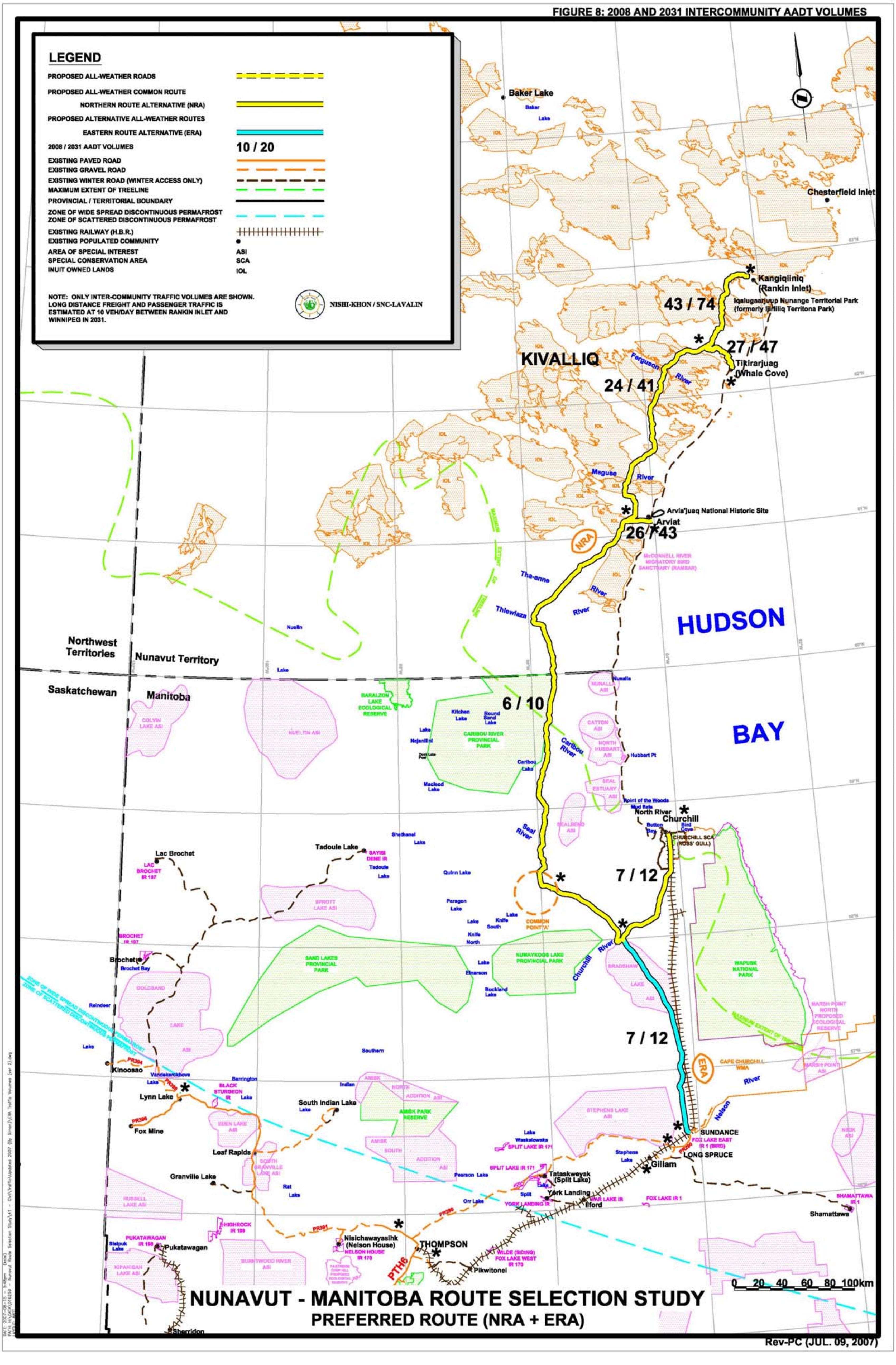
Note: Assume 20 Tonne/Truck one-way for freight movements between Rankin Inlet and Winnipeg.

To estimate the local traffic between the communities along the preferred route, a gravity model was developed based on the Average Annual Daily Traffic (AADT) in the northern Manitoba communities provided by Manitoba Infrastructure and Transportation. The model was applied to estimate the 2008 (assumed Opening Year of NU-MB road) and 2031 AADT volumes within the communities along the preferred route. The highest inter-community traffic demand is estimated to occur between Rankin Inlet and Whale Cove, the two closest communities along the proposed road, with an estimated 40 daily trips in 2031. The next highest demand is estimated to occur between Rankin Inlet and Arviat with an estimated 30 daily trips in 2031. Table 4-3 and Figure 4-2 summarizes the inter-community traffic volumes between each community in 2008 and 2031.

Table 4-3: Inter-community AADT Traffic Volumes on NRA + ERA - 2008 and 2031

	2008 AADT Volume				
	Community				
Community	Rankin Inlet	Whale Cove	Arviat	Churchill	Total
Whale Cove	23				23
Arviat	18	4			22
Churchill	1	0	2		3
Gillam	1	0	2	4	7
Total	43	4	4	4	55
	2031 AADT Volumes				
	Community				
Community	Rankin Inlet	Whale Cove	Arviat	Churchill	Total
Whale Cove	40				40
Arviat	30	7			37
Churchill	2	0	3		5
Gillam	2	0	3	7	12
Total	74	7	6	7	94

Figure 4-2: Inter-community Traffic AADT Volumes: 2008 and 2031 (NRA+ERA)



4.3 Major Bridge Crossings

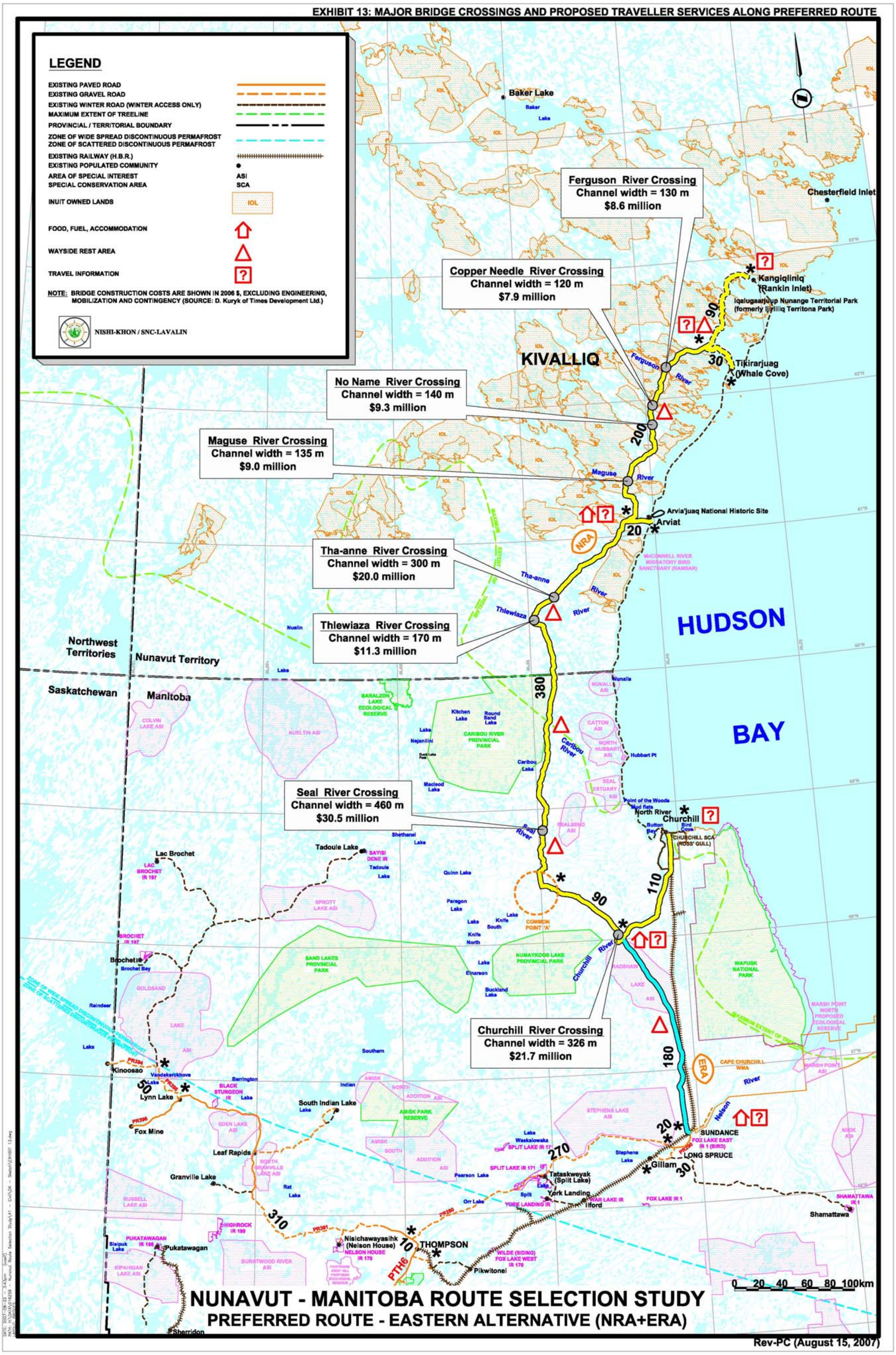
In selecting the river crossing sites (after appreciating terrain conditions in the entire study area), the constraints influencing the selection of a fairly narrow route corridor dictated a fairly narrow reach of river within which a preferred bridge site needed to be chosen. Foundation conditions, borrow availability, directness (length) of crossing, and various environmental constraints all resulted in a limited number of locations available for river crossings. Individual crossing-site selection was aided by the interpretation of surface and bedrock geology maps, topographic maps, stereoscopic examination and interpretation of small-scale (1:50,000 to 1:60,000) airphotos. Some major factors considered in selecting bridge sites were the width of river channel and width of valley crossing, possible use of islands in a river to reduce span length, and consideration of the type (i.e., characteristics) of river channel based on several controls.

In addition to the above controls, river-ice effects were considered, such as ice scraping of river banks, and rapids that create ice dams in northern rivers. The ice dams can cause potentially significant rises in water levels upstream of rapids and eroded (deepened and widened) riverbeds immediately downstream. Information on the stability of river bank and river bed materials were also assessed in choosing bridge-crossing sites. Another constraint on some rivers was environmental concerns, such as the heritage sections of rivers. As well, the prospect of future hydro development was taken into consideration in a few locations. The potential negative effects of permafrost degradation resulting from summer thawing was also another consideration.

As a result of this analysis, a total of 63 stream or river crossings have been identified along the preferred route of the Nunavut-Manitoba Road. Of these crossings, 48 are located along the NRA segment from Rankin Inlet to Churchill, and 15 are located along the ERA portion from Churchill River to Sundance/PR290. These crossings are identified by J.D. Mollard & Associates in their route engineering analysis and are numbered from north to south starting in Rankin Inlet, NU[9]. For cost estimates, the crossings are classified into 12 types of bridge crossings based on the channel width of each crossing.[10] Of the total proposed 63 bridge structures, 8 are considered major bridges with a channel width of more than 120 m. These major bridges are shown in Figure 4-3.

[9] See "Bridge Sites on ERA and CRA Road Routes", J.D.Mollard & Assoc., Ltd, Sept 28, 2006.
[10] See "Cost Estimate" report by D. Kuryk of Times Development Ltd., Section 4.0.

Figure 4-3: Major Bridge Crossings and Proposed Traveller Services along Preferred Route (NRA+ERA)



As noted above, considerable study and analysis by J.D.Mollard & Associates has been undertaken to define the preferred locations of the major river crossings along the preferred route. In the next phase of work needed to bring this important project to fruition, it will be necessary to carry out more detailed engineering, environmental assessment and stakeholder consultations. This is required to meet the following objectives:

- Engineering feasibility: The major river crossings identified to date need to be confirmed as being feasible from structural, hydraulic and geometric perspectives, as well as being cost effective and facilitating construction;

- Environmental acceptability: The locations must cause only a minimal impact on the natural and social environment and do so in a manner that can be readily mitigated or compensated for.

To achieve the above objectives the detailed engineering at the major river crossings will need to include:

- New low-level large-scale ground-referenced aerial photography and topographical mapping at an appropriate contour interval;

- On-site geotechnical investigations on the crossing approaches (to identify ground conditions and potential aggregate sources for building approach embankments), the river banks and along the river bed. Any evidence of erosion of the banks or river bed should be carefully noted. The geotechnical work would be undertaken in tandem with a survey of water elevations, as well as depths to the river bed at the crossing and immediately upstream and downstream of the crossing. Rapids that could influence the crossing will also need to be identified. Observations should be made if possible, of the river in the vicinity of the crossing during spring break up of ice;

- Preparation of estimates of the hydraulic capacity required for the bridge opening based on historic river flows, if available (as for instance from Manitoba Hydro, for the Churchill River from which water is diverted to the Nelson River to feed the hydro electric generation stations on that system); or if not, based on the gradient of the river, historic precipitation in the river's watershed area, assumed run-off coefficients and so on;

- Development of preliminary geometrics of the roadway alignment and profile for the crossing and its approaches;

- Confirmation of the clear roadway width to be provided on the bridge (assumed 4.3 m in this study);

- Confirmation of the loadings to be accommodated on the bridge (assume 120 tonne capacity in this study);

- Development and evaluation of a number of span arrangements for the bridge, with or without piers in the river, as well as materials to be used for the superstructure, substructure and foundations of the bridge, their cost including maintenance, and their suitability to facilitate construction in a remote northern region;

- Preparation of conceptual designs and cost estimates.

In the current Route Location Study, we have assumed use of 4.3 m wide Acrow (Bailey) type bridges at all major river crossings. Since all of the major crossings shown in Figure 4.3 are wider than 80-85 m, we have further assumed piers will be needed in the river for all bridges, since based on current practice in Northern Manitoba, this is considered to be the maximum unsupported span for this type of bridge. Clearly all these assumptions will need to be revisited in the next phase of this project.

The detailed environmental studies at the major crossings will need to include on-site investigations and address such issues as:

- Fisheries values and windows including definition of the wetted perimeter and the boundaries of adjacent riparian habitat;
- Wildlife values (flora and fauna) including information, if known, on caribou migration routes, caribou calving and post calving areas, as well as caribou exclusion areas in the vicinity as well as points where caribou may cross the river;
- The likelihood of disturbing archaeological sites, sacred sites and the like;
- Potential mitigation and compensation strategies for all of the above.
- Stakeholder consultations will need to address such issues as:
- Identifying the boundaries of protected areas close to the crossing such as parks, areas of special interest, enduring features, or areas crossed such as treaty entitlement lands, Inuit Owned Land, trap lines and so on;
- The need for formal consultations with First Nations;
- Identification of important recreation/wilderness and aesthetic values such as those experienced by travellers along the Seal River (Heritage Designation).

4.4 PROPOSED TRAVELLER SERVICES

In order to provide for the safety, convenience and comfort of travellers using the proposed Nunavut-Manitoba road during its all-weather road phase, certain basic services should be provided at strategic locations along the road. These services should be inaugurated as the various segments of the all-weather road are brought into operation. Except for the general need for up to date information on whether a winter road is open or not, and its driving conditions (both of which are a provincial/territorial/contractor responsibility), the services described hereafter only apply to the all-weather road (see Figure 4-3 for the proposed service locations).

Food, Fuel and Accommodation:
We suggest that these services be based on a spacing of about 500 km, this distance being within the range of modern automobiles starting with a full tank of gasoline. Trucks used for long distance haulage have a considerably greater range than automobiles. Assuming an average travel speed of 80 km/h without stops, the associated driving time of just over 6 hours without stops or say, about 8 hours with stops, would also justify the provision of food and

accommodation at the same intervals and locations. Since the road is to be routed through a wilderness region, these services should be located:

- Where long distance and intercommunity traffic volumes are greatest in order to maximize use of the services;

- As close as possible to existing populated communities. This should increase the commercial viability of the service (i.e. by enabling it to be patronized by locals, as well as by long distance travellers) as well as making it possible for the service to be staffed from a local pool of labour.

Based on the above criteria we propose these services be provided on a commercial basis at:

- The junction of the Arviat spur with the Nunavut-Manitoba Road (290 km south of Rankin Inlet);

- Just south of the Churchill River crossing at the junction of the Port of Churchill spur with the Nunavut-Manitoba Road (470 km south of the Arviat junction; 110 km from Churchill and 180 km north of Sundance/PR290);

- Between Gillam and Sundance at the junction of Provincial Roads 280 and 290. This location is on the direct route from Thompson to Rankin Inlet and Churchill, but avoids the need for travellers to backtrack 30 km or so into Gillam to refuel.

Wayside rest areas:
We suggest these facilities for travellers to stop and rest for short periods be provided at an approximate spacing of 100 km, representing just over one hour driving time between potential stops. These areas should preferably be located just off the roadway, with sufficient parking for 2-3 trucks or buses and 3-6 cars, together with basic picnic and toilet facilities. If there is an opportunity for a scenic overlook at no extra cost, it should be considered. Since these rest areas may be desirable havens if vehicles break down, or are caught in sudden storms or blizzards, further consideration should be given to equipping them with storm-proof shelters and some form of heating such as solar heating, wood or oil fired stove.

Based on the above spacing criteria, we propose wayside rests be provided at the following locations:

- The junction of the Whale Cove spur with the Nunavut-Manitoba Road (90 km south of Rankin Inlet);

- Near the Copper Needle River (about 100 km south of the Whale Cove junction);

- Near the Thlewiaza River (about 100 km south of the Arviat junction)

- Near the Caribou River (about 200 km south of the Arviat junction)

- Near the Seal River but respecting its heritage designation (about 300 km south of the Arviat junction and about 100 km north of the Churchill River)

- At the south end of the Bradshaw Lake Area of Special Interest (about 80 km south of the Churchill River and 100 km north of Sundance/PR 290)

Travel Information:
Because of the remote wilderness nature of the route between Rankin Inlet, Churchill and Gillam, as well as the communities in between, it will be important to notify intending travellers of what road conditions they can expect, especially in the long winter period. We therefore propose that conditions be posted at each point of entry into the system as follows:

- At Rankin Inlet
- At the Whale Cove spur
- At the Arviat spur
- At the Churchill River crossing
- At the Port of Churchill
- Between Gillam and Sundance

The information to be posted could include the following items:

- The anticipated driving conditions described in English, Iniktitut, Cree and Dene on a scale from “road closed”, “poor” through “average” to “good”, displayed in a similar manner to forest fire risks; also a reminder to always carry emergency supplies when travelling this route: food, water, blankets, candles, flashlight etc.
- A phone number to call (for satellite phone users) or radio frequency to dial with up to date road information and traveller advisories, together with access to emergency response in case of emergencies
- Web site address or television channel number with up to date road information and travellers’ advisories. These would be a useful source of information to check from home or office prior to travel.

Lockable barrier gates:
These would be located at all points of entry to the road corresponding to the travel information locations above. They would be operated by road maintenance staff and would be closed when conditions were too unsafe for travel, due for example to inclement weather or large concentrations of migrating caribou along the road corridor.

4.5 Global Climate Change and Alignment Alternatives

The potential impacts of global climate change and related thaw settlement and erosion issues were assessed such that these issues and impacts could be understood, addressed and mitigated where feasible. Efforts were made to locate a route on relatively ice-poor smooth bedrock, ice-poor sand, gravel eskers, beach ridges and low ice-content basal till landforms. In some areas basal till – by far the most common terrain type preferred on the proposed right-of-way from Rankin Inlet to the Churchill River crossing – is mantled with a discontinuous thin mantle of fine-grained marine deposits. As noted earlier, bedrock on the proposed right-of-way is almost non-existent and granular deposits on the ROW are spotty in occurrence north of the Common Point.

Basal till along the preferred route north of the Common Point contains a relatively low content of fines (silt plus clay), typically ranging from about 5% to 20%. This till has a high content of sand, gravel and cobbles, with surface boulders in places. Basal till is expected to be relatively compact because it was deposited under the weight of thick easterly and southerly advancing ice sheets. Having a low content of fines, frozen, coarse and compact basal till is expected to contain “dry” permafrost, so is expected to drain fairly rapidly when melted, resulting in significantly lower thaw settlements.

Considerations were also given to locate the route to avoid extensive boulder-pile ridges and hummocky supra-glacial till, released from stagnant ice upon melting. Short stretches of relatively thin peat and marine silt commonly overlie basal till in shallow undrained depressions north of the Common Point. South of the Churchill River crossing, along the common northern route link to the Port of Churchill, some one-half to three metres of ice-lensed bog peat overlies marine silt and sand. Both the bog peat and the underlying marine silty and fine sandy layers can have significant ice lensing, even massive ice. Most of the peat here occurs in peat plateau bogs and in polygonal (ice-wedge) peat plateau bogs, where melting of ground ice can cause significant thaw settlement and erosion problems. The same peat and marine silt occurs in a short section of the Eastern Route Alternative (ERA) immediately north of Sundance (PR290/Nelson River). Most of the ERA route is on sand/gravel beach ridge and thus climate change is not a significant factor in the performance of this route.

Two critical issues associated with the preferred route are the crossing of the Churchill River and the crossing of the Bradshaw Lake ASI. Follow-up studies were conducted to refine the alignment of the route through these locations. Alternative crossing sites and alignments were identified, in addition to the original proposed in the preferred route, to ensure that the crossing locations and alignments were indeed the most favourable in terms of lifecycle costs, terrain, topography, availability of granular materials, and minimal impacts on protected areas and unique environmental features.

4.6 Issues for Further Studies

To ensure a smooth transition of this study to the future development phases of the all-weather road, some of the issues identified for more detailed data collection and studies are summarized in Table 4-4 below in the areas of i) route engineering, ii) environmental/social/economic assessment, and iii) consultations. This is not an all-inclusive listing.

Table 4-4: Outstanding Issues for Further Studies and Consultations

i) Route Engineering: ⦿ Review hydrology data for the Churchill River crossing (preliminary flow data from MB Hydro obtained in this study) ❍ Obtain flow data for hydrology design for all rivers along the preferred route ❍ Contact Qulliq Energy regarding hydro-electric generating potential of major rivers along the preferred route within Nunavut; also potential for joint use of the corridor for a transmission line ❍ Contact telecommunications companies with an interest in Nunavut-Manitoba linkages ❍ Identify specific tie-in locations to existing roads in Rankin Inlet, Whale Cove, Arviat, Churchill and PR 290 near Bird ❍ Obtain new, large-scale, ground-controlled aerial photography with ground elevation data along the preferred route ❍ Obtain community land use plans and study the feasibility of incorporating existing trails into the preferred route, including: Rankin Inlet west and south; Whale Cove west and Arviat to Maguse River.
ii) Environmental/Social/Economic Assessment: ⦿ Update renewable and non-renewable resource and harvesting data (e.g. caribou, quarries/mineral extraction, forestry, fisheries) ⦿ Update mining and mineral exploration data and economic development potential in the vicinity of the preferred route ⦿ Confirm caribou calving ground avoidance in consultation with the Beverly Qamanirjuaq Caribou Management Board (BCQMB) ❍ Investigate and cite road impacts on caribou from Northern Quebec, Dempster Highway and other comparable locations ❍ Identify potential conflicts between the preferred route (NRA+CRA), caribou migration corridors and caribou water crossings; assess potential severity of conflicts and range of feasible mitigation measures ⦿ Confirm McConnell River Migratory Bird Sanctuary avoidance ⦿ Confirm location of east boundary of the Caribou River Provincial Park in order to minimize encroachment ❍ Conduct detailed environmental survey (archaeological/cultural artifacts, flora & fauna, fisheries and fish habitat, and enduring features such as soil, climate and surface geology) for crossing the Bradshaw Lake ASI ❍ Conduct detailed environmental survey for the entire route from Rankin Inlet to Churchill to Sundance/PR290 and provide an inventory of the natural and social environmental features (archaeological/cultural artifacts, flora & fauna, fisheries and fish habitat, wildlife and wildlife habitat, trap lines, sacred sites to avoid, mitigate or compensate) ❍ Identify the enduring feature north of Latitude 59^{0}N and provide mitigation strategy for the preferred route
iii) Consultations: ❍ Maintain contacts with all stakeholders, government agencies and non-government organizations regarding issues and opportunities related to the development of the Nunavut-Manitoba road ❍ Hold public meetings at appropriate junctures in the project development ❍ Conduct official consultation with the First Nations communities along and affected by the preferred route as required by the regulatory guidelines

Legend:
⦿= Started in current study; to be completed in next phase of road development project
❍= Outstanding; to start in next phase of project

5.0 MINING INTERESTS, HYDRO-ELECTRIC AND UTILITIES DEVELOPMENT

5.1 Mining Interests and Activities

In the early phases of the Route Selection Study, a cursory review of mineral exploration activities in the Kivalliq Region and northern Manitoba was conducted to understand the mining activities and interest in the study area. As documented in the "Ecological Values and Related Issues" report by Hubert and Associates (see Appendix 7 of Milestone Report A), current exploration in Northern Manitoba is focused on the area along the northern common route south of the Nunavut/Manitoba border while exploration in Nuvavut is generally inland from the northern route (see also Appendix 1 of this report for the Nunavut and Manitoba Mining Maps). While the interest for mineral exploration is strong, the distribution of resources is, in general, widespread in the region. Based on this initial assessment, the Consultant Team believed that the location of potential mine sites in the study area should not be a major determinant in the route selection for the Nunavut-Manitoba road. Despite the significant number of potential mine sites in the area, questions remain as to which ones will proceed, when they may open, and how long they may remain in operation. The route location was determined based primarily on an assessment of currently known transportation policy, engineering, natural and social environmental factors, all incorporated in the Multiple Account Evaluation (MAE) framework presented earlier.

Having established the above, it should be noted that the timing of construction of the new road could be influenced by mining development in the study area. There is the potential of a mining company cost sharing in the construction of the road if it can form a component of the required land access to the mine. In addition, the new road would provide a backbone for access to the region and exploration activities would likely increase in the corridor along the proposed road. After the selection of the preferred route for the proposed Nunavut-Manitoba road, the Consultant Team met with representatives from the mining industry to present the location of the preferred route and to understand the current status of mining interest and activities in Kivalliq and Northern Manitoba. Based on these discussions, there was general agreement in the mining industry that the proposed road would be needed to support exploration activities in potential mine sites and to enhance mining interest in the region as a whole. There was also strong support that the government and industry should work together in the development of the proposed road.

The known mining sites that could benefit from the preferred route are identified below. The location of these sites are shown in Figure 5-1 as extracted from the Nunavut Mining Map (see Appendix 1 for the full version of this map).

i) <u>Baker Lake Gold Project (Site 45)</u>

- Known as the Meadowbank Project, the mining site is located 70 kilometres north of the Hamlet of Baker Lake. The project covers an area of 30,521 hectares and consists of 10 Crown mining leases encompassing 7,395 hectares and three exploration concessions held 100% by Cumberland Resources Ltd.
- The Meadowbank project is currently serviced by sea via Baker Lake, which has summer shipping access and year-round airport facilities. Winter access is also available via an ice

road from Baker Lake and a private all-weather road is currently under construction from Baker Lake to the mine site.

- An all-weather road from Rankin Inlet to the south could benefit the mining project and would likely expedite the construction of an all-weather road from Rankin Inlet to Baker Lake, the subject of an earlier route selection study.[11]

ii) Baker Lake Uranium Project (Site 35)

- The 200,000-hectare property is located within the Baker Lake Basin and is owned by Kaminak Gold Corporation. The property is host to at least 20 known uranium prospects that occur along 75 kilometers of the Archean–Proterozoic unconformity. A number of other exploration and feasibility studies are also being carried out for the discovery of iron-oxide-copper-gold deposits.
- Similar to the Meadowbank project, this site would benefit from the proposed Nunavut-Manitoba road from Rankin Inlet to the south, and from an extension of this road from Rankin Inlet to Baker Lake.

iii) Meliadine East and West (Sites 46 and 47)

- The Meliadine property, being developed under two separate projects called Meliadine West and Meliadine East, is located about 15 km north of Rankin Inlet and is held by Cumberland Resources Ltd. and Comaplex Minerals Corp. The sites are currently serviced by air and barge from Rankin Inlet, and to some extent, by overland hauling on the private winter road from Rankin Inlet with various all-terrain vehicles.
- The entire Meliadine property is over 80 kilometers long with total land holdings of 94,558 hectares. The target of exploration on the Meliadine property is a mesothermal lode gold deposit and regional exploration work is being carried out on concession lands owned by Nunavut Tunngavik Inc.

iv) Churchill Diamond Project (Site 36)

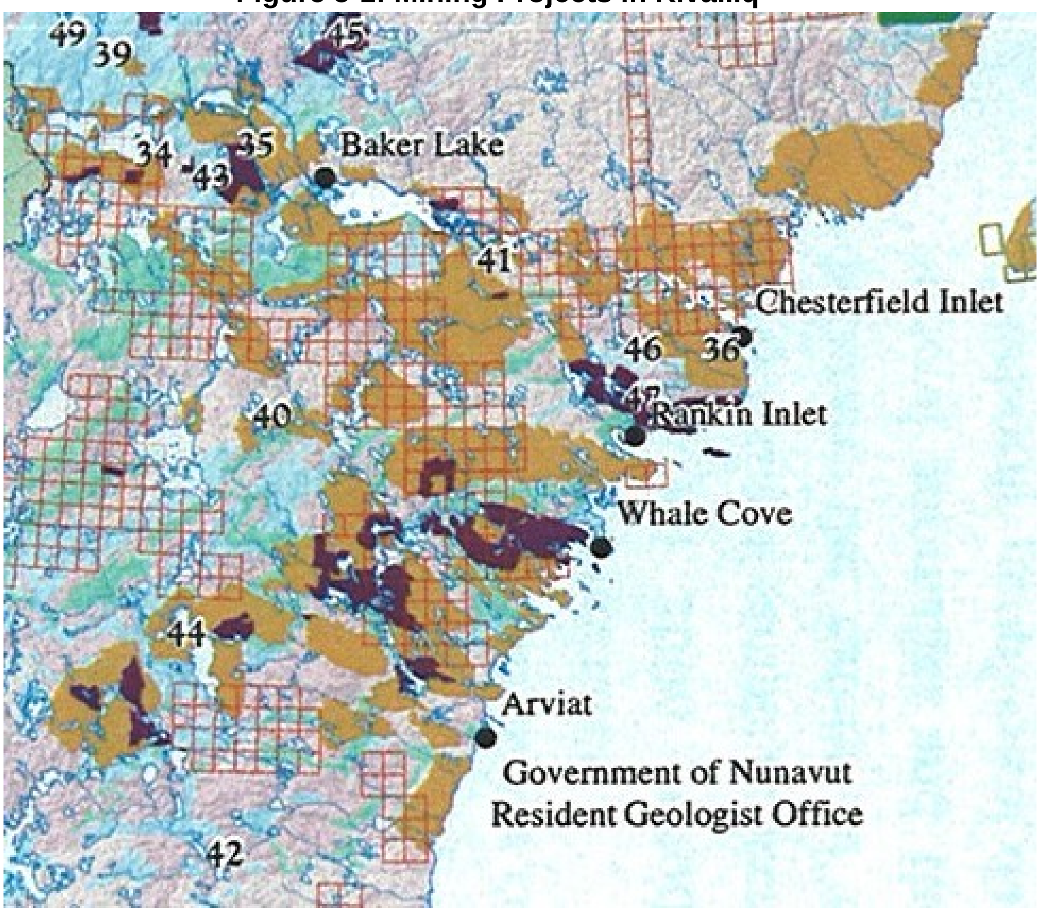
- The Churchill Diamond Project is comprised of mineral rights to more than 800,000 hectares located between the communities of Rankin Inlet and Chesterfield Inlet. The project is owned by joint venture partners Shear, Stornoway and BHP Billiton. To date, the joint venture has drilled 45 kimberlites over a 60 km by 60 km area on the Churchill and Churchill West projects. The partners have now narrowed down the areas of interest to two priority indicator mineral corridors -- the Josephine River Corridor and the Sedna Corridor. The joint venture intends to ramp up exploration activities on the property in the 2007 season.
- The site is currently serviced by rail to the Port of Churchill and then by barge across the Hudson Bay . The proposed road from Churchill to Rankin Inlet would provide significant benefits to this project, particularly with a road extension from Rankin Inlet to Chesterfield Inlet, the subject of an earlier road study in the area[12].

[11] See "Route Selection, Terrain Mapping and Estimation of Construction Quantities and Costs of Two Road Route Alternatives from Rankin Inlet to Chesterfield Inlet, Whale Cove and Baker Lake Communities", J.D. Mollard and Associates, August 28, 2003.
[12] Ibid.

v) Ferguson Lake Project (Site 40)

- The Ferguson Lake project is located about 240 km west of Rankin Inlet and 160 km south of Baker Lake. The property, which contains world class amounts of nickel and copper, was initially discovered by Canadian Nickel Company Ltd. (now Inco Ltd.) in 1950 and was held in its mineral inventory for over 40 years. Significant quantities of palladium, platinum and cobalt were found in 1987 and the property was acquired by Starfield Resources Inc. in 1998. Starfield Resources has continued to explore and define the resource and has spent over $56 million on drilling over the 15-km long strike since 1999.
- The project is currently serviced from Rankin Inlet and Starfield has plans to expand the existing runway at Ferguson Lake. The proposed Nunavut-Manitoba road could provide benefits for the future exploration phases of the project. If a mine is opened, the proposed Rankin Inlet-Sundance road could be used as a segment of the Ferguson Lake resupply route as well as for the transport of ore or refined products.

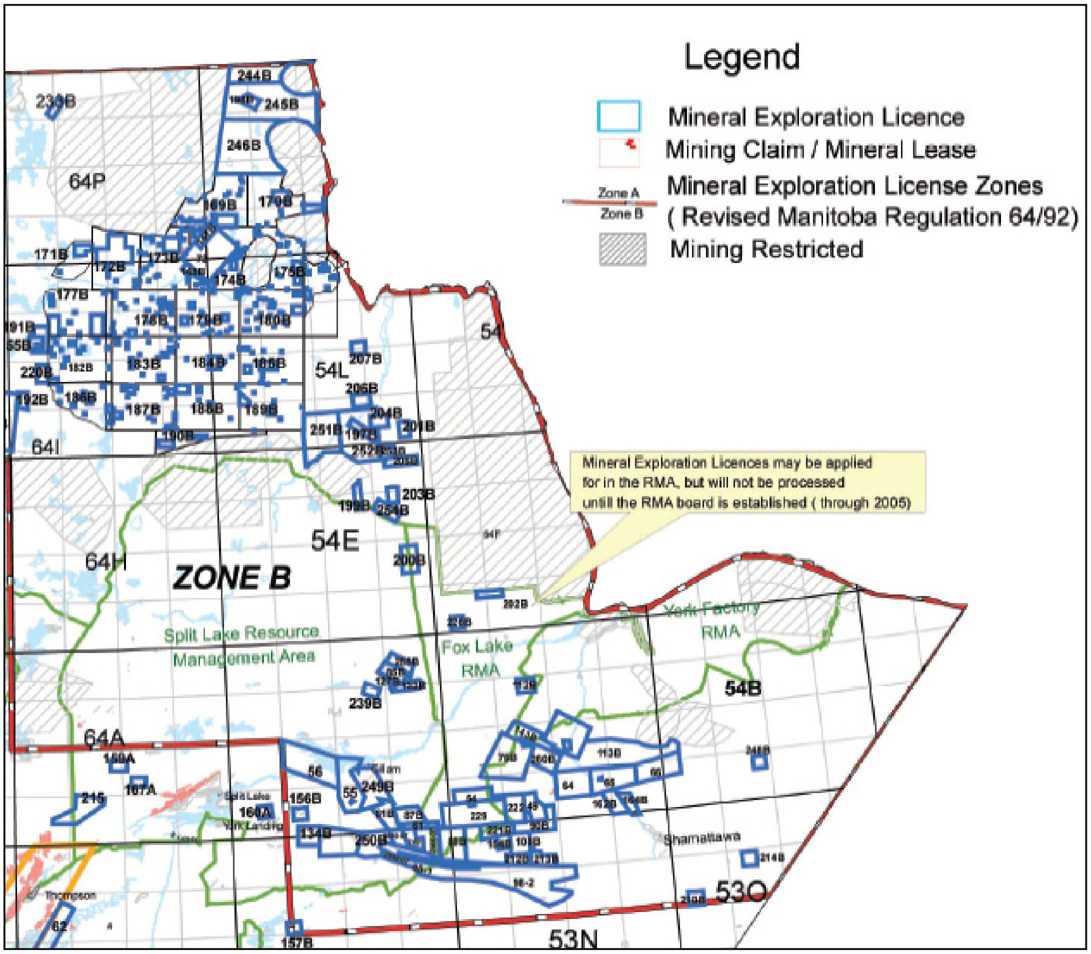
Figure 5-1: Mining Projects in Kivalliq



Source: Government of Nunavut, September 2005. Map shown for illustrative purposes only.

Within the study area in Northern Manitoba, the current exploration activities are concentrated along the preferred route south of the Nunavut/Manitoba border. In the absence of confirmed mining information in the area, mineral exploration licences are used as proxy to indicate the mining prospects of the area (see Figure 5-2 below). The preferred route is located through some potential hot spots in the area and the new road would likely spur exploration activities leading to potential opening of mining sites. To date, De Beers, Western Warrior and Peregrine Minerals are among the leading companies currently exploring for diamonds west of Churchill near the Seal River.

Figure 5-2: Mineral Exploration Licenses in Northern Manitoba



Source: Manitoba Industry, Economic Development and Mines, January 4, 2007. Map shown for illustrative purposes only.

5.2 Hydro-Electric And Utilities Development

In 1999, a "Transmission Pre-Feasibility Study" was completed under the Canada-Manitoba Economic Development Partnership Agreement[13] to evaluate the viability of constructing a transmission line from Manitoba into the Kivalliq Region of Nunavut. The study was based on a transmission line originating at Churchill and terminating at Rankin Inlet for supplying hydro-electric power to the Kivalliq communities. The transmission line corridors would generally follow the coast line along the western shore of Hudson Bay, with a nominal length of 640 km from Churchill to Rankin Inlet. As shown in Figure 5-3, the proposed Nunavut-Manitoba road and transmission line corridors follow independent as well as common routes due to their respective functional, design, construction and operation requirements. Even though the Transmission Pre-Feasibility Study concluded that the benefits of shifting the transmission line location to align with the Nunavut-Manitoba road might not be justified, further synergies in joint development should be explored.

Currently the generation of electricity in Nunavut is from diesel power together with a wind turbine at Rankin Inlet. Qulliq Energy (formerly Nunavut Power Corporation) is evaluating alternative energy sources including hydro-electric generation. There are a number of rivers in Kivalliq that have the potential to generate electricity such as the Ferguson, Maguse, Tha-anne and Thlewiaza Rivers (see Figure 5-4), all crossed by the preferred Nunavut-Manitoba road route. If these rivers were to be used to produce electricity, the road would clearly be useful in accessing the generation sites. In addition to power generation for local consumption, Nunavut has the potential to export hydro power south to the USA. Hydro power is considered a renewable resource and is currently paid for at high premiums. The Nunavut-Manitoba road could be built to transport fuel to the north initially, but the corridor could also be used to transport hydro power to the south for exports in the future.

There is also a possibility that, at some future date, a north-south power grid may be developed for power transfer or sharing between Manitoba and Nunavut. Since the road will have a generally linear impact on the natural environment, as do power transmission lines, there would be a benefit in the future to locate both the road and a transmission line alongside each other. This would have the added advantages of providing a generally sound foundation for transmission towers (since the road will be generally located on good ground), as well as enabling the transmission line to follow a route in which every attempt has already been made to minimize environmental impacts. Furthermore, the road would facilitate year-round access to the transmission line for routine maintenance and to respond to any extraordinary events leading to power outages. We understand that the communities of Rankin Inlet, Whale Cove and Arviat currently rely on wireless communications with the rest of Canada. A new road route to the south would provide a right-of-way in which to place a landline linking these communities to each other and to the rest of Canada, significantly increasing communication reliability.

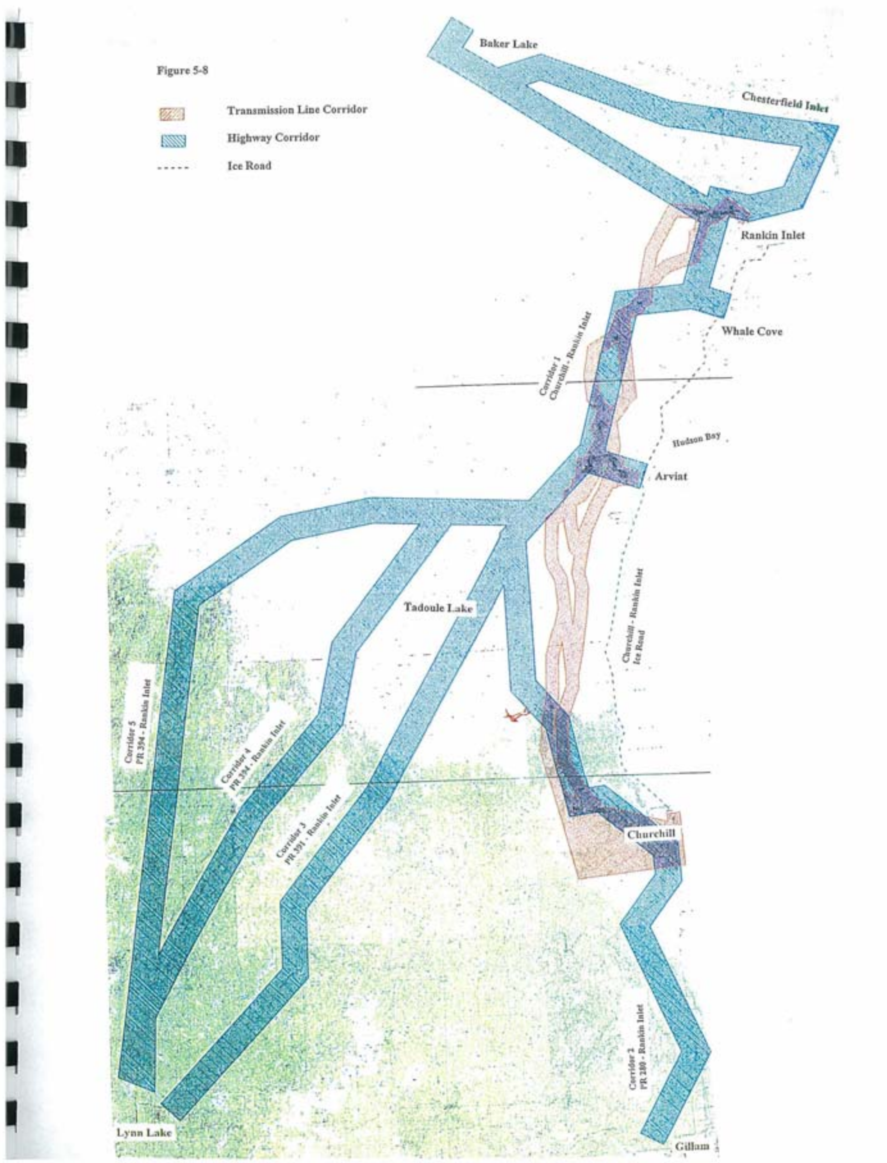
If, in the future, there is a need to bring northern oil or gas to southern Canada by pipeline through Kivalliq, portions of the right-of-way of the road corridor could be considered for the pipeline location, in those areas where it is sufficiently remote from human habitation not to pose risk in the event of a pipeline incident. The advantages of joint corridor use would be similar to those for electric transmission lines with the proviso that there would need to be

[13] See "Churchill to Kivalliq Region Transmission Pre-Feasibility Study", Manitoba Hydro, May 1999.

adequate lateral separation between the various utilities to ensure safe operation and maintenance.

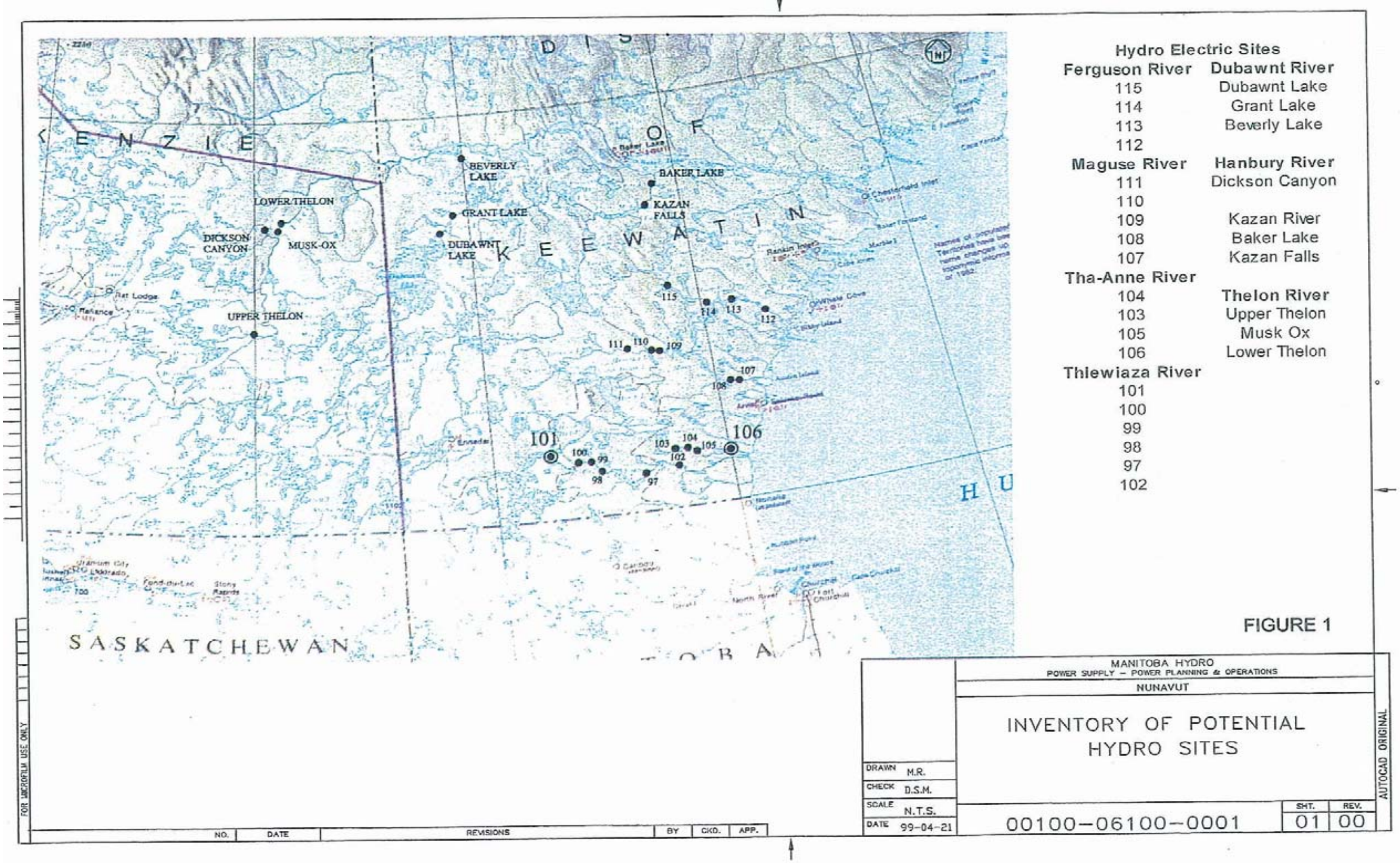
Within the study area in Northern Manitoba, it is noted that the northwest communities of Brochet, Lac Brochet and Tadoule Lake all rely on diesel generation for their electricity needs. In the northeast, Churchill is linked to the Manitoba electricity grid by an overland 138 KV transmission line that connects to the grid in the vicinity of Gillam. If Manitoba Hydro extends their grid in the future to the northwest communities, it may be debatable as to whether Tadoule Lake should be serviced from Lynn Lake or Common Point "A", should, in the latter case, a power transmission line be built along the road between Rankin Inlet and Manitoba.

Figure 5-3: Churchill to Kivalliq Region Transmission Line Corridors



Source: "Churchill to Kivalliq Region Transmission Pre-Feasibility Study", Manitoba Hydro, May 1999

Figure 5-4: Potential Hydro Sites in Kivalliq



SOURCE: "CHURCHILL TO KIVALLIQ REGION TRANSMISSION PRE-FEASIBILITY STUDY", MANITOBA HYDRO, MAY 1999.

6.0 WORK STAGING AND PRELIMINARY IMPLEMENTATION STRATEGY

The proposed Nunavut-Manitoba road along the preferred route (NRA+ERA) will involve a total of 1,100 km of new road construction between Rankin Inlet in Nunavut and Sundance/PR290 in Manitoba, including the link to Churchill. For construction phasing of the all-weather road, it was assumed that five years would be required for the road development from feasibility study, environmental assessment, functional and detailed engineering, financial modelling, land assembly, to permits application. This assumption, as confirmed by members of the Project Steering Committee and Project Working Group, is considered achievable given strong support from the communities, willingness from the governments to proceed, timely project funding approvals, and a coordinated and expedited permitting process. The road construction would then occur between Year 6 and Year 25 from the present time of 2007, a 20-year construction period (resulting in an overall average of 55 km of road construction per year). To sequence the construction of this road along its entire length, considerations are given below for the all-weather road phase and the winter road phase respectively.

6.1 All-Weather Road Phase

In consultation with the Project Steering Committee and Project Working Group, two preliminary options of work staging were developed for the all-weather road (AWR) between Nunavut and Manitoba. These options are described as follows.

<u>i) AWR Option 1: North to South Staging</u>

- 6-10 years: Rankin Inlet – Whale Cove – Arviat (340 km; $388 million)
- 11-20 years: Arviat – Common Point – Churchill (580 km; $664 million)
- 21-25 years: Sundance/PR290 – Churchill River (180 km; $128 million)

This option involves constructing the Nunavut-Manitoba road from north to south, starting in the Nunavut section between Rankin Inlet and Arviat (340 km) in 6 to 10 years, followed by the cross-boundary section between Arviat and Churchill (580 km) in 11 to 20 years, and finally the Manitoba section between Sundance/PR290 and the Churchill River (180 km) in 21 to 25 years. The rationale for this staging plan is that:

- Early completion of the 340 km Nunavut section will provide inter-community connection between Rankin Inlet, Whale Cove and Arviat, thereby delivering social and economic benefits to these and other Kivalliq communities in the region. This section will also be part of the future National Highway System as soon as the road is completed between Arviat and Churchill.
- Since rail access currently exists between Thompson, Sundance/PR290 and Churchill, all-weather access to Kivalliq from Manitoba can be completed by Year 20[14] without having to build the entire length of the Nunavut-Manitoba road. The section between Churchill and Arviat may be considered a higher priority than the section between Sundance/PR290 and Churchill from the perspective of the Government of Canada.

[14] Assuming 20 years from the current year 2007, including 5 years of road development, engineering and environmental assessment before construction begins.

- Construction equipment and materials can be shipped north from the rail head at Churchill; duplication of rail/road service between Sundance/PR290 and Churchill can be deferred in the short to medium term.
- The entire Nunavut-Manitoba road can be completed in 25 years (including 5 years of further studies and 20 years of construction), allowing a staged process for funding approvals, detailed engineering, environmental permitting and land assembly.

ii) AWR Option 2: Fast-tracked Staging

- 6-10 years: Rankin Inlet – Whale Cove – Arviat (340 km; $388 million)
- 6-10 years: Sundance/ PR290 –Churchill (290 km; $245 million)
- 11-20 years: Churchill River – Arviat (470 km; $547 million)

This option entails commencing construction in the Nunavut section from Rankin Inlet, Whale Cove to Arviat (340 km) simultaneously with the Manitoba section from Sundance/PR290 to Churchill (290 km) in 6 to 10 years, and completing the section from Arviat to Churchill River (470 km) in 11 to 20 years. The rationale for this staging plan is that:

- Same as Option 1, early completion of the 340 km Nunavut section will provide inter-community connection between Rankin Inlet, Whale Cove and Arviat, thereby delivering social and economic benefits to these and other Kivalliq communities in the region.
- Provision of the 290 km Manitoba section between Sundance/PR290 and Churchill will ensure that extension of the existing National Highway System from Thompson to Churchill can be completed as early as possible, providing social and economic benefits to the Port of Churchill and the rest of Manitoba and Canada. These benefits could include earlier diversification in trade and an increase in international exports and imports, to offset the future decrease in barge service from Churchill to communities on the west shore of Hudson Bay, who will eventually be served by road from Winnipeg as well as Churchill.
- Simultaneous work in the two jurisdictions of Nunavut and Manitoba should not be a barrier to federal funding contributions on the two fronts and could reduce completion of the overall road link from Nunavut to Manitoba by as much as 5 years (i.e. with completion in 2027 rather than 2032).
- Starting work from Sundance/PR290 to Churchill (from south to north) should result in the lowest construction costs and easiest work staging for this segment of the project.
- To complete the 470 km cross-boundary section between Arviat and the Churchill River, the Dene/Inuit overlap land claims issue will, if it is a barrier to road development, need to be resolved within 6 to 10 years. This section could be the last phase of construction after any land issues have been settled in this area. The construction of this last section can be completed in 11 to 20 years if it were to start simultaneously from both ends: Arviat in Nunavut and Churchill River in Manitoba.

The advantages and disadvantages of these staging options are summarized in Table 6-1.

Table 6-1: Preliminary Options for All-Weather Road (AWR) Construction Staging

AWR Options	Advantages	Disadvantages
1. North to South Staging: • 6-10 years: Rankin Inlet – Whale Cove – Arviat (340 km; $388 million) • 11-20 years: Arviat – Churchill River – Churchill (580 km; $664 million) • 21-25 years: Sundance/ PR290 – Churchill River (180 km; $128 million)	• Early connection of Kivalliq communities: - Enable inter-community travel between Rankin Inlet, Whale Cove and Arviat (social benefits: health, education, reduced isolation, travel) - Increase employment in local communities via road construction/maintenance • Enhance Rankin Inlet as the regional hub in Kivalliq (economic benefits: reduced transport costs) • Enhance mining access and other resource development in local communities • All-weather access to Kivalliq from Churchill completed by Year 20 - Sundance/PR290 to Churchill River section can be built last since rail access already exists	• Nunavut-Manitoba road completion in 25 years - Extension of National Highway System to Churchill and Kivalliq delayed • Higher cost of construction for central section between Arviat and Churchill due to lack of land access for southern supplies (this section also contains the 4 largest bridge crossings on the NU-MB road, i.e. the Churchill, Seal, Thlewiaza and Tha-anne River crossings)
2. Fast-tracked Staging: • 6-10 years: Rankin Inlet – Whale Cove – Arviat (340 km; $388 million) • 6-10 years: Sundance/ PR290 –Churchill (290 km; $245 million) • 11-20 years: Churchill River – Arviat (470 km; $547 million)	• Early connection of Kivalliq communities (same as Option 1) • Increased flexibility of service between road/rail from Sundance/PR290 to Churchill in the short/medium term • Nunavut-Manitoba road completion in 20 years - Early extension of National Highway System to Churchill (by Year 10) - Immediate social and economic benefits to the Port of Churchill - Simultaneous work in the two jurisdictions of NU and MB not a barrier to federal funding - Longest section between Churchill River and Arviat can be built last allowing for staged project funding and land assembly • Lower cost of construction and easy staging from the south once Sundance/PR290 is connected to Churchill	• More funding required in 6-10 year period ($633 million)

Note: Construction costs are based on the unit costs for each road section as summarized in Table 4.1 in this report.

6.2 Winter Road Phase

As set out in the study Terms of Reference, the proposed development strategy for the Nunavut-Manitoba road was based on initial staging as a winter road, followed in time by possible construction of a single-lane, all-weather road, then finally, construction of a two-lane, all-weather road. During the evaluation of the route alternatives, it was suggested that construction of an overland winter road above the tree line (between Latitudes 59^{o}N and 60^{o}N across the preferred route) might be challenging. Unless the level of the winter road is higher than the adjacent land, the lack of trees will likely result in the rapid filling in and blocking of the winter road by blowing snow, thus decreasing the reliability and increasing the annual maintenance cost of the winter road. Based on the experience of winter roads in the Northwest Territories, annual operating costs for winter roads in the tundra could be in the range of $12,000 to $15,000 per kilometre per year[15], compared to $3,000 in northern Manitoba.

In light of the length (total 1,100 km) and high construction cost ($1.2 billion) of the all-weather Nunavut-Manitoba road, questions were raised whether a winter road could be constructed as an interim annual solution for this road link such that the winter road could be upgraded to all-weather road as and when funding becomes available. As suggested by experienced engineers and road contractors who have worked in similar terrain regions, winter roads above the tree line could be expensive and difficult to build and operate, and thus may not be a practical interim solution for the Nunavut portion of the road. The following reasons were provided related to the feasibility of winter roads in the tundra:

- Local contractors who have worked or lived in Rankin Inlet do not build their winter roads in a similar manner as those in north central Manitoba. Trails are opened and sleds are pulled by tractor to move materials.
- A former professional construction engineer from the Northwest Territories suggested that building a winter road in open tundra and for the distances required from Rankin Inlet and approximately the Caribou River would not be practical or recommended.
- The requirements to constantly maintain and clear the winter road would make it impractical from a logistics perspective.
- Safety would be a concern due to potential road break-down, snow “white-outs” and disrupted communications.

In light of the above considerations, the sheer length, and therefore high construction cost, of the all-weather road, particularly in the cross-boundary section between Arviat and Churchill (580 km), poses the question of whether an all-weather road could be afforded at initial construction (i.e. $1.2 million per kilometre for all-weather road construction, compared to $15,000 per kilometre per year for winter road maintenance). The business case for the all-weather road and the optimal construction timing will need to be further established in the next phase of this project. At the feasibility study level, the governments of Canada, Manitoba and Nunavut may consider the following options to construct a winter road as an interim phasing for the all-weather road.

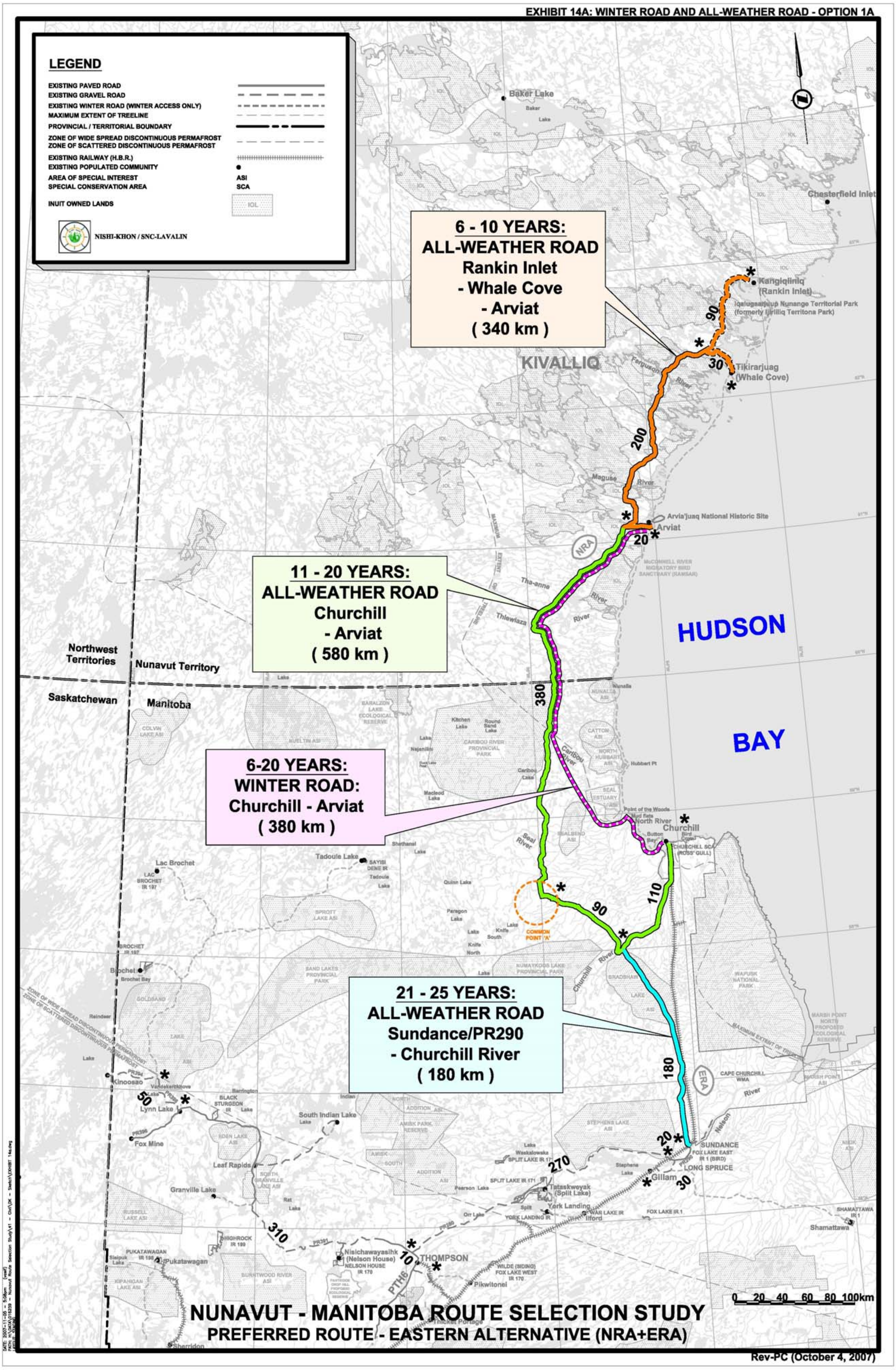
[15] Based on the Tibbitt to Contwoyto Winter Road between Yellowknife and Contwoyto Lake in the Northwest Territories.

In the case of AWR Option 1:

- A winter road between Rankin Inlet, Whale Cove and Arviat is not recommended to serve the inter-community travel needs between these communities. The winter road would be expensive to maintain and would unlikely prove competitive compared with the existing private route along the coast. Consequently, it may only poorly serve the intercommunity travel needs in the area.
- For the section between Churchill and Arviat, a private, shorter winter road currently exists along the west coast of Hudson Bay. A new winter road further inland following the preferred all-weather Nunavut-Manitoba route might not receive much use due to the longer distance of travel.
- If a winter road between Churchill and Arviat is preferred by the governments of Nunavut and Manitoba in order to defer expenditures on the all-weather road, the alignment of the winter road could follow the existing sea ice route from Churchill, then proceed overland between the Seal Bend and Seal Estuary Areas of Special Interest (ASI's) in the vicinity of the Seal River and connect to the all-weather road from Arviat near the tree line (see Option 1A in Figure 6-1). This winter road could start construction in Year 6 and connect to the Nunavut all-weather road between Rankin Inlet and Arviat (to be completed by Year 10).
- Once the winter road is in operation between Churchill and Arviat, community supplies and construction equipment could be transported to Kivalliq by tractors or trucks, thus providing early benefits to the communities and cost savings in the all-weather road construction between Rankin Inlet and Arviat. The all-weather road construction in this section could start whenever funding in made available, possibly proceeding concurrently from the north (from Arviat) and south (from the Port of Churchill).
- It should be noted that since the southern portion of this winter road (from Churchill to just south of the Caribou River) does not follow the alignment of the ultimate all-weather road, a route selection study will be required to confirm its location and technical/environmental feasibility. Temporary bridges would be desirable across the Churchill and Seal Rivers, both major rivers with potentially significant flows. The winter road route will be located in close proximity to a numbers of ASI's, thereby posing potential environmental concerns. Other than crossing on the ice, finding a temporary crossing of the Churchill River near the Port of Churchill would be very challenging. The weir completed by Manitoba Hydro, and opened in 1999 to impound the waters of the Churchill River, is 2,400 m long, where the river estuary narrows upstream from the port facilities. Areas upstream and immediately downstream of the weir were selected for environmental enhancement, making any consideration of a temporary bridge structure with associated in-river piers, likely unacceptable. Furthermore, providing a winter road location going directly north west from Churchill, once established, could generate pressure to make it the all-weather route, although the Route Selection Study has already concluded that the NRA+ERA is the preferred route from engineering, environmental and long term maintenance perspectives.
- A winter road between Sundance/PR290 and Churchill would have questionable value since all-weather rail access currently exists along this corridor: freight unit costs by rail would be lower than those by trucks on winter roads[16]. For this particular option, a winter road phase is not recommended for this section of the Nunavut-Manitoba road.

[16] Based on data collected in the "Nunavut-Manitoba Transportation Assessment" (Prolog, 2000), freight unit costs were \$0.163/Tonne-km by rail, \$0.135/Tonne-km by trucks on all-weather roads, and \$0.500/Tonne-km by trucks on winter roads (in 1999 Dollars).

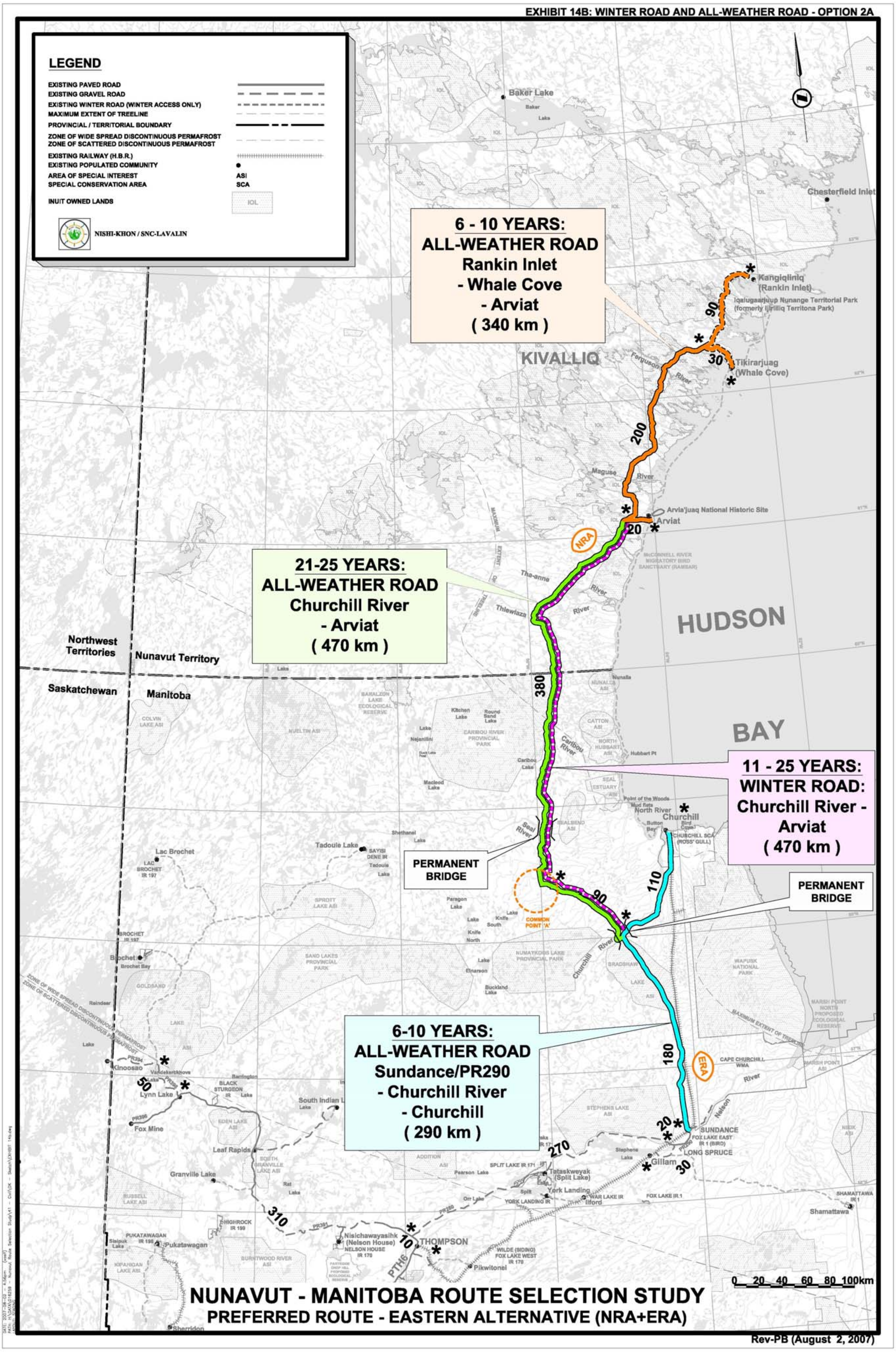
Figure 6-1: Staging of the Preferred Route (WR and AWR - Option 1A)



In the case of AWR Option 2:

- Similar to AWR Option 1 above, a winter road between Sundance/PR290 and Churchill would have questionable value since all-weather rail access currently exists along this corridor: freight unit costs by rail would be lower than those by trucks on winter roads. A winter road phase is not recommended for this section of the Nunavut-Manitoba road.
- For the cross-boundary section between Arviat and Churchill River, a winter road might have some value in serving as an interim solution until funding for this long stretch of the all-weather road is made available. A winter road could be constructed in Year 11 from Churchill River to Arviat along the alignment of the all-weather road, and connect to the all-weather road between Arviat and Rankin Inlet (see Figure 6-2 for Option 2A). This winter road will then connect the Manitoba all-weather road to the Nunavut all-weather road (both completed by Year 10).
- Compared with the winter road under AWR Option 1, this winter road route, being located overland along the future all-weather route, would be safer and more reliable since, in all likelihood, early construction of permanent bridges would be justified over crossings such as the Caribou, Seal and Churchill Rivers. This route is also well removed from designated Areas of Special Interest.
- Freight diversion to this winter road from the existing Churchill-based rail/barge service might still be limited (due to longer road distance and the lower freight unit costs by rail and barge when compared to those by trucks on the winter road), but freight and possibly some limited passenger travel could use this winter road as an alternative to the existing high cost air travel.
- Once the winter road is in operation between Churchill and Arviat in Year 11, the all-weather road between Arviat and Churchill River could be built whenever funding is allocated for such construction.

Figure 6-2: Staging of the Preferred Route (WR and AWR - Option 2A)



6.3 Preferred Implementation Sequence

In considerations of the staging of the Nunavut-Manitoba all-weather road, the Project Steering Committee and Project Working Group have expressed their preference for Option 1, the north to south staging. In addition, the construction of a winter road for the cross-boundary section between Churchill and Arviat is desired such that early benefits of the Nunavut-Manitoba road could be realized, particularly in enabling freight movements to Kivalliq by surface transportation during the winter to augment barge service.

There are a number of location options for a winter road between Churchill and Arviat:

- Option 1A: the route shown in Figure 6-1;
- Option 2A Modified: the route shown in Figure 6-2, with the addition of a winter road along the south bank of the Churchill River from the Port of Churchill to the crossing of the Churchill River 110 km to the south west (following the route of the future all-weather road);
- The existing winter road ice route along the west coast of Hudson Bay; shown in a dashed line in Figures 6-1 and 6-2.

The above three winter road route options are shown in Figure 6-3, and any one of them could, after the appropriate environmental approvals have been obtained, be implemented in a 6-10 year time frame, to coincide with the 6-10 year time frame for building an all-weather road from Rankin Inlet to Arviat. Each route option has positive and negative aspects: those of the two overland routes have already been referenced earlier in this section of the report. The coastal route has the advantage of being the shortest and most level route, as well as already being familiar to local private operators. Since it is located just offshore, over the waters of Hudson Bay, we understand that it will essentially fall within the jurisdiction of Nunavut. Its disadvantages are that it may be the route that thaws the earliest in the spring. Being located entirely over frozen sea ice, it may pose greater safety and environmental risks than the inland routes. Furthermore there is no realistic way of extending its operating season by bridging the major river outflows it crosses.

We believe it may be premature at this point to make a recommendation on the preferred route for the winter road. There are three realistic options, and a final decision could in fact rest with decision makers closer to the time when construction of the all-weather road is due to commence between Rankin Inlet and Arviat. We do, however, feel it would be prudent to include the three winter road route options, along with the preferred all-weather route, in applications to the appropriate government agencies for environmental approval.

The winter road would augment barge service, and be used for shipping equipment and materials north for construction of the all-weather road, as well as shipping general freight to Arviat for distribution. The winter road could remain in operation during the 11-20 year period while the all-weather road is under construction between Arviat and the Port of Churchill.

There are four significant issues associated with all three route options for the winter road between the Port of Churchill and Arviat:

i) The magnitude of the one-way travel distance and travel time between the 2 communities (assuming an average travel speed of 20-30 km/h on the winter road):

Route	Approx Length Churchill to Arviat (km)	Non-Stop Travel Time (hrs)	Required No. of 10 hr shifts
Option 1A	380	13-19	2
Option 2A Modified	600	20-30	2-3
Existing Coastal Ice Route	290	10-15	2

- In the case of Option 1A and the Existing Coastal Route, a minimum of one rest area will be needed at the midway point (near the Manitoba/Nunavut boundary) to provide adequate overnight shelter for the transport operators. In the case of Option 2A Modified a minimum of two overnight rest areas will be needed. Potential winter road rest areas are also shown in Figure 6-3.

ii) The condition and depth of ice:

- This is an issue along Hudson Bay in the case of the Existing Coastal Route as well as Option 1A which follows the coastal route for a short distance. It is also an issue at the major river crossings for the inland portion of Option 1A, as well as for Option 2A Modified. The most problematic situation is likely the condition and depth of ice along the course of the Churchill River, and where it outflows into Hudson Bay at the Port of Churchill. Most of the time Manitoba Hydro diverts a substantial portion of the waters of the Churchill River into the Nelson River hydro-electric generating system through the use of the Missi Falls and Rat River (Notigi) control structures. However, the volume of upstream flows in both rivers can fluctuate considerably, and there are times when the flow in the Churchill can rapidly increase. In the winter, the flow of water may swell over the existing ice cover, then freeze again in a relatively thin layer, separated by slush from the lower layer of ice.
- This condition can prove treacherous for vehicular crossings in the winter. Furthermore the Churchill and other major river crossings may thaw earlier in the season than the rest of the winter road, rendering it impassable. Where the winter road route follows the future all-weather route, the safety and environmental risks associated with the river crossings can be eliminated by building permanent bridge structures.

iii) The type of equipment to be used for hauling along the winter road:

- Based on our observations during trips to the Kivalliq communities of Rankin Inlet, Whale Cove and Arviat, together with discussion with one major freight hauler, we believe that the safest and most reliable method of transporting freight along the winter road during its initial operating period will be by using Challenger type tractors, with large diameter tires and hauling sleds. These operate successfully on the existing coastal ice route, and would likely be suitable on an inland route, especially where there may be a relatively steep climb down and up the sides of river valleys in order to access the ice on the river crossing.

- At such time as permanent or temporary bridges are in place at all river crossings, it may be possible to introduce the use of regular highway tractor-trailer units (A-trains and B-trains) along the winter road. Challengers would continue to be the vehicle of choice throughout the entire period of operation, if the coastal ice route is used.

iv) To ensure the safety and effectiveness of the winter road, a contractor should be chosen to clear the route, carry out annual winter maintenance, ensure environmental compliance and provision the rest areas, and provide emergency services. It is anticipated that funding of the winter road operation would be a joint federal, provincial and territorial government responsibility, with possible participation by mining companies, who may wish to use the route to re-supply their operations. In the 11-20 year period, there would need to be close coordination between the winter road contractor and the contractor retained to build the all-weather road. Perhaps the latter could be contracted to assume the responsibilities of the former.

The follsowing is a summary of the preferred overall implementation sequence:

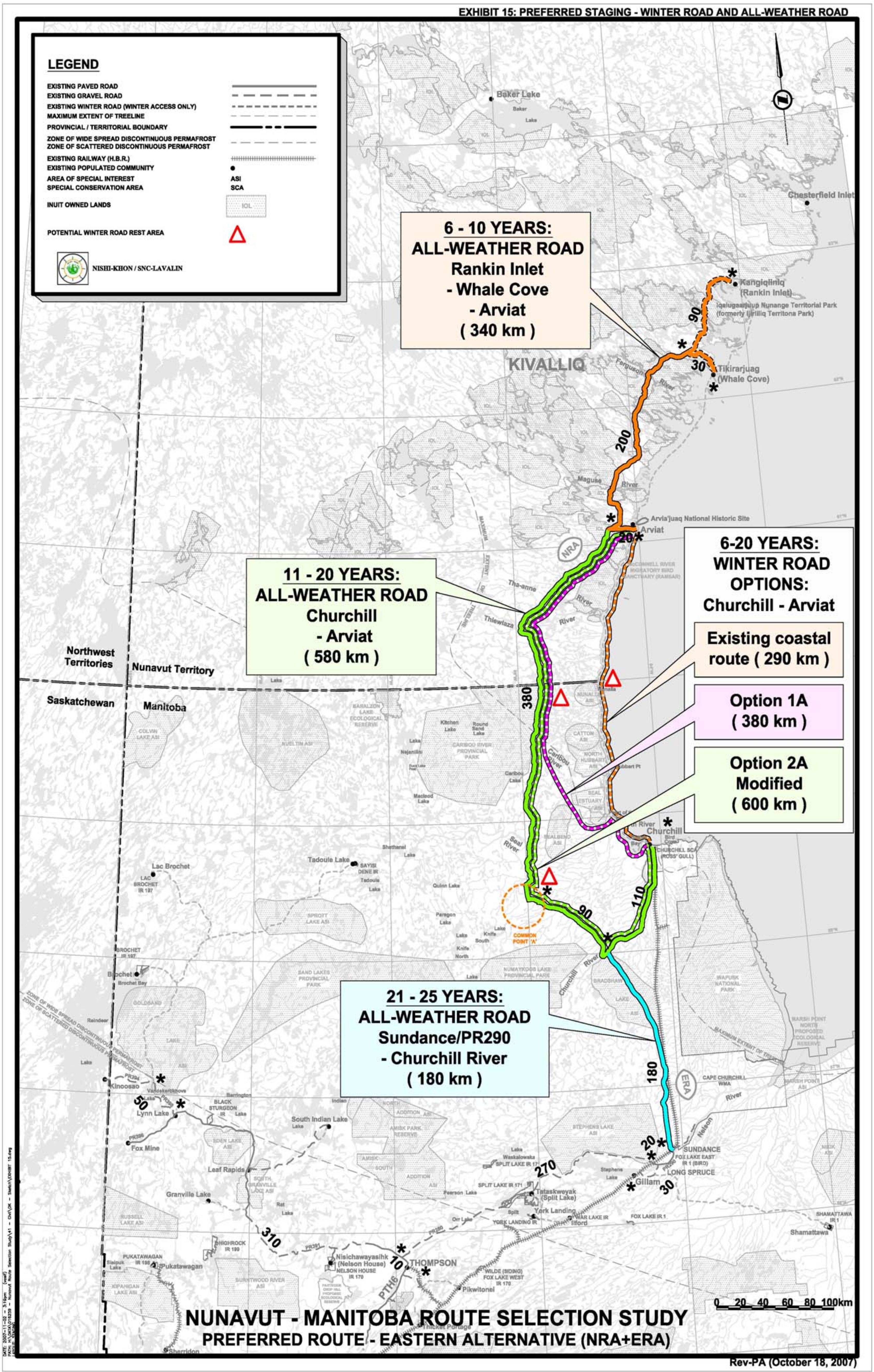
6-10 years:	All-Weather Road: Rankin Inlet – Whale Cove – Arviat (340 km); Winter Road: Churchill to Arviat (initial use, then phasing out of winter road to all-weather road)
11-20 years:	All-Weather Road: Arviat – Common Point – Churchill (580 km)
21-25 years:	All-Weather Road: Sundance/PR290 – Churchill River (180 km)

The rationale for this preferred staging is stated as follows:

- Early connection of the communities of Rankin Inlet, Whale Cove and Arviat in the Kivalliq Region. Interconnectivity among these communities is considered the highest priority of the Nunavut-Manitoba road.
- Road connection of the Kivalliq communities to the Port of Churchill is considered a higher priority than the road connection between Churchill and Sundance/PR 290. Since rail connection currently exists between Churchill and the south, the road extension from Churchill to Kivalliq will complete the Nunavut-Manitoba surface transportation network before the entire road is built to Sundance/PR 290.
- Due to the length of the cross-boundary section between Churchill and Arviat (580 km), a longer implementation period may be required for funding, land claims settlement and construction. A winter road can be considered as an interim staging in this section to provide early connection to the Kivalliq communities.

- Once the winter road is in operation between Churchill and Arviat (in 6 to 10 years), community supplies and construction equipment could be transported to Kivalliq by tractors or trucks, thus providing early benefits to the communities and cost savings in the all-weather road construction between Rankin Inlet and Arviat.
- The section between Sundance/PR 290 and the Churchill River will be the last section to construct once the all-weather road is completed between Churchill and Rankin Inlet.

Figure 6-3: Preferred Staging of Nunavut-Manitoba Road



One possible construction stage for the NU-MB road would be to build a one-lane road (with a 5 m top and assured 8 m top passing opportunities) in the all-weather road phase. A preliminary cost analysis was conducted to evaluate the merits of this one-lane road phase. As shown in Table 6-2 below, reducing the cross section of the entire road from Rankin Inlet to Sundance/PR290 would result in a capital cost saving of $245 million. Constructing a one-lane road in the cross-boundary section between Arviat and Churchill River (470 km) will result in a capital cost saving of $118 million. Upon consultation with the Project Working Group, it was determined that these cost savings were not justified for the one-lane road phase. The Project Working Group is of the opinion that the development of a single lane roadway is an unnecessary stage in the construction process and that this stage is not justified due to the following reasons: 1) the incremental cost between a single lane roadway and a two lane roadway is relatively small; 2) as a National Highway System route, the expectation of road users is, at minimum, a two-lane road; and 3) development of a single lane road would impact benefits to road users. In particular, a one-lane road between Rankin Inlet, Whale Cove and Arviat would be unlikely to meet expectations for and inter-community traffic service between these communities.

Tables 6-2: Capital Cost* and B/C Ratio
(Two Lane Road vs One Lane All-Weather Road)

	Capital Cost 8 m Top (two-lane all-weather road from Rankin Inlet to Sundance/PR290)	Capital Cost 5 m Top**(one-lane all-weather road from Rankin Inlet to Sundance/PR290)	Capital Cost 5 m Top** Arviat to Churchill River (one-lane all-weather) and 8 m Top Other Sections (two-lane all-weather)
Total Capital Cost ($ million)	1,180	935	1,062
Cost Savings ($ million)	-	245	118

*Note: Capital cost includes engineering, mobilization, construction and contingency in 2006 dollars.

** Note: 5 m top road option would include frequent 8 m top width sections to provide assured passing opportunities.

The final phase of the Nunavut-Manitoba Road, beyond the initial 20-year construction period, possibly in the 50+ year range, may consist of paving the travel lanes and providing partially paved, partially gravel shoulders, in keeping with guidelines for the National Highway System.

In order to ensure the functional integrity of the route well into the future, as an extension of the National Highway System, it will be important in the early phases to:

- Protect a sufficient width of right-of-way for the highway as well as for all associated services required for the travelling public;
- Provide the flexibility to achieve safe high-speed operation in the horizontal as well as the vertical alignment of the highway;

- Control land use and access along the highway;
- Ensure the preservation of aggregate sources along the highway corridor, to be used for ongoing maintenance and future upgrading; and
- Meet all necessary environmental permitting requirements.

6.4 Corridor Land Use Policy

The proposed all-weather road linking the Kivalliq Region of Nunavut to the Port of Churchill and the existing Manitoba all-weather road system, Provincial Road PR 290 near Gillam, and thence via PR280 and PR391 to the Provincial Trunk Highway PTH6 at Thompson, will initially, in all likelihood, be the sole year-round overland link between Nunavut and the rest of Canada. Portions of the route south of the tree line within Manitoba may initially be staged as a winter road. Since the Nunavut-Manitoba route will link Rankin Inlet, the economic and administrative centre of the Kivalliq Region to Churchill, and in turn Churchill, Canada's foremost international port on the Arctic Ocean, to Canada's National Highway system at Thompson, the proposed all-weather road should, we believe, when it is completed, be incorporated in the National Highway System and designated as a major provincial and territorial highway. Furthermore, the portions of Manitoba's Provincial Roads PR 280, 290 and 391 that link the Nunavut-Manitoba route to Thompson, should be elevated to major provincial highway status and also included in the National Highway System. In the meantime, drawing from Manitoba's Provincial Land Use Policy Number 8, "Provincial Highways", we propose that any development or uses on lands in the Nunavut-Manitoba Route corridor and along the relevant portions of PRS 280, 290 and 391 should be planned:

- to complement the future highway system's function as an important component of sustainable development in Nunavut and northern Manitoba;
- to minimize environmental impacts attributed to future highway operations and to protect the public investment in the Nunavut-Manitoba route from any development which may jeopardize its intended safe and economical operation, or the implementation of future improvements to enhance its safe operation.

We suggest the following draft land use policy objectives and application be considered for adoption by the territorial, regional and provincial authorities for the corridor containing the proposed Nunavut-Manitoba route (NRA + ERA). This draft policy could be used by the appropriate levels of government, in Nunavut, Kivalliq and Manitoba, as a benchmark in the reviews of developments in areas where a development or land use plan has not been adopted or requires review to accommodate the proposed Nunavut-Manitoba route. Once such a plan has been adopted it would replace this draft policy as the instrument guiding development within the route corridor. This draft policy would not derogate from the Nunavut Land Claims Agreement or Treaty and Aboriginal rights within Manitoba.

A. Policy Objectives

Efficient transportation is an essential element in sustaining existing economic viability and ensuring sustainable economic growth. The primary role of the proposed Nunavut-Manitoba highway system will be to move goods and people safely and with minimal interruption. Although many types of land uses adjacent to the proposed highway may not interfere with this function, certain uses may cause unsafe highway travelling conditions, result in delays for the travelling public, and accelerate the need for costly highway improvements. In addition, some land uses, particularly those containing residential components could be negatively affected by highway traffic operations if located immediately adjacent to the highway transportation network.

The objectives of the Policy therefore are:

1. to sustain the economic viability of communities, promote sustainable economic growth, and prevent negative environmental and economic consequences to land uses adjacent to the proposed highway;
2. to maintain and improve a high level of service and safety on the proposed highway;
3. to protect the public investment in the proposed facilities and prevent premature obsolescence of the transportation network; and
4. to minimize disruption to local development in the future, and reduce the cost to the public for land acquisition when highway upgrading is required.

B. Policy Application

1. Where appropriate, land use plans shall implement this Policy by:
   a) Identifying the proposed major highway as per the map set out in this route selection study;
   b) Developing policies that ensure the protection of the proposed highway and adjacent land uses.
2. Compatible land uses (for example, natural resources harvesting, wayside parks and highway commercial operations) may be permitted adjacent to the proposed highway where interference with other resources is minimized and the safe and efficient operation of the proposed highway can be maintained.
3. Proposed development that lies within 300 m of the centre line of the proposed highway or within an 800 m radius of the intersection with another major highway must be reviewed by the appropriate government authorities prior to approval to determine whether and to what degree:
   a) the development may have a detrimental impact on the safety and function of the proposed highway;
   b) the proposed highway may have a detrimental impact on the development;
   c) the development may lead to further development that is contrary to this section;
   d) appropriate functional improvements and environmental mitigative measures may be incorporated into the development.
4. A review by the appropriate government authorities will determine whether a proposed development should proceed.
5. If a review determines that a proposed development should proceed, appropriate functional improvements and environmental mitigative measures should be incorporated into the development.

6.5 Environmental Permitting and Approval

The proposed Nunavut-Manitoba road between Rankin Inlet, Whale Cove, Arviat, Churchill and Manitoba's road transportation system will be subject to a number of review processes set out by the applicable government authorities. In Nunavut, the Nunavut Impact Review Board (NIRB) will be responsible for administering the environmental assessment and review process under Article 12 of the Nunavut Land Claims Agreement (NLCA). Depending on the staging of the NU-MB road, the review process may involve either a Part 5 review for proposals in the Nunavut territory or a Part 6 review to address cross-boundary issues among various jurisdictions. The Part 5 review will be led by the NIRB whereas a Part 6 review will be conducted by a Federal Environmental Assessment Panel with representatives from all affected provincial and territorial governments. The NIRB review process consists of 16 steps from Project and Issue Scoping, submission of a Draft Environmental Impact Statement (DEIS), technical review, NIRB determination, approval by the Department of Indian and Northern Affairs, issuance of Project Certificate, and finally, monitoring and enforcement upon project approval (see Appendix 8 of Milestone Report B for the detailed NIRB Review Process guidelines). The assessment process could take up to 280 days from the receipt of the DEIS.

In harmony with the NIRB review process, the Nunavut Planning Commission (NPC) will be responsible for determining whether the project proposal is in conformity with the applicable land use plans. The Keewatin Regional Land Use Plan (KRLUP), approved by the Governments of Nunavut and Canada in June 2000, contains specific conformity requirements relating to transportation corridors. The study team received a letter by NPC on April 10, 2007, confirming the regulatory approval requirements for the project and NPC's commitment to working with the project team and other agencies to ensure that any project proposals related to the proposed NU-MB road will be fairly and efficiently tested for conformity with the KRLUP (see Appendix 2 at the end of this report). In addition, the Nunavut Water Board and the Nunavut Wildlife Management Board will be responsible for reviewing and approving any proposals related to the use, management and regulations of water bodies and wildlife in the region. These agencies have been consulted during the second round of public consultation of the Route Selection Study in February 2007.

In Manitoba, environmental pre-screening should be initiated at the early project design phase to identify any environmental issues that need to be addressed in the design process. An iterative process should be put in place to allow for timely feedbacks on environmental impacts at major decision points in the design process. Regular and comprehensive communication should be maintained between the Project Manager, Regional Design staff and the Environmental Section of Highway Planning and Design at the Department of Infrastructure and Transportation. Consultation with relevant project stakeholders and agencies (local governments, interest groups, environmental, transportation or business lobbies) should also be maintained in the form of an on-going communication program.

As detailed in Appendix 3, the following approvals should be obtained at the end of the Functional Design Phase:

Manitoba Environment Act License
The proposed Nunavut-Manitoba road, in both winter and all-weather road phases, will require licensing under the Manitoba Environment Act. The proposal for licensing will be filed by the

Environmental Section of the Department of Infrastructure and Transportation, after which an interdepartmental technical review will be conducted under a Technical Advisory Committee. The proposal will then be advertised in a local newspaper and subject to public review. Additional information may be required to undertake a more detailed Environmental Impact Assessment to address any issues raised in the review process. A minimum of three months is required to obtain the license.

Canadian Environmental Assessment Act
The project will be subject to the Canadian Environmental Assessment Act since the federal government will be involved as a decision-making authority - as a source of funding, a land owner and a regulator. Canada and the Province of Manitoba have entered into a harmonization agreement regarding environmental assessments whereby the licensing application is filed under the Manitoba Environment Act and the Canadian Environmental Assessment Agency will be responsible for circulating the proposal to various federal government departments for review and approval. The Environmental Section of the Manitoba Department of Infrastructure and Transportation will be responsible for liaising with the federal agency which has been designated as the responsible authority for the project approval.

Fisheries and Oceans and Navigable Waters Authorization
Authorization will be required by Fisheries and Oceans Canada for works affecting fish habitat in the project area pursuant to the Canada Fisheries Act. Construction of water crossings will also be subject to the Transport Canada Navigable Waters Protection Act. In light of the scale and number of water crossings in the project, a formal authorization will likely be required where project impacts will need to be evaluated, mitigated and compensated as required. The Environmental Section of the Manitoba Department of Infrastructure and Transportation will be responsible for liaising with these federal agencies in the relevant screening, review and application processes. A minimum of three months will be required to obtain an authorization under each of these acts.

In light of the number of regulatory agencies involved in the environmental permitting and approval phase of the project, it is recommended that an External Team be formed in the immediate next phase of this project to represent the regulatory agencies for the proposed NU-MB road. This External Team will consist of representatives from the KIA Lands Department, the Nunavut Impact Review Board, Nuvavut Water Board, Nunavut Planning Commission, Nunavut Planning Division (Environmental Lands Affairs Officer), Environmental Section of the Manitoba Department of Infrastructure and Transportation, Fisheries and Oceans Canada, Environment Canada, Manitoba Conservation and Manitoba Industry, Economic Development & Mines. Early engagement of this External Team will allow for timely stakeholder input and ensure that all project issues are identified and constraints addressed at critical decision points in the project design phases. The next phases of the project are further elaborated in Section 8.0 of this report.

7.0 BUSINESS CASE AND PROJECT FUNDING OPPORTUNITIES

As documented in the earlier studies for the Nunavut-Manitoba road link, the Governments of Canada, Nunavut and Manitoba see implementation of the new road as a means of supporting the objectives of healthy communities, simplicity and unity, self-reliance and continued learning[17]. The proposed road is expected to enhance opportunities for resource development such as mining and tourism; benefit employment, small business development and standard of living; and reduce the cost of transporting people and goods between the Kivalliq Region and urban centres in Manitoba.[18]

In this study, direct benefit cost analysis was conducted for each of the route alternatives (the Western, Central and Eastern Alternatives, all in combination with the Northern Common Route from Rankin Inlet to Churchill). This benefit cost analysis compared the life-cycle cost of the proposed road (including engineering, construction, maintenance and salvage value over a 25-year project life) to the direct user benefits in the terms of cost, time and safety benefits associated with the various modes of freight and passenger travel along the corridor. The benefit to cost ratios were determined to be 0.32, 0.30 and 0.25 for the Eastern, Central and Western Alternatives respectively. For the preferred Eastern Alternative, the total project benefit in net present value over a 25-year project life was $358 million, compared to a total project cost of $1,106 million. This result is consistent with earlier assessments of the economics of the Nunavut-Manitoba road link in that the project may not be viable from a strictly economic perspective.

However, many public investments in infrastructure and programs are made on the basis of social and public policy imperatives, rather than solely on economic considerations. The proposed Nunuvut-Manitoba road would deliver the greatest benefits from a sovereignty and national interest perspective. It is considered essential to public service in the Kivalliq communities, to address the isolation, unemployment, and high costs of goods and services associated with the lack of reliable public road infrastructure connecting the local communities to one another and to the rest of Canada. The proposed road is critical to the further development of the Port of Churchill as a trade and naval base for the Canadian Arctic region, and to provide improved access to world trade markets from Nunavut and northern Manitoba. The social and economic benefits of the proposed road are further discussed in the following sections, as well as opportunities for project funding and procurement among the public and private sectors.

7.1 Social and Economic Benefits

In addition to the direct and immediate benefits of the proposed Nunavut-Manitoba road in reduced freight and passenger transport costs (included in the benefit cost analysis for the Route Selection Study), the project will generate other social and economic benefits to the region associated with the construction of the new road. The phased $1.2 billion construction expenditure will create “spin-off” benefits to the provincial, territorial and Canadian economies in the form of increased employment, income and Gross Domestic Product (GDP). The potential employment and training opportunities provided to the aboriginal communities in Kivalliq and

[17] These are priorities specified in the Bathurst Mandate, on which the Nunavut Transportation Strategy 2001 is based.
[18] See “Manitoba Nunavut Transportation Assessment” (Prolog, 2000) and “Nunavut Transportation Strategy 2001”.

northern Manitoba, in particular, will need to be understood in the regional context. Unemployment rates in Kivalliq currently range from 14% in Rankin Inlet to 36% in Arviat[19], while 49% of the population in Nunavut is under the age of 19[20]. Without access to gainful employment, these people and communities are supported by transfer payments from the federal government. The social dependency rate in the remote communities in northern Manitoba ranges from 30 to 80 percent.[21] Education, training and employment benefits to the youth are cited as the single, largest concern expressed by the communities during the two rounds of public consultations conducted in this current study.

The "spin-off" economic benefits associated with the construction of the Nunavut-Manitoba road will have significant impacts to the regional economy in the following ways:

- Local hiring of construction workers and project spending on wages, materials and equipment during construction (direct impacts)
- Local hiring of maintenance workers and spending on wages, materials and equipment for the operational period of a winter road and eventually the all-weather road (direct impacts)
- Additional economic activities generated as a result of the construction-related purchases of goods and services from local and non-local suppliers (indirect impacts)
- Additional economic activities associated with the purchase of consumer goods and services incurred by the construction and maintenance employees within the region (induced impacts)

The new road will provide improvements in essential service to the local communities (e.g. medical and emergency services). In the year 1999/2000, a total cost of $22 million was estimated for Medevac travel (emergency evacuation of patients from remote communities to regional health facilities) and Medial travel (travel by patients and families on a non-emergency basis) in Nunavut. It can be expected that substantial savings can be achieved with the provision of an all-weather road and more advanced medical facilities in Rankin Inlet, Churchill and other regional centres in northern Manitoba.

Furthermore, the proposed new road will bring about business and economic development opportunities in the region as a result of the improved access to labour, attraction of investment capital for resource development, reduction of supply and servicing costs, and greater recreational and tourism activities between and within the local communities. Given the size and scale of the project, the proposed road will likely be constructed as a long-term regional development initiative. Notable economic development opportunities associated with the proposed Nunavut-Manitaba road are discussed under the following headings: mineral exploration and development, tourism, commercial fishing, hydro-electric and utilities development, and the Port of Churchill.

[19] Source: Sakku Investments Corp., an investment organization owned by the KIA.
[20] Government of Nunavut, 2006.
[21] "All-Weather Road – East Side of Lake Winnipeg Justification and Scoping Study", Manitoba Highways and Government Services, August 28, 2000.

Mineral Exploration and Development

It is anticipated that the new road would promote mineral resource development in the Kivalliq Region and northeastern Manitoba. In particular, the Rankin-Ennadai-Qamanirjuaq greenstone belt is considered to have excellent mineral potential and is comparable to the Abitibi greenstone belt in Ontario and Quebec for copper, gold, lead, nickel, platinum, silver and zinc.[22] The preferred route of the Nunavut-Manitoba road is located in the vicinity of a number of known mining sites (see Section 5.1) that could benefit from the construction of the road in terms of reduced exploration and mining development costs, and reduced transport costs of supplies, equipment and ore concentrates at the operational phase of the mine. Road access will also increase the mining potential of the region as a whole since mineral deposits that are uneconomic without a road link may become economic if a road were available.

Mineral exploration and mining activities have the potential to generate significant social and economic benefits to the region in terms of employment, training and business opportunities, as well as direct taxes and royalties from the capital investments and mining revenues. According to economic models developed by the Government of Northwest Territories, a diamond mining operation could generate royalties in excess of $600 million over a 25 year mine life, gold operations could provide $60 million royalties over a 15-year mine life, and a base metal operation could provide $20 to $25 million royalties over a 20-year mine life.[23] Economic models developed by the Nunavut Tunngavik Incorporated (NTI), the organization responsible for the management of all Inuit-Owned Lands in Nunavut, suggested similar results in that a low-profit mine might pay royalties of $35 to $40 million, while a high-profit mining operation would be expected to pay royalties of up to $80 and $90 million over the life of the mine.[24] The NTI model further suggested that the Government of Nunavut would receive an amount of taxes equivalent to the royalties described above, while the Government of Canada would receive twice this amount in taxes. Taxes paid to the Nunavut Government would help to provide benefits to the local communities in the areas of housing, education and health care.

To ensure that the benefits from mining development in an area would flow to local residents and businesses, impacts and benefits agreements could be formulated between the regulatory authorities and the mining companies such that employment and business opportunities would largely stay in the local communities. The NTI has a mining policy requiring that, to the extent possible, the benefits of mining will remain in Nunavut. The Diavik Diamond Mine is a successful example of such an agreement.

Case Study: Diavik Diamond Mine

The Diavik Diamond Mine is located on a 20 square kilometre island approximately 300 kilometres northeast of Yellowknife, capital of Canada's Northwest Territories. The area was surveyed in 1992 and construction began in 2001, with production commencing in January 2003 and a mine life of 20 years. The Diavik Diamond Mine is an unincorporated joint venture between the UK-based Diavik Diamond Mines Inc. (60%) and Aber Diamond Limited Partnership (40%), a wholly owned subsidiary of Aber Diamond Corporation of Toronto, Ontario.

[22] "Keewatin Regional Land Use Plan", Nunavut Planning Commission, May 2000.
[23] Bullen, W. and Zhang, J, (2003): "The Economics of Mining Projects in the Canadian Arctic", in Proceddings, Seventh International Symposium on Mining in the Arctic; CIMM, pp. 3-18.
[24] "Background Paper On the NTI Uranium Policy", Department of Lands and Resources, Nunavut Tunngavik Incorporation, November 2006.

The site is connected by an ice road to Yellowknife and a 1.6 km gravel runway that regularly accommodates Boeing 737 jet aircraft. The project has now become an important part of the regional economy, employing an average of 700 people, grossing $100 million in sales, and producing 8 million carats (1,600 kg) of diamonds annually.

Under the Diavik Social-Economic Monitoring Agreement (SEMA) established in 1999, the project is committed to providing training, employment and business opportunities to residents in Northwest Territories and the west Kitikmeot Region of Nunavut, including the following:[25]

- During project construction: 40% northern workforce and 74% of northern purchasing, representing $900 million worth of northern contracts, of which $600 million was with Aboriginal companies; direct annual wages to all employees during the 20-year mine life is forecast to be $30 million per year.
- During project operations: 66% northern employment and 40% aboriginal employment, 70% of annual supplies of goods and services from northern companies ($223 million total operations spending in 2004)
- Scholarship programs to support education among aboriginal bands, communities and schools at all levels (close to $1 million awarded through some 500 individual scholarships); community-based training partnerships created 250 graduates during construction
- Total $6.4 million provided to communities for capacity building and general wellness programs
- Total cumulative spending with northern businesses in excess of $1.7 billion, or 74% of $2.3 billion project spending since 2003

Tourism

It is likely that the new road would stimulate tourism and recreation activities in the region by providing land access to the parks, lakes and communities along the road. In the study area, the combination of large lakes and wilderness areas will provide measurable benefits to local businesses providing goods and services to the road travellers and tourists. Net tourism benefits will result in additional employment within the region and capital investments in lodges, restaurants and other recreational facilities. These benefits could be significantly enhanced if the road development were conducted in conjunction with a regional tourism development plan in Kivalliq and northern Manitoba.

Commercial Fishing

The proposed all-weather road will provide access to more commercial fishing quotas in northern Manitoba and Kivalliq. The Kivalliq region is home to large populations of fresh and saltwater fish which are currently harvested for subsistence use in the local communities. The new road will enable development of larger-scale commercial fishing in the region and generate an increase in the economic value to the industry.

[25] Source: Diavik Diamond Mines website: http://www.diavik.ca.

Hydro-electric and Utilities Development

As discussed in Section 5.2 above, the proposed Nunavut-Manitoba road could provide significant benefits to hydro-electric, utilities, and other land-based communications development in the region. The road corridor will offer a natural transmission line route interconnecting potential hydro-electric generating sites to the various load centres along and beyond the road limits. The supply of hydro-electricity to the northern communities could displace remote diesel generated electricity with its attendant concerns, such as dependence on non-renewable fossil fuel, as well as air quality and greenhouse gas implications. Dam structures would provide crossing opportunities for the NU-MB road. In fact, river crossings along the preferred route were selected at or near potential hydro sites

Port of Churchill

The Port of Churchill is a strategic connection point for the Nunavut-Manitoba road for a number of reasons. It is Canada's foremost international arctic port and is key to the northern regions' integration into the world economy. With the existing rail and port system, the port supports a network of northern communities and industries, and is the principal staging and supply centre for the Kivalliq communities. To date, the port contributes $26 million to the national GDP and employs over 359 person-years annually.[26] The new road is expected to provide significant economic benefits to the port in terms of increased north-south imports and exports through the port. It will reinforce Manitoba as the service centre for the Kivalliq Region in the provision of efficient, cost-effective and reliable supply of dry goods, perishables and fuel to the Kivalliq communities, and increase Manitoba's competitiveness with other regional gateways in Quebec, Ontario and Saskatchewan. At the national level, the Port of Churchill is Canada's gateway to the arctic region and the proposed terminal of the Marine Arctic Bridge from Russia, Europe and Asia. All these developments would hinge, to a large degree, on the provision of an all-weather road linking Churchill to the rest of Canada and North America.

In summary, construction of the new road will provide direct economic "spin-off" benefits to the region and to local communities in terms of employment, income and GDP. Indirect and induced benefits will also be realized in the form of increased travel, education and business opportunities when the road is in place. To estimate and quantify these "spin-off" benefits of the Nunavut-Manitoba road, a multiplier analysis could be conducted. Regional and national versions of Statistics Canada's Interprovincial Input-Output Model could be used to capture the direct, indirect and induced impacts from the road construction upon employment, income and GDP in Manitoba, Nunavut and Canada respectively. This analysis is not in the scope of the current Route Selection Study, but could be conducted on a stand-alone basis to support funding decisions before proceeding to the next phase of the project. The Manitoba Bureau of Statistics has developed their own models for highway construction and maintenance in their jurisdiction and could be approached to run the models for the Manitoba portion of the Nunavut-Manitoba road.

In addition, a comprehensive economic impact analysis could be conducted as part of the Route Feasibility Study in the immediate next step of the project to quantify the benefits associated with economic development opportunities as a result of the new road. Further studies on the

[26] "Manitoba's Northern Transportation Partnerships", Presentation to Northern Transportation Conference, November 14, 2005, Manitoba Transportation & Government Services.

renewable and non-renewable resources in the region would be carried out, and the impacts of the road on the development potential of these resources would be estimated.

7.2 National Highway Policy

During the last two decades, considerable effort has been undertaken by Transport Canada and the provincial and territorial highways and transportation ministries to identify criteria for inclusion of existing highways in the national system; the condition of these highways relative to nationally agreed performance criteria; and the financial costs, environmental impacts and social benefits associated with bringing deficient highways up to the agreed performance criteria. It is generally recognized by the national, provincial and territorial transportation ministries that: "*A national highway is any existing, primary route that provides for interprovincial and international trade and travel by connecting as directly as possible a capital city or major provincial (or territorial) population and commercial centre in Canada with:*

- *another capital city or major population and commercial centre*
- *a major port of entry or exit to the U.S.A. highway network*
- *another transportation mode served directly by the highway mode*[27]

National highways also include regionally important primary routes that currently serve resource or recreation purposes. Historically, when the Government of Canada have created national infrastructure improvement cost sharing programs, provinces and territories have often earmarked a substantial proportion of the available funding to achieve improvement and strengthening of the National Highway System.

Currently the identified National Highway System in Manitoba includes the Trans Canada Highway i.e. Provincial Trunk Highways (PTHs) 1, 16 and 100; PTH 6 from Winnipeg to Thompson; and PTH75 from Winnipeg to Interstate 29. The Port of Churchill has no all-weather road connection to the rest of Manitoba or Canada. It is connected by rail to the National Highway System at Thompson. Passengers and freight are transported on the railway, known as the Hudson Bay Railway, which connects to the CNR at The Pas. The passenger service is not daily.

The new territory of Nunavut has some limited road segments (often a few kilometres long) within communities but no roads connecting the often widely scattered communities to one another. Iqaluit, the capital of Nunavut, located on Baffin Island across the Hudson Strait from northern Quebec and Labrador, cannot, in practice, be connected by road to the rest of Canada. However,` Rankin Inlet, the administrative and commercial centre of the Kivalliq Region of Nunavut, can be connected by road to both Churchill and the National Highway System in Thompson. The proposed Nunavut-Manitoba road, together with portions of Provincial Roads (PRs) 280, 290 and 391 in Manitoba, will accomplish this connection.

[27] "National Highway Policy Study for Canada", Steering Committee Report on Phase 3, September 1990.

To bring this connection up to national highway criteria would eventually require the following:

- Design speed 100 km/h
- Operating speed 90 km/h
- Two lanes, arterial, undivided (RAU)
- Full shoulders (0.8 m paved shoulder)
- All-weather service (no seasonal load restrictions) carrying national standards for vehicle weights and dimensions
- Riding Comfort Index (RCI) of 6.0 or greater

While satisfying all of these criteria may not be achievable for many decades, we believe implementation of a pioneer all-weather, gravel top road, with a top width of 8 m (two-way operation) connecting Rankin Inlet and Churchill to the National Highway System at Thompson, would meet national transportation policy objectives and as such make the project eligible to receive funding from a federal infrastructure cost sharing program

7.3 Project Funding Considerations

Considering that one key mandate of the Nunavut-Manitoba road is to provide a road connection to Nunavut to reinforce Canadian sovereignty and national interest in the north, it is assumed that the project will be funded primarily using public funds. To understand the scale of capital investments required for the road, a sample capital budget is shown in Table 7-1 based on the preferred staging plan for the all-weather road discussed in Section 6.3.[28] From Year 6 to 10, an annual capital budget of $78 million will be required for the Nunavut portion of the all-weather road between Rankin Inlet, Whale Cove and Arviat. For Year 11 to 20, an annual capital budget of $24 million and $43 million will be required respectively for Nunavut and Manitoba to complete the cross-boundary section between Arviat and Churchill. For Year 21 to 25, an annual capital budget of $26 million will be required for the last section of the road from Sundance/PR290 to Churchill River in Manitoba. Such funding commitments will likely be beyond the reach of the regional and territorial capacities of Manitoba and Nunavut for construction of a single highway project. It is anticipated that the Government of Canada will be the primary funding partner for the Nunavut-Manitoba road, given what we understand to be the federal mandate for the proposed road.

[28] Since the location and phasing of the winter road has yet to be confirmed at later stages of this project, the sample capital budget discussed here excludes the cost of the winter road.

Table 7-1: Sample Capital Budget for Nunavut-Manitoba Road (Preferred Staging AWR)

		Year 6-10 All-weather Road Capital Budget	Year 11-20 All-weather Road Capital Budget	Year 21-25 All-weather Road Capital Budget
Nunavut	i) Rankin Inlet– Whale Cove – Arviat (340 km)	Total $388 million $78 million/yr		
	ii) Arviat – NU/MB Boundary (190 km)		Total $238 million $24 million/yr	
Manitoba	iii) Churchill – MB/NU Boundary (390 km)		Total $427 million $43 million/yr	
	iv) Sundance/PR 290 – Churchill River (180 km)			Total $128 million $ 26 million/yr
Total Cost ($ million)		$388	$665	$128
Total Construction		340 km (68 km/yr)	580 km (58 km/yr)	180 km (36 km/yr)

Note: Capital budget is based on the capital cost for the road segment in 2006 Dollars, including engineering, mobilization, construction and contingency, excluding property acquisition.

For project funding considerations among the various public and private entities, potential beneficiaries of the proposed all-weather Nunavut-Manitoba road (and therefore potential cost-sharing partners) are listed in Table 7-2 below.

Table 7-2: Project Beneficiaries and Cost-sharing Opportunities

Cost-sharing Entities	Project Benefits
Government of Canada	• Fulfillment of national policy direction to provide reliable, all-weather, year-round, surface transportation inter-connection between all provinces and territories (NU is the current exception) • Reduced cost of providing social and medical services (due to reduced passenger travel & freight costs and increased employment opportunities) • Enhanced sovereignty and security in northern Canada to counter international challenges to Canada's jurisdiction o E.g. navigation through the Northwest Passage
Government of Nunavut	• Reduced resupply costs to remote communities (with no roads) served from Rankin Inlet o E.g. Baker Lake, Chesterfield Inlet, Repulse Bay, Coral Harbour • Reduced cost for exporting local products: packaged caribou meat, fish, cottage industry products such as traditional clothing, carving and artwork • Enable large-scale resource development o E.g. mining, eco-tourism, improved access to granular materials • Improved standard of living & increased employment • Opportunity to consolidate public institutions and infrastructure (economy of

	scale) in communities directly connected to road, such as colleges, medical services, docks and airports, government services
Government of Manitoba	• Enhanced service centre for Kivalliq region o Reliable resupply of dry goods, perishables, fuel and medical services • Develop Port of Churchill as international gateway o Improved trade opportunities and access to world markets • Improved access to parks and potential mine sites in Northern Manitoba and Kivalliq
Manitoba Hydro, Qulliq Energy Corp (NU) and other utility companies	• Potential for joint corridor use with reduced construction, accessibility and maintenance costs o Electricity transmission lines (shared power to and from the north) o New hydro-electric generation sites o Other electricity generation sites e.g. wind power o Oil or natural gas pipelines o Telecommunications (e.g. fibre optic cable)
Mining Companies	• Improved accessibility and reduced resupply costs to new mines and promising mineral exploration sites • Reduced transportation cost for exporting mining products

7.4 Community Access Program Approach

Since the Nunavut-Manitoba road is considered an important initiative of the long-term development strategies in the Canadian North, a Community Access Program Approach can be used for the road construction. This approach would shift the focus from short-term road construction to long-term economic development in the region, using a multi-jurisdictional, inter-disciplinary and multi-phased approach to provide stimulus to the regional economy and training opportunities for the local population. It would provide opportunities for using existing training and business development programs and resources in the First Nations and Inuit communities for the construction and operation of the new road. This approach has already been used in Nunavut to a certain degree with the construction of all-weather trails out of Rankin Inlet, towards the Meliadine River, Iqalugaarjuup Nunanga Park and Landing Lakes; out of Whale Cove towards the west; out of Arviat towards the Maguse River; as well as at Chesterfield Inlet.

Constructing the road using a Community Access Program Approach would require that the provincial or territorial governments focus certain activities on the road, including community consultation, education and economic development, which are the focal points of this approach. Options for private sector involvement and contributions could also be explored in training and labour force development. Such options will depend on further resource development in the region, which will be an important study focus in the immediate next phase of this project.

8.0 NEXT PHASES OF ROAD DEVELOPMENT PROJECT

With the completion of the Route Selection Study, it is estimated that a five year period would be required for the road development from feasibility study, environmental assessment, functional and detailed engineering, financial modelling, land assembly, to permits application. The road construction could then start in Year 6 and be completed by Year 25 depending on the funding, delivery and construction phasing decisions from the respective jurisdictions (as discussed in Sections 6.0 and 7.0 above). The future development phases of the proposed Nunavut-Manitoba Road are depicted in Figure 8-1 below. Project tasks and activities are identified in each development phase under two parallel processes: technical and legislative. Depending on the construction/procurement packages, project development could be fast-tracked by overlapping the design, permitting, financing and construction phases, by early engagement of First Nations, regulatory agencies, stakeholders and industry participants, and by possibly employing a public-private partnership model for project financing and procurement. These decisions will need to be explored in more details in Business Case and Route Feasibility Study that follow this current study.

Figure 8-1: Future Development Phases of Proposed Nunavut-Manitoba Road

	FEASIBILITY STUDY & BUSINESS CASE	FUNCTIONAL DESIGN & ENVIRONMENTAL ASSESSMENTS	DETAILED DESIGN/ CONSTRUCTION
Technical Process	Route Selection Study (Complete Nov 2007) Feasibility Study & Business Case (1 to 1.5 years) • Engineering at 1:15,000 • Public, government and stakeholder consultation • Environmental, social and economic assessment (Canada/NU/MB joint process) • Right-of-way identification • Design packages; • Financing and delivery options * Deliverables: Route Feasibility Study Report , Business Case and Financing Plans	Functional Design of Road Packages (2 to 3 years) • Engineering at 1:5,000 rural; 1:2,000 urban • Prepare Project Description and Environmental Impact Statement (EIS) for regulatory approval (Canada/NU/MB joint process) • Public, government and stakeholder consultation • Land assembly, financing and permitting * Deliverables: Functional Design Reports, Project Description, EIS and Procurement Packages	Prepare Detailed Design (in the case of Design/Bid/Build Procurement Package – 0.5 to 1 year) Prepare Construction/ Concession Packages (0.5 to 1 year) • Final land negotiation and assembly • Procure construction managers/concession partners (Request for Qualifications; Request for Proposals) • Establish Project Office for execution and administration Project Award, Financial Close and Project Implementation (All-weather and Winter Road Phases: 5 to 25 years)
Legislative Process	Project Working Group • Members present to INAC, Transport Canada, KIA, NU and MB for: - Approval - Funding for next phase - Procure consultants	Project Working Group • Members present to INAC, Transport Canada, KIA, NU and MB for: - Approval - Multi-year funding for road construction - Facilitate environmental approval process - Procure consultants/Owner's Engineers	Project Working Group • Members present to INAC, Transport Canada, KIA, NU and MB for: - Approval - On-going funding for road construction, maintenance and environmental mitigation - Reporting on construction progress - Reporting on monitoring of natural environment, social issues & benefits associated with project development
	2007-2009	2010-2012	2013-2031

9.0 CONCLUSION AND RECOMMENDATIONS

This report concludes the work completed under a two-year multidisciplinary study to determine the best location for a road route linking the community of Rankin Inlet in the Kivalliq Region of Nunavut to the Port of Churchill in Northern Manitoba and the existing all-weather road transportation network in Manitoba. Three groups of all-weather route corridors were initially generated in the route engineering, socio-economic and environmental scoping analysis. After the first round of public consultations, these corridors were refined to three competing route alternatives, namely the Western, Central and Eastern Alternatives connecting to Manitoba's all-weather road network at Lynn Lake, Thompson and Gillam respectively, all in combination with a Northern Common Route from Rankin Inlet to Churchill.

Using a Multiple Account Evaluation (MAE) framework consisting of financial costs, transportation benefits, social/community, natural environment and economy/national interest accounts, the three route alternatives were evaluated based on how each alternative met the project goals. Based on the results of the MAE, the preferred route was identified to be the Eastern Alternative (in combination with the Northern Common Route), connecting Rankin Inlet to Sundance/PR290 near Gillam, including a link to Churchill. The rationale for selecting this preferred route is summarized as follows:

- Most effective, safe and reliable route from Rankin Inlet, Whale Cove and Arviat to Churchill and Thompson in light of its length, the terrain, the lowest construction and maintenance costs and ease of staging
- Strong support from directly affected communities along the route
- Moderate environmental impact due to shortest length of new road construction and avoidance of all protected areas except the Bradshaw Lake ASI (the width of the Great Beach on which the route is located through this protected area appears to be sufficient to allow for adequate mitigation of impacts along this feature).
- Greatest potential for early extension of the National Highway System to Churchill and Nunavut and in so doing, to address inter-jurisdictional trade opportunities, national sovereignty and security needs.

The preferred route was then presented to the Project Steering Committee, the Project Advisory Committee, the affected communities along the route, and other government/non-government agencies in the second round of public consultations. Generally, strong support was received from the stakeholders and the general public on the prospect of the Nunavut-Manitoba road via the preferred route. First Nations representatives stated that their communities have come to recognize the need for an all-weather road and would adapt to changes associated with a new road. There were concerns that the three remote communities in northwestern Manitoba (i.e. Brochet, Lac Brochet and Tadoule Lake) would not be connected by an all-weather road. It was suggested that the need for an all-weather road by the western communities (in addition to an all-weather connection from Nunavut and Churchill to Gillam) be documented even though it might not be a mandate of the Nunavut-Manitoba Route Selection Study.

Following the selection and consultation of the preferred route, some further technical studies were conducted for the refinement of the preferred route in the areas of terrain analysis, bridge crossings and potential impacts on environmentally sensitive and protected areas. Mining interests, hydro-electric and utilities development prospects were also explored to identify opportunities for joint corridor development along the preferred route. Finally, work staging and implementation considerations were undertaken, project funding opportunities explored and future development phases suggested.

9.1 Technical Feasibility

One key goal of the Route Selection Study was to determine whether it is technically feasible to build an all-weather road from Rankin Inlet to connect to Churchill and Manitoba's all-weather road network. In this study, we have concluded that the Eastern Route Alternative (NRA+ERA) is the best route for this connection and that this route would be technically feasible. Recognizing that the foundation conditions are the controlling factor vis-à-vis the technical performance of the all-weather road, we summarize the technical challenges of each road segment along the preferred route as follows:

a) Rankin Inlet to Caribou River:

- This entire segment lies within the present continuous permafrost zone. This segment is not expected to present unusual performance problems if the road foundation can be maintained frozen. How quickly the continuous-discontinuous boundary will move north from climate warming is unknown. As this boundary moves north with climate change, more of the segment south of the Caribou River is expected to become discontinuous permafrost. At that time, the alignment will develop similar problems to segments that are in the discontinuous permafrost zone, as described in the road segments further south.

b) Caribour River to Seal River:

- This segment of the preferred route is one of the more questionable segments between Rankin and Sundance with respect to foundation performance owing to the potential effects of climate change.
- This segment consists of granular material in esker sections alternating with coarse till. The segment is partly in discontinuous permafrost (south portion) and partly in continuous permafrost (north segment). Climate change may cause some of the continuous permafrost segment south of Caribou River to become discontinuous within an unknown time frame. Till sections in the approximately south half of this segment are expected to perform similar to many till segments along the Churchill railway, Thompson-Gillam, Thompson-Lynn Lake, and Leaf Rapids-South Indian highways, where local cross-section restoration from thaw settlement is required from time to time. Thaw-settlement problems and treatments of these existing road segments in Manitoba can be referenced when constructing and maintaining this new road segment of the NU-MB road.

c) Seal River to Weir River (30 km north of Sundance/PR290):

- The road foundation consists of nearly continuous granular material in a long variable width beach ridge. No significant foundation problems are expected on this segment in what is termed "widespread discontinuous permafrost", with the exception of a few short segments of grade requiring cross-section restoration from thaw settlement.

d) Weir River (30 km north of Sundance/PR290) to Sundance/PR290:

- This segment consists of extensive ice-rich bog peat in discontinuous permafrost. Expected route performance is similar to that along the Churchill railway. The grade may need cross-section restoration resulting from ground ice melt-out (thaw settlement) in the road foundation. Thermosyphons can also be used for ground cooling and stabilization for this section of the road. These have not, however, been included in the cost estimates.

While climate and snow conditions are important factors affecting the performance of the road, it is important to note that road and railway foundations built over continuous and discontinuous permafrost are presently in use in Canada as well as in other countries worldwide (e.g., Scandinavia and Siberia). Example of roads and railways built in Canada in similar climate zones include:

In the discontinuous permafrost zone:

- Churchill railway - settlement problems are ongoing while railway is still in use after 80 years;
- Leaf Rapids to South Indian Settlement in Manitoba;
- Gillam to Lynn Lake in Manitoba;
- Ponton to Thompson in Manitoba;
- Parts of the Dempster Highway in the Yukon and the Northwest Territories;
- Roads leading to Yellowknife, Northwest Territories;
- Parts of northern Saskatchewan where all-weather highways have been built.

In the continuous permafrost zone:

- Parts of the Dempster Highway in the Yukon;
- Inuvik to Arctic Red River to Fort McPherson, Northwest Territories;
- Ekati and Diavik winter roads in the Northwest Territories diamond mine area.

These roads and railways could be referenced in the more detailed design phase of the NU-MB road project to draw on lessons in road construction and maintenance in the northern region.

9.2 Study Recommendations

The key recommendations for the next phases of this project are summarized as follows:

- Conduct feasibility study and business case to confirm the alignment and financial feasibility of the preferred route, including:
  - detailed route engineering using large-scale, ground-controlled aerial photos along the preferred route
  - hydrology design for major bridge crossings along the preferred route
  - local transportation studies to determine the tie-in points of the proposed road to existing trails, municipal infrastructure and other airport/port facilities

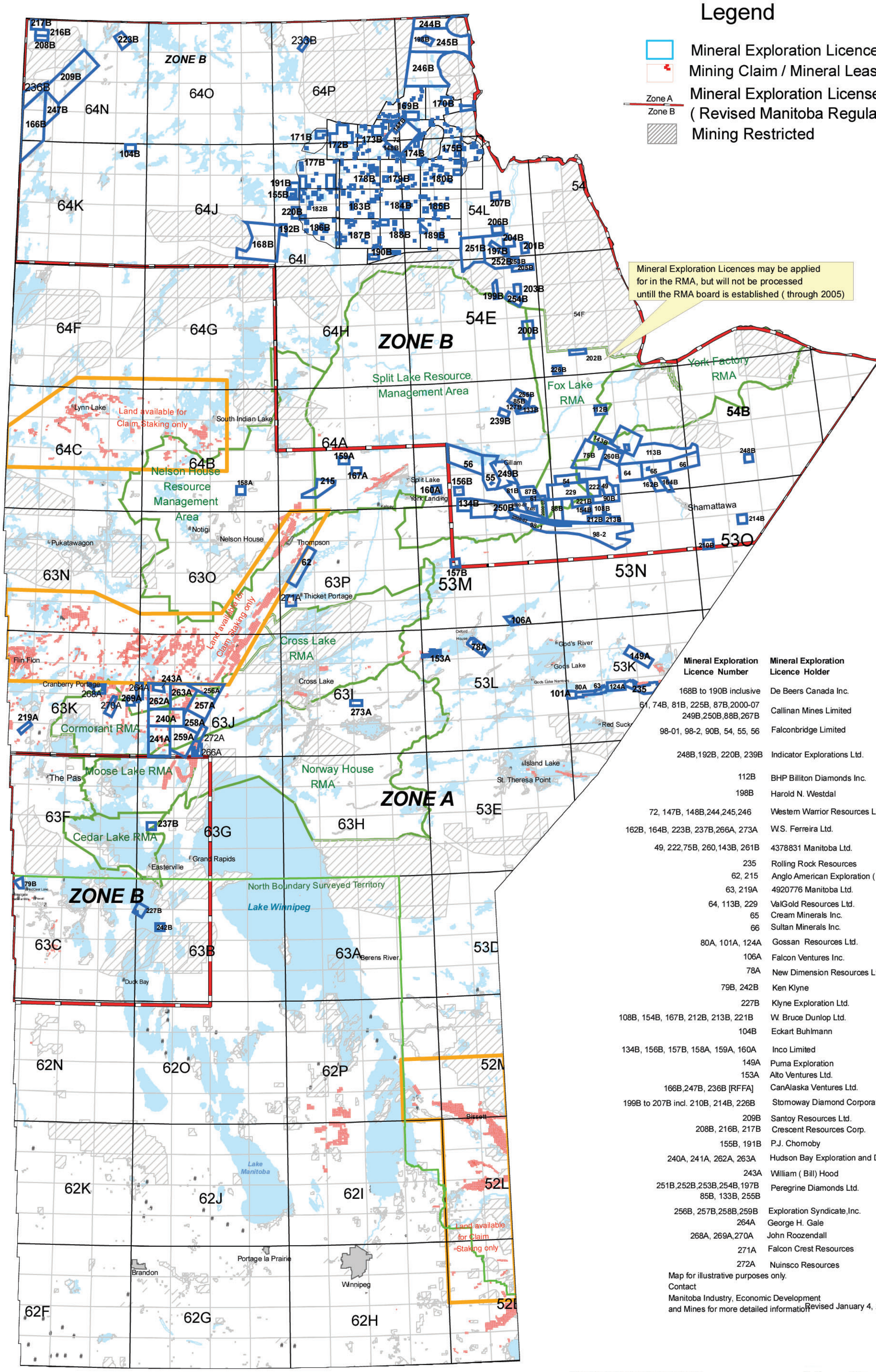
  - benefit cost analysis and financial modelling to confirm project financial feasibility, and to determine construction scope, financing options and procurement packages

- Conduct environmental, social and economic impact assessment to secure project permits and licenses required before construction commences, including:
  - Detailed environmental survey for the entire route from Rankin Inlet to Churchill to Sundance/PR290, including an inventory of the natural and social environmental features to avoid, mitigate or compensate (e.g. archaeological/cultural artifacts, flora & fauna, fisheries and fish habitat, wildlife and wildlife habitat, trap lines and sacred sites)
  - Confirm avoidance/mitigation of proposed road on caribou calving ground, McConnell River Migratory Bird Sanctuary, Caribou River Provincial Park, Bradshaw Lake ASI and other protected areas
  - Conduct an inventory of renewable and non-renewable resource and harvesting data (e.g. caribou, quarries/mineral extraction, forestry, fisheries)
  - Update mining and mineral exploration activities in the vicinity of the preferred route
  - Confirm hydro-electric development plans and prospects with Manitoba Hydro and Qulliq Energy

- Conduct official consultation with the First Nations communities along and affected by the preferred route as required by the regulatory guidelines
- Approach the Governments of Canada, Nunavut and Manitoba, First Nations and other key stakeholders for project approval and funding for the next development phases of the project.

Legend

- Mineral Exploration Licence
- Mining Claim / Mineral Lease
- Zone A / Zone B — Mineral Exploration License Zones (Revised Manitoba Regulation 64/92)
- Mining Restricted



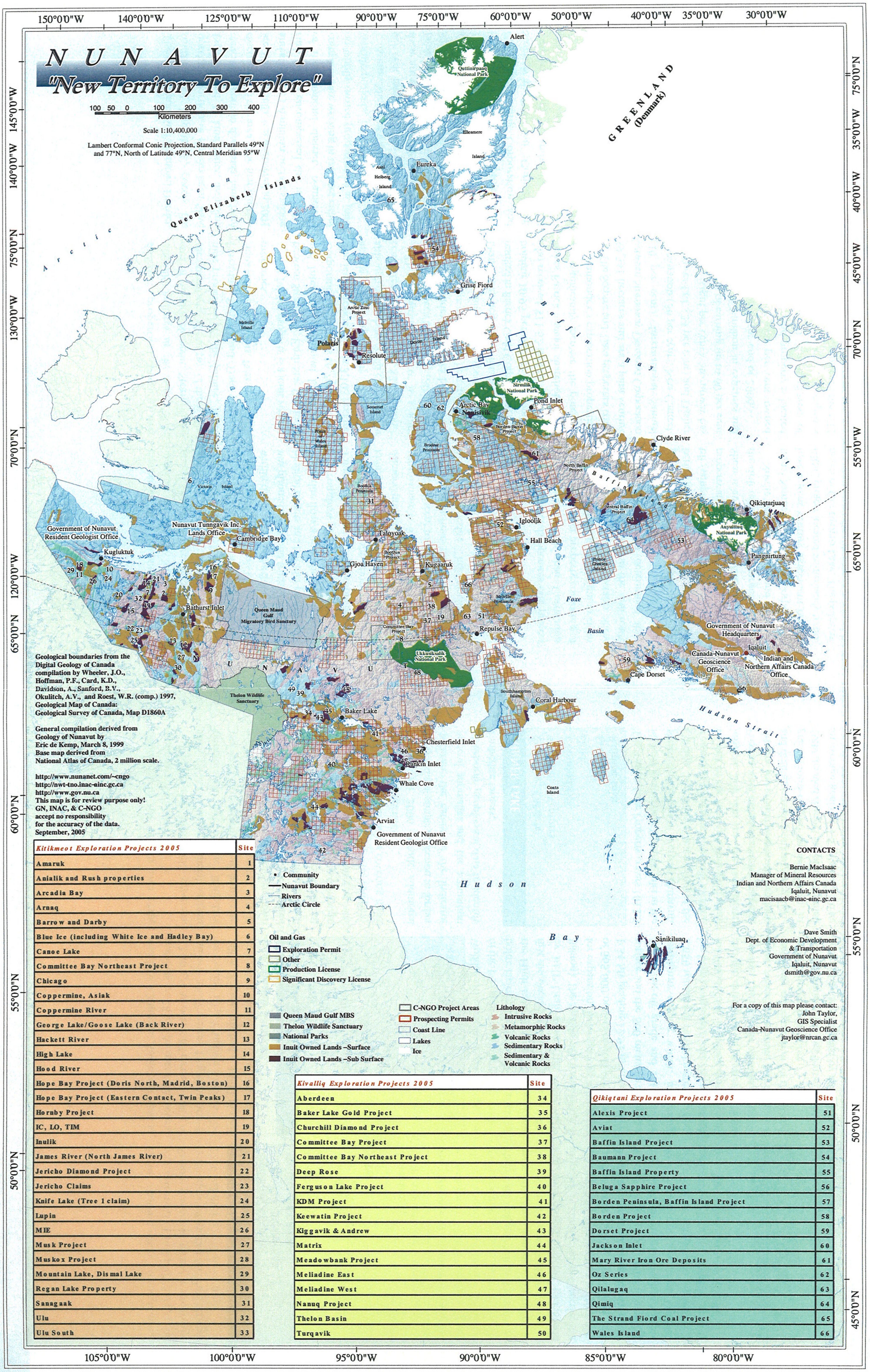
Mineral Exploration Licence Number	Mineral Exploration Licence Holder
168B to 190B inclusive	De Beers Canada Inc.
61, 74B, 81B, 225B, 87B,2000-07 249B,250B,88B,267B	Callinan Mines Limited
98-01, 98-2, 90B, 54, 55, 56	Falconbridge Limited
248B,192B, 220B, 239B	Indicator Explorations Ltd.
112B	BHP Billiton Diamonds Inc.
198B	Harold N. Westdal
72, 147B, 148B,244,245,246	Western Warrior Resources Ltd.
162B, 164B, 223B, 237B,266A, 273A	W.S. Ferreira Ltd.
49, 222,75B, 260,143B, 261B	4378831 Manitoba Ltd.
235	Rolling Rock Resources
62, 215	Anglo American Exploration (Canada) Ltd.
63, 219A	4920776 Manitoba Ltd.
64, 113B, 229	ValGold Resources Ltd.
65	Cream Minerals Inc.
66	Sultan Minerals Inc.
80A, 101A, 124A	Gossan Resources Ltd.
106A	Falcon Ventures Inc.
78A	New Dimension Resources Ltd.
79B, 242B	Ken Klyne
227B	Klyne Exploration Ltd.
108B, 154B, 167B, 212B, 213B, 221B	W. Bruce Dunlop Ltd.
104B	Eckart Buhlmann
134B, 156B, 157B, 158A, 159A, 160A	Inco Limited
149A	Puma Exploration
153A	Alto Ventures Ltd.
166B,247B, 236B [RFFA]	CanAlaska Ventures Ltd.
199B to 207B incl. 210B, 214B, 226B	Stornoway Diamond Corporation
209B	Santoy Resources Ltd.
208B, 216B, 217B	Crescent Resources Corp.
155B, 191B	P.J. Chornoby
240A, 241A, 262A, 263A	Hudson Bay Exploration and Development Co. Ltd.
243A	William (Bill) Hood
251B,252B,253B,254B,197B 85B, 133B, 255B	Peregrine Diamonds Ltd.
256B, 257B,258B,259B	Exploration Syndicate,Inc.
264A	George H. Gale
268A, 269A,270A	John Roozendall
271A	Falcon Crest Resources
272A	Nuinsco Resources

Map for illustrative purposes only.
Contact
Manitoba Industry, Economic Development and Mines for more detailed information Revised January 4, 2007

Map for illustrative purposes only.
Contact Science,Technology, Energy and Mines for more detailed information

Manitoba

Revised January 5, 2007



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Nunavut Planning Commission
Nunavummi Parnaiyiit

April 10, 2007

Government of Nunavut
Department of Economic Development
and Transportation
P.O. Box 1000, Station 1500
Iqaluit, NU X0A 0H0

Attention: Alex Campbell, Deputy Minister

Re: Manitoba Road Route Selection Committee Community meeting, February, 2007, Arviat, Nunavut

Dear Mr. Campbell,

The Nunavut Planning Commission (the NPC) had the opportunity to take part in the Department of Economic Development and Transportation community meeting, regarding results of the Nunavut-Manitoba route selection study, held in Arviat in February of 2007.

As the governments of Nunavut and Manitoba move toward development of a possible all-weather road linking Rankin Inlet, Whale Cove, and Arviat, in Nunavut, with Churchill, Manitoba, the NPC would like to bring to your attention our authority and role with respect to such project proposals under the *Nunavut Land Claims Agreement (NLCA)*.

Under the NLCA, the NPC must "determine whether a project proposal is in conformity with a land use plan" [§ 11.4.4(k)]. This authority extends to both Crown and Inuit Owned Lands, where an approved land use plan exists.

In June of 2000, the Government of Nunavut and the Government of Canada approved the *Keewatin Regional Land Use Plan (KRLUP)*, which, in addition to conformity requirements that apply to all projects, contains specific conformity requirements relating to transportation corridors:

5. Transportation and Regional Infrastructure (p. 32)

5.6 All parties wishing to develop a transportation and/or communications corridor shall submit to the NPC a detailed application for an amendment. This application must include an assessment of alternative routes, plus the cumulative effects of the preferred route. It shall provide reasonable options for other identifiable transportation and utility facilities. In particular, this application must meet the information requirements set out in Appendix I.

5.7 The NPC and either NIRB or a panel acting under s. 12.4.7 of the NLCA shall publicly review the proposed corridor to determine whether the proposal adequately meets the requirements of Appendix I and the guidelines of Appendix J. Once it is determined that a proposal meets the guidelines, the NPC may request the Minister of DIAND to amend the plan to include the new transportation corridor.

The Commissioners and staff of the NPC, in the best interest of the residents of the Kivalliq region, Nunavut, and Canada as a whole, are committed to working with your committee and other agencies to ensure that any project proposal(s) relating to the proposed road are fairly and efficiently tested for conformity with the KRLUP.

Please do not hesitate to contact me, or Adrian Boyd Director, Policy at 867-983-2613 should you have any questions concerning the conformity determination process, the plan amendment process, or the terms of the *Keewatin Regional Land Use Plan*.

Respectfully,

Sharon Ehaloak
Executive Director

Enclosed – Appendix I and J

cc. Michael Nadler, Regional Director General,
Indian and Northern Affairs Canada

John Hodgson, Executive Director,
Kivalliq Inuit Association

APPENDIX I

Marine and Terrestrial Transportation/Communications Corridor Alternative Route Assessment

Applicants wishing to develop a transportation and/or communications corridor in the Keewatin region are required to provide the NPC with the following information:

1. A description of the proposed corridor, including its use, its general routing, the possible environmental and social impacts, and any seasonal considerations that may be appropriate.

2. A comparison of the proposed route with alternative routes in terms of environmental and social factors as well as technical and cost considerations.

3. An assessment of the suitability of the corridor for the inclusion of other possible communication and transportation initiatives (roads, transmission lines, pipelines, etc.). This assessment should include:
   - the environmental, social and terrain engineering consequences, and the cumulative impacts of the project, and
   - the environmental and social impact of the project on nearby settlements or on nearby existing and proposed transportation systems.

APPENDIX J

Marine and Terrestrial Transportation/Communications Corridor Guidelines

The following planning guidelines will be used in the assessment of a new transportation / communications corridor proposal:

1. The corridor width shall be a function of:
   - the number and type of identified facilities within the corridor;
   - physical and biophysical conditions;
   - availability of detailed engineering data for one or more transportation modes within the corridor;
   - safe distances between different facilities within the corridor; and
   - aesthetics.

2. Corridors shall:
   - minimize negative impacts on community lifestyles;
   - improve access to other resources having high potential for development, while still maintaining the shortest practicable distance between the primary resource areas and the trans-shipment location;
   - be designed in accordance with existing and prospective land use capability including topography, soil, permafrost and wildlife; and
   - be designed in accordance with the availability of granular supplies.

3. In keeping with existing legal and legislative requirements, including the NLCA, corridors shall not negatively impact:
   - community business, residential and projected expansion areas;
   - important fish and wildlife harvesting areas;
   - key habitat for fish and wildlife species, especially areas used by endangered species;
   - areas of high scenic, historic, cultural and archaeological value.

3.2.7 Initiate Environmental Pre-Screening and Approvals

The intent is to identify any environmental issues that will have to be addressed in the design process. Ideally, a pre-screening should be initiated for virtually all design projects immediately after the Approved Program Review meeting. In this way, the results of the pre-screening will then be available during the Define Functional Project Scope stage of the design process.

However, the reality of Department practice is that a pre-screening is initiated only once a project becomes active. Therefore, this activity is shown in Stage 2 to occur at the same time as the development of the Work Plan. This allows the pre-screening results to be incorporated into the work. If the pre-screening indicates that an environmental licence will be required, then the licence application process should be initiated as soon as practical. Again, the activities required for environmental approvals must be incorporated into the Work Plan, as they are known. As an example there may be significant drafting and survey requirements.

There will be difficulty defining all of the required environmental work at the start of the functional design. This is because the requirements can change as the design evolves. For example, the location of a road corridor may depend on the severity of environmental impacts along different routes. However, a comprehensive study of environmental impacts cannot be done until the road corridor is finalized. In the same manner, environmental impacts associated with a structure can't be finalized until the structure location is finalized.

The solution to this apparent dilemma is to put in place an iterative process that allows feedback. After every major decision in the design process that affects the environment, the impacts must be re-evaluated. In other words, assumptions regarding environmental impacts will have to be made at the start of the design process. As the design is developed, the impact of changes must be assessed against the original assumptions to ensure that they remain valid. Where they are no longer valid, the design may have to be changed to reflect the actual environmental impacts. All of this depends on regular and comprehensive communication between the Project Manager, Regional Design staff and the Environment Section of Highway Planning and Design.

Consult:

Technical Services Engineer, Design Engineer, Senior Project Engineer/Manager, Planning Technologist, Highway Planning and Design Branch (Environmental Engineer).

Documentation Required:

All correspondence associated with undertaking the pre-screening and environmental approvals should be stored in the Project Binder. Any detailed supporting information for various applications can be stored in the project files. Copies of the pre-screening results and any approvals must be stored in the Project Binder as well as the regional files.

3.2.8 Meet with Relevant Stakeholders

The intent is to gather input from all individuals and agencies (local governments, interest groups, environmental, transportation or business lobbies) that have a significant stake in the proposed project. This will be the first consultation in what should become an ongoing communication program with external stakeholders. Therefore, it is important to identify all relevant external contacts at the start of the project and lay out a framework for future consultations.

Consult:

Technical Services Engineer, Design Engineer and Maintenance Engineer/Manager.

Documentation Required:

At the end of the initial round of consultations, a summary document should be prepared that lists all of the stakeholder issues. This report and any consultation meeting notes should be copied to the Project Binder and the regional files.

3.2.9 Develop Base Plan

The intent is to develop a base plan of the existing conditions and constraints. At a minimum, this includes all legal boundaries and developments. However, any known issues that have a geographic component should be mapped. For example, areas classified as environmentally sensitive should be shown on a drawing. In addition, any zoning or planning jurisdictions should be drawn. Initially, the base plan can be developed from information found on existing legal plans, location plans, profiles and aerial photos. This can be supplemented with field surveys for information not found in these sources. Finally, any relevant external sources of geographic information should be investigated. For example, local governments can be contacted for copies of any development or planning maps.

3.6 Obtain Approvals Stage

There are a number of regulatory approvals that need to be obtained before a transportation project is built.

All approvals that may contain conditions or commitments that may have an impact on the final design of a project should be obtained early in the project design development process before irreversible design decisions are made.

The following approvals should be obtained at the end of the Functional Design Phase.

3.6.1 Manitoba Environment Act License

All developments, proposed or operating in Manitoba, having significant impact on the environment are regulated by *The Manitoba Environment Act.*

Activities related to resource use, water developments, electric transmission lines and roads are classified as developments requiring licensing under the act. For roads, the following would require licensing under the *Act*:

- two-lane roads on new location (including associated facilities and borrow pits),
- Winter roads on new location;
- Alterations to stream channels affecting fish mobility and fish habitat;
- Widening of existing roads in areas sensitive to environmental disturbances;
- Roads of four lanes or more on new location; and
- Interchanges.

All proposals for licensing under the *Act* are filed by the Environment Section of the Department with background information supplied by staff that has been involved in the Functional/Preliminary design of the project.

Once an application is filed, it undergoes an interdepartmental technical review by *The Manitoba Environment Act*, Technical Advisory Committee. The proposal is also placed in a Public Registry; it is advertised in a local newspaper and is subjected to a public review.

At the end of the review, if there are no concerns, a license is issued. If concerns are raised, the department may be asked to supply additional information or may be asked to undertake a more detailed Environmental Impact Assessment to address the issues. If major issues are raised, a hearing of the Clean Environment Commission may be convened. The Commission will then decide the fate of the project.

It should be noted that obtaining a *Manitoba Environment Act* licence would take at least three months. It will take considerably more time if major issues are identified and Clean Environment Commission hearings are held.

Documentation Required:
If a project is licensed under the *Manitoba Environment Act*, a copy of the licence and background information will be sent to the Director of Regional Operations by the Environment Section. A copy of the license should be filed in the Project Binder and the regional file. All background information will be kept in the project files.

If a project does not require licensing under *the Act*, a Letter of Approval will be sent to the Director of Regional Operations by the Environment Section. A copy of this letter should be filed in the Project Binder and the regional files.

3.6.2 Canadian Environment Assessment Approval

The intent of this *Act* is to ensure that environmental effects are considered as early as possible in the project planning stage. *The Act* applies to projects in which the federal government exercises one or more of the following duties or powers:

- Contributes financial assistance to a project;
- Sells, leases, or transfers control of land; or,
- Exercises a regulatory duty.

Canada and the province of Manitoba have entered a harmonization agreement regarding environmental assessments. Through this agreement, when a project is filed for licensing under the *Manitoba Environment Act*, it is also referred to the Canadian Environmental Assessment Agency. The agency circulates the proposal to various federal government departments, undertakes a review of the proposal and makes a decision on the application.

For projects that trigger *The Canadian Environmental Assessment Act* but do not require a *Manitoba Environment Act* licence, information is sent directly to the federal department that has been identified as the responsible authority for the project (e.g. the Department of Indian & Northern Development for projects impacting on Indian Reserves, the Department of Fisheries & Oceans for projects requiring *Fisheries Act* Authorization etc.). The responsible authority undertakes the necessary federal interdepartmental review and makes a decision on the project.

The environment section sends proposals for these approvals with available information from the preliminary/functional components of the project.

Documentation Required:
If a project requires approval under this *Act*, a screening approval will be issued by the federal department that has been designated as the responsible authority. A copy of this approval will be sent to the Project

Manger by the Environment Section and should be filed in the Project Binder and the regional files. All background information should be filed in the project files.

3.6.3 Department of Fisheries and Oceans Authorization

The long-term policy objective of the Department of Fisheries & Oceans is to achieve an overall net gain in the productive capacity of fish habitat.

Section 35 of the *Act* prohibits the harmful alteration, disturbance or destruction (HADD) of fish habitat.

Fish habitat is defined as "...spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes."

The Act provided the Minister of Fisheries & Oceans with the power to authorize terms and conditions that would allow projects to proceed in compliance with the *Act*.

Where fish habitat destruction is unavoidable, losses in a habitat's productive capacity are compensated by habitat replacement or enhancement on a case-by-case basis.

If, through the screening process, it is found that a project may impact on fish habitat, information is sent to the Department of Fisheries & Oceans to see if an authorization under the *Act* is required. If an authorization is not required, the Department will approve the project by issuing a letter of advice where they identify a number of recommendations that, if properly implemented, will minimize impacts on fish and fish habitat. If an authorization will be required, the department will be notified and the environment section will prepare the necessary documentation.

It may take a minimum of three months to obtain an authorization under the *Act*, depending on the complexity of the impacts and required replacements or enhancements.

Documentation Required:
Projects impacting on fish and fish habitats will have to be approved by the Department of Fisheries and Oceans Canada. This approval can be in the form of a formal authorization where impacts are major and compensation is required or in the form of a letter of advice where the impacts can be mitigated. Copies of these approvals will be sent to the Project Manager by the environment section and should be filed in the Project Binder and the regional files.

3.6.4 Navigable Waters Protection Act Approval

The *Navigable Waters Protection Act* became law in 1882. The objective of the *Act* is to protect the public right of navigation by prohibiting the building or placement of any work in, upon, over, under, through, or across a navigable waterway without the authorization of the Department of Fisheries & Oceans (Coast Guard).

A waterway is defined navigable if it's capable of being navigated by a floating vessel of any description for the purpose of transportation, commerce or recreation. The authority to determine if a waterway is navigable rests with the Minister of Fisheries & Oceans.

If a project impacts on a navigable waterway, the environment section submits an application, together with relevant environmental approval documentation, to the Canadian Coast Guard.

The Coast Guard undertakes an interdepartmental review of the proposal. General plans, identifying the type of crossing and pertinent navigability clearance requirements, are deposited in the Land Titles Office and the project is advertised in two local newspapers and the Canada Gazette in order to initiate the public review of the proposal from a navigability perspective.

If there are no negative public reactions and the Coast Guard is satisfied that the proposed crossing will not impact on navigability, an authorization is issued.

It is not unusual to take from six months to one year to obtain this authorization. It may take longer if major issues are identified.

> *Documentation Required:*
> If a project impacts on a navigable waterway, an authorization to proceed will have to be issued by the Canadian Coast Guard. A copy of this authorization will be sent to the Project Manger by the environment section and should be filed in the Project Binder and the regional files. All background information should be filed in the project files.

3.6.5 Stakeholders Approval

Upon completion of the recommended plan and after consultation with the local government, a resolution from the local government accepting the functional design is required. It is in the department's best interest to have written approval to ensure the local government adopts the functional design into their Area Planning Document. This will help protect future right-of-way needs, as dictated in the functional design. It may also be necessary to include an Access Management Plan in the resolution if one was developed as part of the functional study.

APPENDIX 1

MINERAL EXPLORATION MAPS

NUNAVUT AND MANITOBA

APPENDIX 2

Letter from Nunavut Planning Commission

April 10, 2007

APPENDIX 3

Excerpts of Environmental Guidelines

From Manitoba Infrastructure and Transportation

July 26, 2007

Appendix 2: Milestone Report A

NISHI-KHON/SNC◆LAVALIN

December 20, 2006

BY COURIER

Kivalliq Inuit Association
P.O. Box 340
Rankin Inlet, NU
X0C 0G0

016259-30RA

Attention: Dawn Brigham, Project Manager

Dear Ms Brigham:

Re: Nunavut Manitoba Route Selection Study: Milestone Report A (Draft)

We are pleased to submit for your review this draft Milestone Report A for the Nunavut Manitoba Route Selection Study.

This report summarizes the work undertaken prior to the evaluation of alternative routes required to determine the best location of a road route linking the community of Rankin Inlet to the Port of Churchill and the existing all-weather road network in Manitoba. The following work has been completed under Task A of the project work plan:

- Road Development Standards
- Identification of Alternative Routes
- Initial Public Consultations
- Social and Economic Scoping Findings
- Ecological Values and Related Issues

The study next steps under Tasks B to D are briefly discussed. The results of the subsequent tasks will be presented in Milestone Report B and the Final Report, as outlined in this report.

We wish to express our appreciation to the members of the Project Steering Committee, the Project Working Group, the Project Advisory Council and the many residents and organizations in Kivalliq and northern Manitoba for their participation in this important project. This report would not have been possible without their input, interest and support.

Please provide us with your review comments on this draft report by January 15, 2007. We anticipate this report to remain a draft working document until its incorporation into the Final Report for the project.

Yours truly,

SNC◆LAVALIN INC.

T. Stevens

Tim Stevens, P. Eng.
Project Manager

Enclosures

DISTRIBUTION LIST

Project Steering Committee:

Methusalah Kunuk	Assistant Deputy Minister, Transportation, Nunavut Department of Economic Development & Transportation
Tongola Sandy	President, Kivalliq Inuit Association
John Spacek	Assistant Deputy Minister, Transportation Policy & Regulation. Manitoba Infrastructure and Transportation
Ken Vipond	Agreements Coordinator, Manitoba Aboriginal & Northern Affairs

Project Working Group:

Amar Chadha, P.Eng.	Director, Transportation Systems Planning & Development, Manitoba Infrastructure and Transportation
Alan Johnson	Manager, Transportation Planning Nunavut Department of Economic Development & Transportation
Luis Manzo	Director of Lands, Kivalliq Inuit Association
Dawn Brigham	Project Manager, Kivalliq Inuit Association
Lorraine Sourisseau	Regional Manager, Coordination Initiatives, Transport Canada

Others:

Alex Campbell	Deputy Minister, Nunavut Department of Economic Development and Transportation
Andrew Horosko	Deputy Minister, Manitoba Infrastructure and Transportation
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Phoebe Cheung, P.Eng.	Project Engineer
Mike Patterson, P.Eng.	Geotechnical Engineer & Project Liaison
Ben Hubert	Environmental Planning/Public Consultation
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John Hickes	Nunavut Liaison
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NKSL Central Filing	

NISHI-KHON/SNC◆LAVALIN	MILESTONE REPORT A	Date: August 17, 2007
	DOCUMENT NO.: 016259-0000-30RA-0002	Revision No.: 0

CLIENT: **KIVALLIQ INUIT ASSOCIATION**

PROJECT: **NUNAVUT-MANITOBA ROUTE SELECTION STUDY**

	Name	Title	Signature
Prepared by:	Phoebe Cheung, P.Eng.	Project Engineer	
Reviewed by:	Tim Stevens, P. Eng	Project Manager	T. Stevens
Approved by:	Tony Wachmann, P. Eng.	Corporate Sponsor/ Director	ARWachmann

REVISION INDEX

Revision No.	Prepared Date	Reviewed Date	Approved Date	Pages Revised	Remarks
PA	Dec 20, 2006	Dec 20, 2006	Dec 20, 2006	N/A	1st Client Submission
PB	Feb 15, 2007	Feb 15, 2007	Feb 15, 2007	Sections 1.0, 3.1 and 4..1.3	Final Draft
0	Aug 17, 2007	Aug 17, 2007	Aug 17, 2007	Section 1	Issued as Final

COVER LETTER

DISTRIBUTION LIST

REVISION INDEX

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Appendices

1.0 INTRODUCTION

The Kivalliq Inuit Association (KIA), together with the governments of Nunavut (NU) and Manitoba (MB), has retained Nishi-Khon/SNC-Lavalin (NKSL) to carry out a two-year multidisciplinary study to determine the best location for a road route linking the community of Rankin Inlet to the Port of Churchill and the existing all-weather road transportation network in Manitoba, and thence to the National Highway System. This study is commissioned under the auspices of the Nunavut-Manitoba Transportation Memorandum of Understanding (MoU), signed in December 2001 between the two jurisdictions, of which a key objective was collaboration on the road initiative. Throughout 1999 and 2000, a "Manitoba Nunavut Transportation Assessment"[1] was undertaken jointly by the Governments of Canada, Nunavut and Manitoba. This study established that a road connection between Manitoba and Nunavut is a critical requirement to providing communities in the Kivalliq Region of Nunavut with access to Manitoba and the rest of North America. In 2001, the Nunavut Transportation Strategy has further identified the need for a road between Manitoba and the Kivalliq region.

The current study is undertaken to identify a preferred route for this road link. A key plan of the study area is shown in Figure 1-1 at the end of this section. There are three possible locations within Manitoba for the southern terminus of the new route: Lynn Lake, Thompson and Gillam.

As specified in the Proposal for this Route Selection Study, this study is being carried out under four task headings:

- Task A: Initial public consultations[2], social, economic, transportation and environmental analysis of corridors, and preparation of road development standards
- Task B: Route selection
- Task C: Refinement of preferred route
- Task D Final reporting

This report, Milestone Report A, documents the work that NKSL has carried out under Task A. The report also outlines the next steps under Tasks B, C & D necessary to complete the study. The development strategy for the new route, including the link to Churchill, is based on initial staging as a winter road, followed in time by possible construction of a single-lane, all-weather road, then finally, construction of a two-lane, all-weather road. The respective governments see implementation of the new road as a means of supporting the objectives of healthy communities, simplicity and unity, self-reliance and continued learning[3]. Furthermore, it has been determined that the road should enhance opportunities for resource development such as eco-tourism and mining; benefit employment, small business development and standard of living; and increase capital investment by reducing the cost of transporting people and goods between the Kivalliq Region and urban centres in Manitoba.

[1] "Manitoba-Nunavut Transportation Assessment Report" (Prolog, 2000) and "Manitoba-Nunavut Transportation Assessment: Road Corridor Sub-Study Report" (DS-Lea Consultants, 2000).

[2] In this study, the term "consultation" is used to refer to the communications sessions and meetings conducted by the Consultant Team and the Project Working Group with the project stakeholders and the general public for providing project information and receiving feedback for the selection of the preferred route. The term should not be confused with the formal consultation process with the First Nations involving a vote from members of the communities.

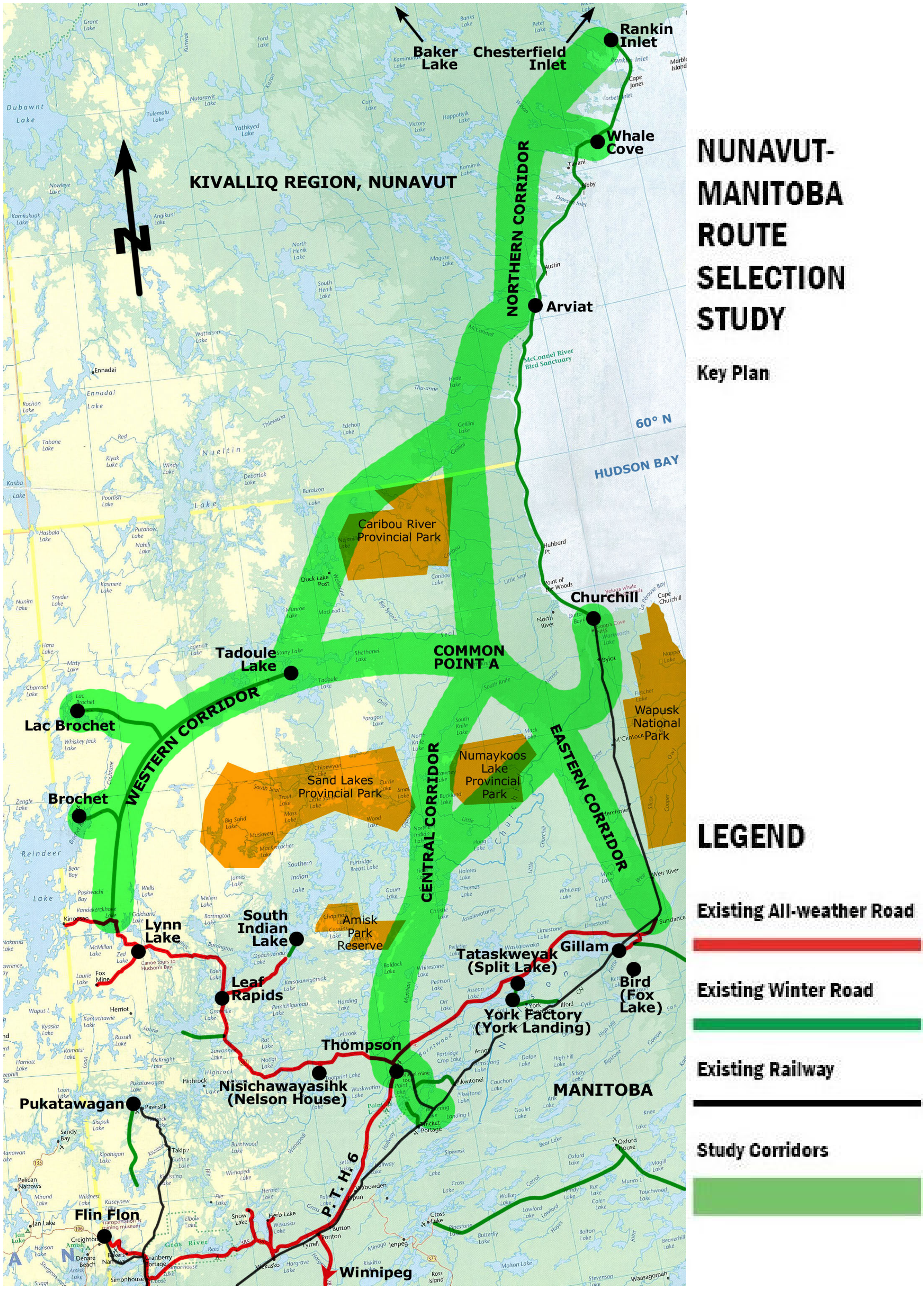
[3] These are priorities specified in the Bathurst Mandate, on which the Nunavut Transportation Strategy 2001 is based.

1.1 STUDY GOALS

The primary goal of this study is to answer the following questions:

- Is it feasible to link Rankin Inlet, NU and Churchill, MB by an all-weather road to the National Highway System in MB?
- What is the likely scope of the social and economic benefits and impacts of an all-weather road on northern communities?
- What are the potential natural environment impacts associated with an all-weather road?
- What is the range of construction and maintenance costs for such a road?
- Can an all-weather road be staged initially as a winter road?
- Where is the best route for an all-weather road, taking into account engineering, the natural and social environment, the regional economy and national interests?
- How strong is the business case for a new road?

Figure 1-1: Study Key Plan



1.2 STUDY AREA

As shown in Figure 1-1, the study area extends from Rankin Inlet in Nunavut to the north, the Hudson Bay to the east, the border between Nunavut and the Northwest Territories to the northwest, the border between Manitoba and Saskatchewan to the southwest, and Thompson, the current terminus of the National Highway System in northern Manitoba, to the south. The study area lies entirely within the Canadian Precambrian Shield where bedrock mantle is or near the surface. The entire study area was glaciated during which continental ice sheets shaped the distribution of glacial land forms such as moraines, eskers, periglacial relics and raised beaches. The multitude of rivers and lakes in the region is caused by the effects of glaciation. The watersheds in the area all drain eastward into Hudson Bay. Elevations of the study area range from sea level along the Hudson Bay to 500 m in the Selwyn Lake Upland. Climatic conditions in the study area are characterized by continuous permafrost in the north and discontinuous permafrost in the south. Mean annual temperature ranges from -11 °C in the north to -4 °C in the southeast.

Incorporated officially on April 1, 1999, Nunavut is the newest and largest geographic territory in Canada. The territory is made up of 3 regions (Qikiqtaaluk, Kivalliq and Kitikmeot) and has a population of 26,745 (2001 Canada Census) spread over a vast area of 1.9 million square kilometres. The population consists of 85% indigenous people, primarily Inuit. Kivalliq is the second largest of the three Nunavut regions with a population of 7,557 (2001 Canada Census). Rankin Inlet is the regional capital of the Kivalliq region and currently serves as the hub for air travel and most freight deliveries to the rest of the region.

For the route selection study, five communities in the Kivalliq Region were included in the study area: three communities along the proposed new road (Rankin Inlet, Whale Cove and Arviat) and two within the region but not directly connected to the new road (Chesterfield Inlet and Baker Lake). The local economy in these communities is made up of a traditional land-based economy with a modern wage-based economy emerging in recent years. The traditional economy is based on Inuit harvesting traditions together with local arts and crafts production. Mineral exploration activity is increasing, creating additional employment and investment opportunities for the local communities. Diamond, gold and base metal deposits are being explored and commercial fisheries are being established throughout the region. These resources, along with potential tourism opportunities in the region, are expected to provide increasing contributions to the region's economy.

Manitoba is the easternmost of Canada's three prairie provinces and has a population of 1.1 million (2001 Canada Census), 60% of which lives in the Winnipeg metropolitan area. The City of Thompson is considered the "hub of the north" and serves as the regional trade and service centre of northern Manitoba. It is currently the northern terminus of Canada's National Highway System via Highway 6 from Winnipeg. Lynn Lake and Gillam are urban centres with all-weather road connection from Thompson to the west and east of the region respectively. Churchill, located on the southwestern shore of the Hudson Bay, is Canada's main seaport on the Arctic Ocean and is linked to the rest of the country by the Hudson Bay Railway currently operated by Omnitrax. In addition to freight traffic (mainly grain exports) carried by Omnitrax, the railway is used by VIA to carry passengers. Aside from Churchill, Lynn Lake, Gillam, and a number of other urban centres, the northern region of Manitoba is primarily made up of First Nations and Metis communities some of which have limited access via winter roads, water or air transport. The First Nations communities aim to be self-sufficient with local amenities such as stores, schools, recreation complexes and health facilities. In some cases, however, serious health issues, achievement of higher levels of education, participation in sporting competitions and the need for rest and recreation, necessitate travel, often at considerable expense, to larger urban centres and facilities.

Within Kivaliq, the proposed new road from Rankin Inlet south to Churchill and Manitoba's all-weather road system needs to be located in a north-south corridor (northern corridor) fairly close to the west coast of Hudson Bay in order to service Whale Cove and Arviat. An earlier study carried out by J.D. Mollard and Associates for the Government of Nunavut identified two preferred routes between Rankin Inlet and Whale Cove. Where the northern corridor approaches the Nunavut/Manitoba border, there are two broad options: i) stay close to the coast and head towards Churchill, staying towards the east side of Caribou River Provincial Park, or ii) head towards Tadoule Lake and stay towards the west side of Caribou River Provincial Park.

The proposed new road from Nunavut will connect to Manitoba's all-weather road network at one of three termini: Lynn Lake (within a western corridor), Thompson (within a central corridor) or Gillam (within an eastern corridor). In addition to Lynn Lake, three communities in northwestern Manitoba are located along the potential western corridor: Brochet, Lac Brochet and Tadoule Lake. Leaf Rapids, South Indian Lake and Nisichawayasihk (Nelson House) are located along or close to the existing all-weather road connecting Thompson to the western corridor. In addition to Gillam, three communities in northeastern Manitoba are located close to the existing all-weather road from Thompson connecting to the potential eastern corridor: Bird (Fox Lake), Tataskweyak (Split Lake) and York Landing. Apart from Thompson, there are no existing communities located along the central corridor. With the exception of Thompson, all these communities are considered remote communities in northern Manitoba, with limited transportation services, high cost of goods, and, in many cases, high unemployment rates.

1.3 CURRENT LAND USE AND TRANSPORTATION SYSTEM

The entire study area has been traditionally used and occupied by tundra-dwelling Inuit in the north and by Dene and Cree in the south. Traditional land rights interests were settled by the Inuit of Nunavut and Canada by way of the Nunavut Land Claims Agreement. KIA is currently the owner of numerous parcels of land in the study area within the Kivalliq region of Nunavut. In Manitoba, the dominant formal land use throughout the study area is conservation as shown by the establishment of Provincial Parks, Reserves and Areas of Special Interest. In Manitoba, notwithstanding Treaty No. 5, there are several outstanding traditional land rights claims.[4] These categories of land use in Nunavut and Manitoba, along with the outstanding land claims in the study area, have been considered in the route selection for the road link between Rankin Inlet and northern Manitoba's all-weather transportation system.

The existing transportation network in the study area is characterized by a severely constrained system serving a small population. Low population density, vast distances between communities and extreme climate have resulted in high costs of goods, materials and labour compared to the rest of Canada. In Kivalliq, in the absence of public roads between the communities and connecting to the rest of Canada, the region is almost wholly dependent on air

[4] Outstanding treaty land entitlements remain for the following Manitoba First Nations in the study area: Brochet – Barren Lands First Nation; Lac Brochet – Northlands Dene First Nation; Tadoule Lake – Sayisi Dene First Nation; Nelson House – Nisichawaysihk Cree Nation; and Fox Lake – Fox Lake Cree Nation.

and seasonal marine services for goods transport and passenger travel. Some goods are moved between Churchill and the Kivalliq communities in the winter via a private operation that moves tractor-drawn sleds over sea ice along the western shore of Hudson Bay. In northern Manitoba, all-weather road connection exists for the communities of Lynn Lake, Leaf Rapids, South Indian Lake, Nelson House, Thompson, Split Lake, Fox Lake and Gillam. The three northwestern communities, Brochet, Lac Brochet and Tadoule Lake, are only accessible by winter roads for up to two or three months in the year. A summary of the population and existing transportation services in selected communities in the Nunavut Kivalliq Region and northern Manitoba is shown in Table 1-1.

Table 1-1: Existing Public Transportation Services - Selected Manitoba and Nunavut Communities

Community	Population[5]	Transportation Service				
		Air	Marine	Rail	Winter Road	All-weather Road
Tadoule Lake, MB	700	✓			✓	
Lac Brochet, MB	900	✓			✓	
Brochet, MB	900	✓	✓[6]		✓	
Lynn Lake, MB	800	✓		✓[7]		✓
South Indian Lake, MB	900	✓	✓			✓
Thompson, MB	15,000	✓		✓		✓
Nelson House, MB	2,600					✓
Split Lake, MB	2,200	✓[8]	✓			✓
Gillam/Bird, MB	1,400	✓		✓		✓
Churchill, MB	1,000	✓	✓	✓		
Arviat, NU	2,000	✓	✓			
Whale Cove, NU	400	✓	✓			
Rankin Inlet, NU	2,500	✓	✓			
Chesterfield Inlet, NU	400	✓	✓			
Baker Lake, NU	1,800	✓	✓			

Specific transportation issues and challenges in the context of a road link between Nunavut and northern Manitoba can be summarized as:

- remote communities with no or limited road infrastructure
- low population density and small markets
- high construction and maintenance costs
- long distances between communities
- extreme climate and difficult terrain

[5] Population in the Manitoba First Nation communities is based on "First Nations Community Profiles Manitoba Region 2007"; population in other Manitoba and Nunavut communities is based on Canada Census 2006, cross-referenced with information provided by the Government of Nunavut for this study.
[6] Marine service available to Brochet via Reindeer Lake.
[7] Rails in place between Pukatawagan and Lynn Lake; public rail service only between Pukatawagan and points south.
[8] Air service at York Landing; residents of Split Lake more likely to travel to Thompson airport.

1.4 CURRENT PUBLIC PERCEPTIONS

A new road in a region that currently has no road connection to the rest of Canada can have a significant impact, both positive and negative, on the inhabitants. It was therefore crucial, early in the study, for the consultant team to meet with local communities and their representatives to receive input related to the potential effects of a new road. In northern Canada, social and economic values as well as the natural environment are closely related and overlapping: the indigenous population and their representatives are clearly the people that have the most knowledge and experience with those opportunities and issues that relate to a potential new road.

In order to receive public input, client representatives and consultant team members met with the Project Advisory Council in Rankin Inlet on November 1, 2005 and in Thompson on November 3, 2005. This council is made up of individuals representing the interests of municipalities, First Nations, business and other entities located in the study area. Two separate meetings were held with the council members in two locations to facilitate travel. As noted later in this report, the team visited ten communities in Manitoba and five in Nunavut in the period from January to October 2006, spending up to one day in each community visited. The community consultations were organized and attended by members of the consultant team who were born, lived and worked in the region: John Makayak Hickes was the local liaison for the Nunavut communities and Churchill, while Daniel Highway was the local liaison for the Manitoba communities except Churchill. John and Dan also attended the Project Advisory Council meetings. Other team members who attended some or most of the community and Project Advisory Council meetings included Ben Hubert, Tony Wachmann, Mike Patterson and Tim Stevens.

The Project Advisory Council and the communities visited were given copies of the project newsletter, maps of all the all-weather route options that were considered to be feasible from an engineering perspective, as well as a powerpoint presentation by the consultant team. Overlaid on the maps and presentation materials was a variety of information including the caribou range and calving areas, provincial parks, Inuit owned land, and treaty land entitlements. The newsletter and powerpoint presentation was also posted on a project website[9] with links from government websites. The newsletter included a return questionnaire for additional public feedback to the study team. A significant number of meetings have also been attended with non-government organizations such as the Beverly and Qamanirjuaq Caribou Management Board (BQCMB) and First Nations (MKIO). The response so far has generally been positive for a new road link with the main issues being:

- Protection of wildlife, especially caribou
- Protection of the natural environment
- Creation of jobs and improvement in standard of living
- The schedule for start of construction of an all-weather road
- Generally positive responses to have a road connecting NU to MB through each community visited
- BQCMB request to look at a railway option than a road.

[9] http://www.nu-mbrss.snclavalin.com

Public perception to a potential new road will be ascertained again during another round of consultation when a preferred route from Rankin Inlet to Churchill and Manitoba's existing all-weather road system will be presented.

2.0 STUDY MANAGEMENT AND METHODOLOGY

2.1 STUDY MANAGEMENT

The study is being carried out by a multi-disciplinary team managed by the NKSL consultant team. As illustrated in Figure 2-1, the Project Steering Committee and Project Working Group represent the interests of the Nunavut, Manitoba and Canadian governments who are co-sponsors of this study. This study is funded by the Canadian government under the Strategic Highway Infrastructure Program, the Manitoba Government, the Nunavut Government and the Kivalliq Inuit Association. The Project Advisory Council is made up of representatives from municipalities, First Nations and other major stakeholders with an interest in the location of the Nunavut-Manitoba road link. The Project Working Group consists of representatives from the respective governments and provides technical and administrative advice to the consultant team.

2.2 STUDY METHODOLOGY

The methodology being used for this study is intended to provide the respective governments with a route selection that will support the realization of the wants and desires of those who live and work in this region, while at the same time minimizing detrimental impacts on the natural environment. The study methodology is shown in the flow charts in Figures 2-2 and 2-3. The study processes are broken into two main streams – Technical Process and Consultation Process. The former refers generally to the technical work of the consultant team which, in conjunction with the Project Working Group, has collected and synthesized topographic, physiographic, geological, social, economic and natural environmental data; generated and evaluated route options from a context-sensitive transportation engineering perspective; made capital and operating cost estimates; and prepared technical reports. The Consultation Process refers to meetings with the Project Advisory Council, the general public and other government/non-government and First Nations organizations. Newsletters, along with the project website, inform the stakeholders and the public of the results of the technical deliberations, and also the ongoing information being gained by the public consultation process. The first newsletter issued included a questionnaire for public feedback and input. The public consultation for this study will end with the issuance of a final newsletter to communicate the results of the study, including the refinement of the preferred route.

Since this study is extending over two years to accommodate public consultation windows, it was felt advantageous to prepare reports at the end of each major milestone in addition to the required Final Report. This Milestone Report documents the work we have completed under Task A (Input Stage and Generate Alternate Routes). It also outlines the work required under Task B (Route Selection), Task C (Refinement of Preferred Route) and Task D (Final Reporting).

Figure 2-1: Study Organization

NU-MB Transport MoU Steering Committee

A. Campbell	Deputy Minister, Nunavut Department of Economic Development & Transportation
A. Horosko	Deputy Minister, Manitoba Infrastructure & Transportation

Project Steering Committee

M. Kunuk	Assistant Deputy Minister, Transportation, Nunavut Department of Economic Development & Transportation
T. Sandy	President, Kivalliq Inuit Association
J. Spacek	Assistant Deputy Minister, Transportation Policy & Regulation, Manitoba Infrastructure and Transportation
K. Vipond	Agreements Coordinator, Manitoba Aboriginal & Northern Affairs

Project Advisory Council

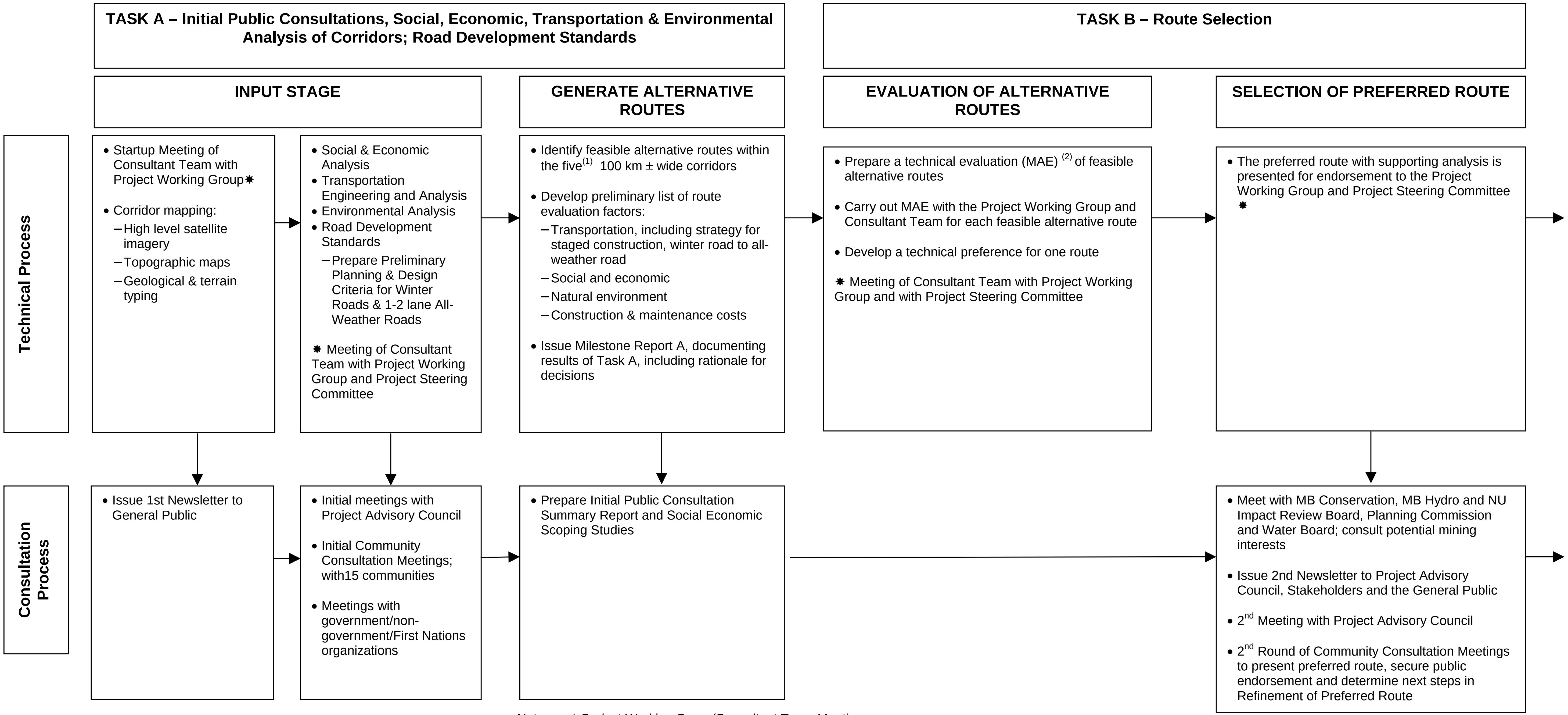
Project Working Group

A. Chadha	Director, Transportation Systems Planning & Development, Manitoba Infrastructure and Transportation
A. Johnson	Manager, Transportation Planning, Nunavut Department of Economic Development & Transportation
D. Brigham	Project Manager, Kivalliq Inuit Association
L. Sourisseau	Regional Manager, Coordination Initiatives, Transport Canada

NKSL Consultant Team

T. Wachmann	Corporate Sponsor/Director
T. Stevens	Project Manager
P. Cheung	Project Engineer
M. Patterson	Geotechnical Engineer & Project Liaison
C. Ganguly	Transportation Engineer
B. Hubert	Environmental Planning/Public Consultation
D. Highway	Manitoba Liaison
J. Hickes	Nunavut Liaison
J.D. Mollard	Route Engineering/Airphoto Interpretation
G. Mollard	Route Engineering/Airphoto Interpretation
D. Witty	Social, Economic & Community Planning
P. Lyall	Transportation Economics
C. Baker	Value Analysis
D. Kuryk	Cost Estimating & Work Staging
J. Dornicak	Quality Assurance

Figure 2-2: Study Flow Chart - Tasks A & B



<u>Notes:</u> ✸ *Project Working Group/Consultant Team Meeting*

(1)	*I*	*Rankin Inlet – South (common corridor)*
	II	*Lynn Lake – North*
	III	*Thompson – North*
	IV	*Gillam – North*
	V	*Churchill – West (common corridor)*
(2)	*MAE = Multiple Account Evaluation*	

Figure 2-3: Study Flow Chart - Tasks C & D

TASK C – Refinement of Preferred Route

INPUT STAGE

Technical Process

- Route Mapping:
  - High level photography
  - Topographic maps
  - Geological & terrain typing
- Road Development Standards:
  - Confirm Preliminary Planning & Design Criteria for Winter Roads and 1-2-lane All-Weather Roads
- Document engineering, social, economic & environmental issues and opportunities along preferred route

CONFIRM & REFINE PREFERRED ROUTE

- Define alignment along the preferred route including link to Churchill
- Review engineering, social, economic and environmental issues and opportunities associated with alignment of preferred route
- Consultant Team to confirm technical preference for alignment of the preferred route
- Issue Milestone Report B, documenting results of the MAE, the preferred route and alignment, and preliminary implementation package

Task D – Final Reporting

REPORTING

- Discuss staging of the road development (initial winter road, followed by a single-lane, then two-lane, all-weather road).
- Discuss the business case for the road development, including potential partnership and procurement opportunities, current and potential future economic opportunities associated with the road access and economic spin-offs.
- Preparation of Final Report (24 copies) by Consultant Team. Includes a Final Summary Report, and extracts from the previously issued Milestone Reports A & B
- Present draft Final Report to Project Working Group & Project Steering Committee for approval✸

Consultation Process

- Issue 3rd Newsletter to Project Advisory Council, to Stakeholders & to General Public
- Results of Refinement of Preferred Route, including rationale for decisions, seek input and reactions

Notes: *✸ Project Working Group/Consultant Team Meeting*

3.0 WORK COMPLETED

The following work under Task A has been either completed or substantially completed as a prelude to carrying out an initial Multiple Account Evaluation of the route alternatives in the next phase of the study:

- Transportation engineering and analysis (including road development criteria, route engineering, construction cost estimates, traffic projections and transportation benefits)
- Initial public consultations
- Social and economic scoping
- Natural environment analysis
- National/Regional Economy and Interests Assessment

The results of these work components are discussed in more detail below.

3.1 TRANSPORTATION ENGINEERING ANALYSIS

3.1.1 Road Development Criteria

i) All-weather Road: Rural Arterial Undivided RAU 80-100

Rankin Inlet has the largest population in the Kivalliq Region, and is an important economic, institutional, cultural and distribution centre for people and goods arriving and departing by air, sea and, in the winter, by a privately operated ice road from Churchill. The proposed all-weather road will, when completed, provide the sole overland fixed link between Nunavut and the rest of Canada, and will therefore likely qualify for National Highway status (similar to the status of PTH6, which connects Thompson to the Trans-Canada Highway at Winnipeg). Assuming that the Nunavut-Manitoba road route will become part of Canada's National Highway System (NHS), the ultimate design standard for this road should conform to NHS standards:

- Two-lane, arterial, undivided with full shoulders (0.8 m paved shoulder and 100 km/hr design speed minimum)
- Capable of providing an operating speed of 90 km/hr
- All weather service (no seasonal load restrictions) and capable of carrying the national standards for vehicle weights and dimensions
- Riding comfort index (RCI) of 6.0 or greater or the equivalent rating using other measurement systems.

For the Route Selection Study, a rural arterial road classification (RAU 80-100) is proposed for initial capital budgeting and to tie route alternatives in to Manitoba's existing all-weather road system in the north (i.e. PR 280, 290 and 391 from Sundance to Thompson, or PR 394 and 391 from Lynn Lake to Thompson). To allow for the future NHS design standard, design and construction should be staged such that the corridor footprint will be established and protected for the ultimate standard. The initial horizontal and vertical alignment of the all-weather road should, if feasible, be based on a design speed of 100 km/hr with allowance for future widening and upgrading to a full NHS standard later.

Preliminary geometric criteria proposed for the new all-weather road are described as follows (see Figure 3-1 for the typical cross sections for the all-weather road):

- Phase 1 Single Lane Road: this is a possible lower cost interim phase to be used if funds are limited, and could apply to the entire length of the road or to portions thereof
    - Top width: 5 m one-lane, one-way, unpaved (i.e. granular surface); passing opportunities would be provided by widening to 8 m at intervals, the spacing being dependent on whether drivers of vehicles were relying on visual cues, or on wireless electronic communication, to be aware of oncoming vehicles from the opposite direction. The 8 m width is considered the minimum practical width to allow safe but slow passing in opposite directions, or for a 2.6 m wide truck to overtake another 2.6 m wide truck stopped at one side of the road.
- Phase 2 Two Lane Road: this could be the next phase in the construction of the all-weather road
    - Top width: 8 m two-lane, two-way, unpaved (i.e. granular surface); the logic for this width is similar to that above for passing opportunities.
- Fill embankment height:
    - 1-1.5 m crush rock or granular materials. This height of road embankment is considered appropriate to provide a satisfactory foundation considering snow clearing and drifting snow, engineering and economic considerations. Excavations in ice-rich, fine-grained soil materials should be avoided. Conventional road construction methods may be used where the foundation materials - such as bedrock without ice in cracks or clean non-frost susceptible sand and gravel without ice - are stable upon thawing.
- Side slopes:
    - Road embankment side slopes will be flatter than customary for rockfill grades for public safety in remote northern areas. A 3:1 slope enables a vehicle to safely traverse the slope, but not necessarily to be able to immediately recover and drive back on to the road (the latter would require a 4:1 slope that is not considered economical for this road at this time, because traffic volumes are expected to be relatively low). Slopes steeper than 3:1, such as 2:1 or 1.5:1 could cause an errant vehicle to overturn, causing serious injury to the driver, passengers and freight, as well as, in the case of tankers, risking serious environmental pollution from spilled fuel.
- Ditches:
    - Drainage is of special importance in road construction in permafrost regions, since frozen ground at shallow depth is a barrier to surface water infiltration and therefore can cause surface water accumulation during summer, even if precipitation is slight. On sloping terrains, the rapid runoff of excess water is an effective erosion agent of frozen soils in addition to creating ponded water against the road embankment toe. A main objective is to keep the water removed from the embankment through proper drainage. Where blasted coarse rock in the bottom of the grade has large connected pore spaces, ponding on the upside grade may allow water to pass through it. In general, in the continuous permafrost zone, natural drainage channels and vegetative cover should be disturbed as little as possible and drainage ditches not excavated. Where ponding of water against the road embankment is a significant problem, particularly in peat-covered lands in the discontinuous permafrost zone,

ditches running parallel to the route alignment should be far enough away from the grade not to create thaw below side slopes, with any ditched excess water diverted into natural drainageways that carry surface water away from the road. Culverts under the road and drainage ditches on the downstream side of the grade are required. However, ditching in continuous permafrost should be minimized wherever possible.

- Design Speed 80-100 km/h:
    - It is proposed to use the higher 100 km/h design speed for both horizontal and vertical alignment where feasible. This will reduce the likelihood of needing to relocate the road in the future if traffic volumes increase, thus avoiding future environmental impacts and right of way acquisition costs.
    - Use lower design speeds for vertical alignment if cost prohibitive. This has similar advantages to the situation above however, initial construction costs will be lower.

<u>ii) Winter Road: Low Volume Road (LVR 30)</u>

- Cleared width:
    - Clearing of trees and tall shrubs should be carried out with no removal of ground cover (small shrubs such as dwarf willows and alder, mosses and lichens). Even a single vehicle pass over the tundra can cause uncontrolled permafrost degradation and runoff erosion. A clearance width of 30 m is typical but may be greater or less depending on the presence of vegetation and trees, or terrain that is susceptible to drifting and blowing snow. Lakes and large bodies of water should be avoided as much as possible to avoid the risk of vehicles breaking through the ice and endangering the vehicle occupants, goods being carried and, in the case of hazardous cargos, environmental damage.

- Design speed:
    - 30 km/h; this will in reality likely be the desired operating speed for the winter road.

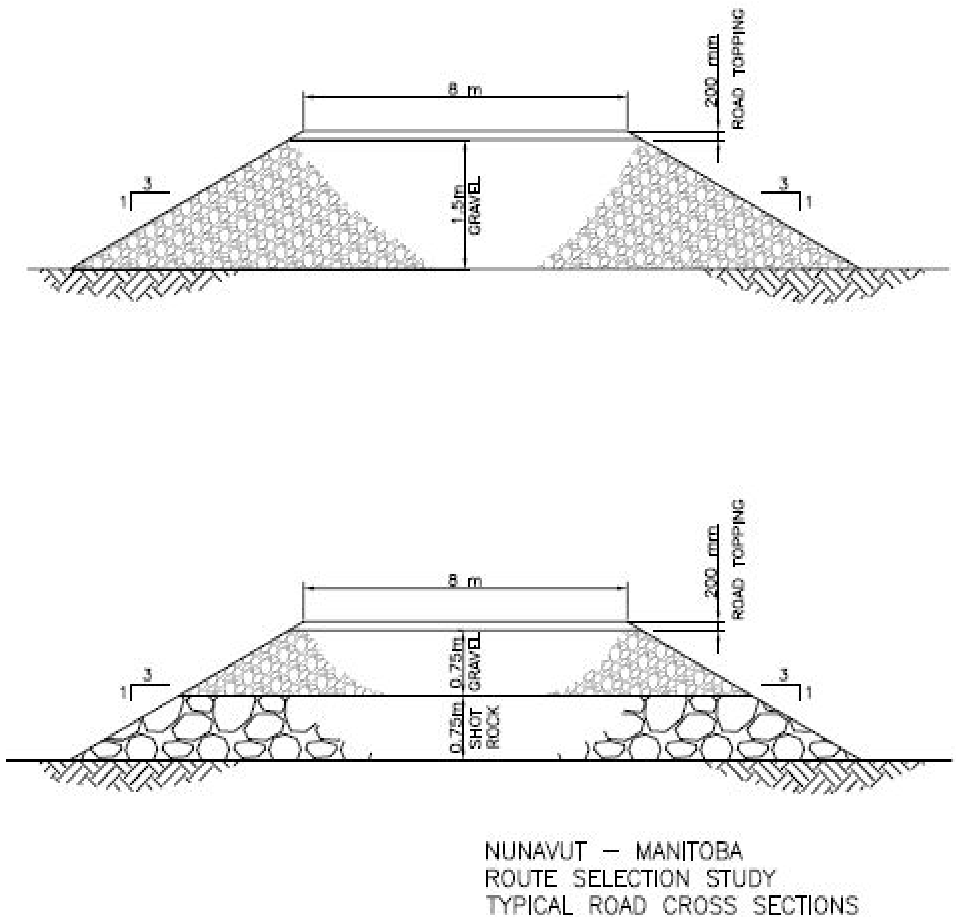
- Horizontal alignment:
    - Desirably the horizontal alignment of the winter road will be compatible with the design speed i.e. in the range 80-100 km/h, of the future all-weather road to which it will eventually develop, and will follow essentially the same alignment. However, since the vertical alignment is determined by the existing ground elevations along the future all-weather route, some local deviations around obstacles may be warranted.

<u>iii) Water Crossing Structures: All-weather Roads and Winter Roads</u>

- Structure clear width 4.3 m:
    - This is sufficient width to accommodate one lane of travel for a 2.6 m wide truck. It is also considered wide enough to accommodate oversize loads such as building components. Acrow type prefabricated panel bridges will be used wherever possible in order to minimize costs and the time required for construction.

- Structure locations:
    - Where feasible, bridges required for the winter road phase will be constructed on the permanent location required for the future all-weather road. This will reduce future environmental impacts and construction costs. Building permanent bridges at water crossings on winter roads improves safety for drivers and freight, may extend the operating season, and reduces the risk of spilling pollutants into fisheries sensitive habitat.

Figure 3-1: Typical Cross Sections - All-weather Road



3.1.2 Route Engineering

Corridor Mapping

Maps, accompanying reports and satellite imagery, were studied to identify feasible alternative narrow route corridors that are relatively direct, follow favourable terrain and avoid unfavourable ground based on engineering cost, social and environmental constraints. Owing to the extensive study area encompassing southeastern Nunavut west of Hudson Bay and much of northern Manitoba, and the difficult and variable terrain conditions there, 31 topographic maps, 41 bedrock geology maps and 31 surficial geology maps were assembled. In addition to these topographic and geologic maps, a collection of environmental, mineral resource and protected land maps were acquired from federal and provincial government agencies to guide the road route selection study (see Appendices 1 to 4 for the engineering reports prepared by J.D. Mollard & Associates).

Route Selection Sequence

In considering route location options, it was decided to select the best alternative road from Rankin Inlet to Churchill Port, and thence from the "Common Point" to three destinations on the existing Manitoba highway system, and at the same time addressing the issue of winter road travel. Current thinking regarding winter roads is to route them overland along the eventual all-weather route. This enables permanent bridges to be built over critical streams and rivers during the winter road phase. It can help overcome the problem of early break-up of ice bridges over lakes and fast flowing rivers and streams, thus enabling longer operation of the winter road, reducing the risk of vehicles breaking through the ice, endangering the life of the vehicle operator and releasing pollutants into fishery-sensitive waters. Furthermore, placing the winter road overland on the ultimate all-weather alignment where possible, can reduce the need for future disturbances and environmental impacts outside an established right of way.

Route Location Criteria

The following criteria were used to generate and locate feasible route alternatives for the proposed all-weather road within the previously referenced northern, western, central and eastern corridors:

- Directness of route between communities, to the extent possible and practical
- Smooth, firm, thaw-stable road foundation
- Avoiding wildlife concerns to the extent possible
- Accessibility to road construction materials
- Gentleness of terrain (i.e. avoid rolling and rugged terrain if possible)
- Minimize construction and maintenance costs
- Minimize length of river crossings; avoid rapids; consider future hydro-electric power generation potential
- Avoid protected areas where feasible

Specific physical and environmental factors and impediments influencing the route selection are shown in Table 3-1 below.

Table 3-1: Route Location Controls and Impediments

Physical and environmental factors influencing the Nunavut-Manitoba route selection and evaluation include the following:

- Large number of closely spaced, long and narrow lakes oriented athwart competing alternative road alignments, especially in the area from Whale Cove to the Wallace River in Nunavut
- Lack of bedrock borrow along significant lengths of alternative road route between Whale Cove and the Manitoba-Nunavut border
- Widely scattered granular borrow, consisting primarily of esker ridges and beach ridges
- Densely boulder-strewn DeGeer and ribbed moraine ridges, both significant impediments to route location and road construction
- Extensive wetland across the thermokarst-affected, pond-dotted marine coastal plain from the Maguse River, north of Arviat, to the 60th parallel
- Multiple wide river crossings across splitting channels, especially approaching Hudson Bay in delta environments
- Extensive ice-rich permafrost peat bogs and fens south of North Knife River in northeastern Manitoba, where the frozen peat in bogs is up to 2 m deep on the marine coastal plain, commonly extending from about 130 m elevation above sea level inland from the coast at Sundance and rising to 180 m inland from the coast in the North Knife River area
- Rolling and uneven relief with bedrock exposures from Rankin Inlet south to about the Wallace River
- Environmentally sensitive areas
- A large number and variety of protected lands of varying sizes
- Prospective future mineral and hydro power resource locations.

Source: Nunavut-Manitoba Road Route Selection Study, Summary Report on Alternative Route Selection, Terrain Mapping and Borrow Location, J.D.Mollard & Assoc., Ltd, June 26, 2006.

Generation of Route Alternatives

A significant number of route alternatives was generated by the consultant team in the route engineering and analysis process. In order to facilitate the subsequent evaluation of route alternatives, it was beneficial to break the routes to be studied and evaluated into a number of groups providing all-weather connection between Rankin Inlet and the all-weather system in Manitoba, together with a cross link to Churchill. We felt this grouping of the routes would reduce the overall analysis workload, and also be an aid to simplifying the public consultation requirements. The groups consisted of western route alternatives (WRA), central route alternatives (CRA) and eastern route alternatives (ERA). Each of the route alternatives (WRA, CRA and ERA) within Manitoba were interconnected with route alternatives between northern Manitoba and Kivalliq to provide a continuous link from Rankin Inlet to Churchill and Manitoba's all-weather road system. These route alternatives were presented to the project stakeholders and the general public in the first round of public consultation starting in early 2006 (see Appendix 8 for a description of these alternatives and the associated exhibits).

3.1.3 Construction Issues and Cost Estimates

The following major issues were taken into account concerning the construction features of all-weather road route alternatives as well as in developing cost estimates for comparing and evaluating these competing alternative routes.

Construction Issues:

i) Permafrost Conditions and Global Climate Change Considerations

The term "permafrost" refers to soil or rock that remains at or below 0℃ for at least two years. Water and ground ice may or may not be present. Earth materials in this thermal condition may be described as permafrost irrespective of their water or ice content. The term "continuous permafrost" means it occurs everywhere beneath the exposed land surface except under deeper parts of lakes and rivers. The term "discontinuous permafrost" refers to the existence of permafrost beneath the ground surface in some areas and not in others (i.e., areas free of permafrost). The active layer refers to the top layer of ground above the permafrost table that thaws each summer and refreezes each fall.

Global climate change, as evident by the rise of air temperatures in the past decades, is a major concern for the Canadian northern regions. Recent studies have predicted a rise of 9°C in mean annual air temperature (MAAT) for the next 100 years for mainland permafrost in Canada, suggesting that the permafrost will start to thaw in the year 2067.[10] Thaw of the surface permafrost will have significant impacts on earth-surface processes and therefore engineered structures. A key question to consider is: if permafrost thaws in a given terrain, will the ground be thaw-stable or will it be thaw-unstable? From an engineering design and construction perspective, the best foundation materials in permafrost terrains are exposed solid rock without ice in cracks, and clean, non-frost-susceptible, well-drained sand or gravel without ice bodies. Both bedrock and granular deposits are sought for roadfill material as well as in thaw-stable roadbed foundations.

Permafrost and ground ice conditions in different terrain types in the study region are studied to identify the potential effects of global warming and related thaw settlement and erosion issues. Based on the interpretation of widely scattered borehole log data, available information from geologic maps and reports, and small-scale (~1:50,000) stereoscopic airphotos, efforts were made to locate a route on relatively ice-poor smooth bedrock, ice-poor sand, gravel eskers, beach ridges and low ice-content basal till landforms derived from eroded Precambrian rock types – rather than high ice-content, complexly stratified, mostly fine waterlaid deposits with and without a peat cover. In road foundations and road construction, ice-rich peat plateau bogs and ice-rich stratified fine waterlaid sediment are among the worst from the standpoint of permafrost. Attempts will be made to avoid these foundations wherever possible in locating the route alternatives.

ii) Icings

Icings are sheetlike masses of layered ice formed on the ground surface, from spring discharges, or on the surfaces of rivers, creeks or lakes. Successive flows of water may freeze after seeping from a spring or emerging from below river ice through cracks. Many icings incorporate snow. Road icings can also form at ice-blocked culverts. As well, road

[10] Holubec, I., "Review of Climate Warming Along Canadian Mainland Continuous Permafrost Region", March 2006.

embankments constructed across small drainage channels can obstruct subsurface drainage flows and cause icings that block traffic. As a result, bridges and culverts must be carefully designed and constructed so that existing stream bed forms, stream flows, and sedimentation are not seriously changed and fish passage is not inhibited. In some locations, stacked culverts may be required and spaced channelized measures or works installed upstream and downstream of bridges and culverts.

The best solution will be site specific, needing to be determined in the future by the designer for each stream crossing.

iii) Geotechnical Design of Road Embankments

The two recognized approaches to geotechnical design of road embankments should be based on whether or not frozen foundation soils and rock are thaw-stable or thawunstable, and whether the usually thaw-stable soils and rock may contain occasional ice bodies in granular soils and ice in cracks in hard rocks. Attempts should be made to not remove but build upon the natural ground cover vegetation (organic mat) and avoid making ditch cuts in the continuous permafrost zone. The use of crushed rock and clean granular materials as roadfill are preferrable. Removal of the insulating ground cover can result in deep permafrost degradation and may not be permitted for environmental reasons.

A shortage of favoured construction materials can mean long haul distances from borrow pits, suggesting that the earthwork quantities be kept to a minimum consistent with geometric and road stability requirements. In general, embankments should be at least 1.2 m thick. High fills should be avoided wherever possible using a rolling gradeline that conforms to the natural ground surface vertical profile. Because geotechnical, hydrological and environmental studies are interdependent, they should be developed together.

iv) Bridges

The locations where a bridge will be required have been identified in the two reports prepared by J.D. Mollard in Appendices 2 and 3. The lengths of the individual crossings are preliminary. Modular bridges are recommended to be used as much as possible. They are a robust design suitable for the heavy loads of highway equipment and are available in standard lengths. This design is favoured for this project because of their modular construction and speed of field erection. The bridges should have a 120 tonne capacity, be 4.3 m wide and have spans from 10 to 40 m. The bridges should be constructed of weathering steel plate girders with treated panelized timber decks and untreated running wear deck and guardrails. The bridge components should be pre-assembled to the fullest extent possible to suit shipping restrictions and to reduce site erection costs. The bridge substructure should be precast concrete pads with coated steel pipe columns and timber ballast walls founded either on bedrock or frozen foundation soils. Bridge abutments should be protected by compacted crushed rock and rock riprap erosion protection adjacent to flowing water. Abutments should be generally placed outside of the wetted stream area with the exception of the major crossings. There are a number of major crossings such as the Seal River (Heritage River) and the Churchill River where modular bridges may not be appropriate. Specialized designs and construction methods may be required because of aesthetic requirements or extreme physical challenges. The J.D. Mollard report in Appendix 4 explores the opportunities for a less demanding crossing of the Churchill River (for all routing alternatives WRA-1, CRA-1 and 2, and ERA-1 and 2).

v) Construction Materials

Typically, natural construction materials are not readily available or are often essentially nonexistent in northern Canada and this also applies along significant sections of the Northern Route Alternative (NRA) within Nunavut. Granular materials and crushed rock are the main source of road embankment fill. Removal of granular material from stream beds will likely be prohibited, and granular material removed from eskers and beach ridges may be restricted for environmental reasons such as certain wildlife, environmental and archaeological restrictions. A road grade composed of blasted/crushed bedrock is recommended for a 1-m thick fill (i.e. 50 mm maximum size on the travelling surface; 0.25 m of 150 mm maximum size blasted rock on 750 mm maximum rock size. Note that 900 mm blast rock is too large a size for 1-m fill but is okay for a 1.5 m fill. The “topping” crushed rock on the grade should be a 150 mm lift of 50 mm maximum rock.

Furthermore, the thickness of material from available granular landforms (without blasting) will decrease from south to north as the average annual air temperature decreases with latitude. Thus it may be necessary to remove and stockpile granular construction materials in the summer season and haul the material to the road right-of-way, for use in road construction during the following winter. Gravel deposits in eskers are routinely highly variable in grain-size composition, ranging from fine sand to coarse gravel over short distances. These sediments may also be “dirty” in their natural state, requiring extensive washing and screening before being used for concrete aggregate. Beach ridge deposits are more consistent in gradation and quality than eskers. Coarse granular outwash and delta deposits, common in parts of the Canadian North, are rare along the routes in the study area.

Cost Estimates:

Preliminary estimates have been prepared for construction and maintenance of all-weather and winter roads. These costs are undergoing an independent check and will be documented in Milestone Report B.

3.1.4 Traffic Projections and Transportation Benefits

A transportation analysis has been undertaken using existing studies[11] to estimate the use of current transportation modes (including air, marine, rail and road) together with the flows of goods and people to and from the communities in the study area. Using this as a baseline, estimates of annual growth rates can provide future traffic volumes for the alternative locations of the proposed all-weather road. The transportation benefits of the proposed road can be derived by comparing the transportation costs under the baseline conditions (with no all-weather road in place) and future forecast conditions with an all-weather road along each of the route alternatives. This work is under way and will be incorporated in the Multiple Account Evaluation of the route alternatives.

[11] Existing transportation studies/reports relevant to this study include: “Manitoba-Nunavut Transportation Assessment Report” (Prolog, 2000); “Manitoba-Nunavut Transportation Assessment: Road Corridor Sub-Study Report” (DS-Lea Consultants, 2000); “Nunavut Transportation Strategy 2001”; “East Side of Lake Winnipeg: All-weather Road Justification and Scoping Study” (Dillon, 2000); “2020 – Manitoba’s Transportation Vision: Strategic Directions Report”; and “2020 Manitoba’s Transportation Vision: Remote Community Consultation”.

3.2 INITIAL PUBLIC CONSULTATIONS

During the initial round of consultation, meetings were held between the NKSL consultant team, the Project Working Group and the following stakeholder and public groups:

A. Project Advisory Council

- First Meeting: Rankin Inlet, NU, November 1, 2005
- Second Meeting: Thompson, MB, November 3, 2005

B. Communities along or affected by the potential route alternatives in Manitoba and Nunavut:

Tadoule Lake, MB	January 31, 2006
Lac Brochet, MB	February 2, 2006
Brochet, MB	February 3, 2006
Lynn Lake, MB	February 6, 2006
South Indian Lake, MB	February 7, 2006
Thompson, MB	February 8, 2006
Nelson House, MB	February 9, 2006
Split Lake, MB	February 10, 2006
Gillam/Fox Lake, MB	February 11, 2006
Baker Lake, NU	February 27, 2006
Rankin Inlet, NU	March 1, 2006
Arviat, NU	March 3, 2006
Churchill, MB	March 4, 2006
Chesterfield Inlet, NU	April 10, 2006
Whale Cove, NU	October 18, 2006

C. Government/Non-Government Organizations and First Nations, including:

- Nunavut Day: Winnipeg, MB, April 27, 2005
- Hudson Bay Neighbours Regional Round Table (HBNRRT): Rankin Inlet, NU, May 18, 2005 and Gillam, MB, October 5, 2005
- Beverly and Qamanirjuaq Caribou Management Board (BQCMB), Rankin Inlet, NU, May 27, 2005 and Winnipeg, MB, Nov 24, 2005 and Nov 7, 2006
- NorMan Regional Development Corporation (NMRDC): Flin Flon, MB, September 9, 2005; Winnipeg, MB, November 24, 2005; and Snow Lake, MB, February 24, 2006
- MB Conservation: Thompson, MB, November 3, 2005; Winnipeg, MB, November 4, 2005
- Thompson Unlimited, Thompson, February 8, 2006
- Keewatin Tribal Council: The Pas, MB, February 14, 2006
- Kivalliq Chamber of Commerce: Rankin Inlet, NU, March 28, 2006

In order to facilitate public comprehension of the large amounts of relevant information, map-type exhibits were prepared from a satellite image base, to illustrate within the study corridors and on an area, line or point basis, the following:

- “Opportunities” such as the most direct route from Rankin Inlet to Churchill and Thompson; number and populations of communities being connected; public accessibility to parks; availability of construction aggregates; gentle terrain;

- “Issues” such as rugged terrain; extensive muskeg soils; severe weather conditions; limited availability of construction aggregates; proximity to wide tidal estuaries; proximity to caribou calving grounds; undesirable impacts to parks and areas of special interest.

In addition to “hard copy” map exhibits, powerpoint presentation materials were also prepared for the community meetings (see Appendices 8 and 9 for the exhibits and powerpoint presentation prepared for the stakeholder and public consultation meetings). Newsletter No. 1 was issued in November 2005 when the consultant team met with the Project Advisory Council (see Appendix 10). It was issued in English, Inuktitut (Syllabic), Cree (Roman and Syllabic) and Dene (Roman and Syllabic). As well as being posted on the project website with links from the government websites, it was extensively distributed in hardcopy at the Project Advisory Council and community consultation meetings. The newsletter also included a return form for additional comments from the public. A few were mailed in by individuals who asked to be put on the project mailing list.

The results and feedback from these consultation meetings are summarized in Appendix 5: Initial Public Consultation Summary Report. The following provides an overview of the consultation summaries from the stakeholders and general public.

A. Project Advisory Council

Members of the Project Advisory Council indicated that the overall study process should be clear and transparent, and that public consultation is very important in the regulatory approval phase of the project. Major issues related to the route selection raised at these meetings included: caribou protection, current land claims in the region, environmental impacts, regional land use, connection to communities, resource extraction, cost of goods/standard of living in remote communities, construction costs and project funding. Some of the First Nations representatives expressed the need for resources to participate in the study and undertook to write a letter to Indian and Northern Affairs Canada (INAC) regarding funding for Dene participation with the study group.

B. Community Consultations

After meeting with the Project Advisory Council, the NKSL consultant team scheduled and conducted consultations in the previously referenced 15 communities within the study area. In the Kivalliq region, community liaison officers were used as a resource to arrange the consultation meetings and to provide advice with respect to local customs, meeting venues and appropriate community officials to be consulted. Members of the NKSL consultant team facilitated the consultation process with the help of local interpreters as required to ensure that the presentation materials were understood by uni-lingual residents. Consultation with the First Nations and community elders was conducted with sensitivity, to elicit Traditional Knowledge, and to flag cultural and environmental issues at the initial round of the consultation process. Public feedback from Nunavut communities focused on the shortest and most economic route south to Churchill and Manitoba’s all-weather road system. Public feedback from Manitoba communities on the locations of route alternatives generally focused on the pros and cons of selection of an eastern route versus a western route. The northwestern Manitoba communities on the winter road system seemed to have a greater interest in a direct all-weather connection to the south than for a direct route to the north. No communities provided any direct feedback on route variations within the western, central, eastern and northern corridors.

To effectively capture the community consultation feedback and to provide input into the evaluation of the route alternatives, the community comments and issues were summarized as they related to Social/Community, Natural Environment and Economy/National Interest concerns. The community comments were also used to inform the Social and Economic Scoping Study as discussed below.

C. Government/Non-Government Organizations and First Nations

The NKSL consultant team received several invitations to attend meetings of government/non-government organizations (NGOs) and First Nations organizations to brief them on the status of the study. During these meetings, exhibits on the proposed route alternatives were provided and a powerpoint presentation was made to the meeting attendees. The presentations made to these organizations were similar to those made to the communities to ensure that all consultations were based on the same information about the study. The presentations were generally well received and generated a high level of interest among all meeting participants. Many participants were in favour of the new road and would like it to service their communities. The issues raised at these meetings were largely similar to those at the Project Advisory Council and Community Consultation meetings. Specific questions were asked about the decision-making process of the route selection, as well as the scope, funding and timing of the road construction.

A resolution letter was sent from the Keewatin Tribal Council Chiefs giving support for an all-weather and permanent road through the northwest region of Manitoba to Nunavut (a western route alternative) to service the Barren Land, Northlands and Sayisi Dene First Nations (see Appendix 11). The study team asked to meet with Manitoba Conservation and did so in Thompson on November 3, 2005, with regional staff, and in Winnipeg on November 4, 2005 with head office staff. Manitoba Conservation followed up with a letter on February 17, 2006 (see Appendix 12). Their main concern is to avoid all provincial parks, reserves and areas of special interest. They indicated a preference for an eastern route alternative as long as it could bypass the Bradshaw Lake Area of Special Interest. The Beverly and Qamanirjuaq Caribou Management Board (BQCMB) has concerns with the impacts of a new road and have asked for a rail option to be studied. Their concerns are documented in a letter dated November 14, 2006 (see Appendix 13).

3.3 SOCIAL AND ECONOMIC SCOPING FINDINGS

A Social and Economic Scoping Study was conducted for the communities located along a potential new route (Arviat, Brochet, Churchill, Lac Brochet, Tadoule Lake and Whale Cove) or at the terminus of a potential new route (Gillam, Bird, Lynn Lake, Rankin Inlet and Thompson). Two complementary approaches were used for the Social and Economic Scoping Study: i) Assessment of Place and ii) State of Community,

- <u>Assessment of Place</u>: individual communities were asked to provide input related to the potential effects of a fixed link upon their community's social/cultural, economic and ecological variables, in effect conducting a self-evaluation of the positive and negative implications of a new road;
- <u>State of Community</u>: key community indicators were identified in the State of Community Base Information Table that summarized the economic, social and cultural conditions of each community in terms of current conditions and potential future conditions with or without a fixed link. The Base Information Table was prepared and follow-up telephone calls were made to key respondents identified for each community.

As documented in the Social and Economic Scoping Findings Report prepared by Dr. D. Witty (see Appendix 6), a review of the community feedback indicates that the communities have identified a number of positive and negative effects resulting from a fixed link connection to the Manitoba road network (see Table 3-1 for a summary of these findings). Overall, there appears to be a neutral to positive view by community members of the Nunavut-Manitoba route proposal. There is widespread agreement that a fixed link will bring economic benefits, but there are some concerns about the social issues (principally an expected increase in drugs and alcohol use) that might arise. Community concerns about the environment were generally negative (impacts on caribou and increasing hunting), resulting in a negative impression of the fixed link upon the environment.

The State of Community study findings are summarized in Table 3-2 based on telephone interviews with the key respondents in each community. The scoping of social and economic considerations for the Nunavut-Manitoba Route Selection Study has confirmed that the majority of communities support a fixed link connection, but that the greatest support exists in four communities studied: Arviat, Churchill, Gillam/Bird, Lynn Lake, and Rankin Inlet. Potential for increased drug and alcohol use and detrimental effects upon caribou were common concerns in most communities. Tadoule Lake expressed particular vulnerability issues around social and environmental considerations. The communities of Brochet and Lac Brochet expressed cautious support for a fixed link. In all communities, there was considerable recognition that a fixed link would reduce cost of goods and provide greater flexibility for construction of houses and other buildings. The findings of this work are key to the evaluation of the route alternatives within the overall Route Selection Study.

Table 3-1: Summary of Self-assessment of Fixed Link Effects[12]

Community[13]	Economic	Environment	Social	Overall assessment
Arviat	+	-	+	**+**
Bird	+	o	o	**o/+**
Brochet	+	-	o/-	**o/-**
Churchill	+	o	o/+	**+**
Gillam	+	o	o/+	**+**
Lac Brochet	+	-	-	**-**
Lynn Lake	+	o	o/+	**+**
Rankin Inlet	+	-	o/-	**o/-**
Tadoule Lake	o	-	-	**-**
Whale Cove	+	o	o	**o/+**
OVERALL	**+**	**-**	**o**	**o/+**

Where: + is positive; o is neutral; - is negative

[12] As stated by community members at the community meetings.
[13] Thompson is not included in this study since its effects are considered positive and equal in all scenarios of a fixed link.

Table 3-2: Key Respondent Feedback by Community

Community[14]	Key respondents					
	CEO/CAO/Band Manager	EDO	Health Care Worker	School Principal	Other	Overall
Arviat	n/a	+	n/a	+	n/a	**+**
Brochet	n/a	n/a	+	n/a	n/a	**+**
Churchill	+	+	+	+	n/a	**+**
Gillam	+	none	+	+	n/a	**+**
Lac Brochet	o	none	o	+	+	**o/+**
Lynn Lake	+	+	+	+	n/a	**+**
Rankin Inlet	+	+	o	+	n/a	**+**
Tadoule	-	+	-	+	+	**o**
Whale Cove	+	+	+	+	n/a	**+**
Overall	**+**	**+**	**+**	**+**	**n/a/+**	**+**

Where: n/a is not available; + is positive; - is negative; o is neutral; none means no such position.

CEO = Chief Executive Officer; CAO = Chief Administration Officer; EDO = Economic Development Officer.

3.4 NATURAL ENVIRONMENT ANALYSIS

A natural environment analysis was conducted to provide an initial scoping of the ecological values and related issues associated with the proposed Nunavut-Manitoba road link. As detailed in the Ecological Values and Related Issues Report prepared by B. Hubert & Associates (see Appendix 7), the study area is generally a large tract of continuous wilderness with relatively little commercial activity other than the isolated communities and related utilities and services. There are three notable exceptions:

- the railroad along the eastern boundary of the study area from Gillam to Churchill; it has been operating for 75 years since 1931;
- the diversion of most of the Churchill River's flow through the Nelson River for hydroelectricity generation; this diversion resulted in significant flooding in the areas of Southern and Northern Indian Lakes.
- the winter road from north of Lynn Lake serving Brochet, Lac Brochet and Tadoule.

The ecological values along the routes within the corridors under consideration (i.e. the northern, western, central, eastern corridors) are similar in that all are dominated by extensive undisturbed landscapes with numerous lakes and rivers. Wilderness values rank very high throughout the study area. In Northern Manitoba this value is reflected in the disposition of lands for provincial parks and Area of Special Interest (ASIs) with their attendant conservation policies (see correspondence from Manitoba Conservation in Appendix 12). In Nunavut, the Caribou Protection Area and the McConnell River Migratory Bird Sanctuary are further expressions of the conservation values recognized for the lands throughout the study area (see correspondence from the Beverly and Qamanirjuaq Caribou Management Board in Appendix 13).

[14] Thompson is not included in this study since its effects are considered positive and equal in all scenarios of a fixed link.

The benefits and risks on the resource use and natural environmental associated with each of the alternatives are classified and assessed under each of the following categories:

- Resources Use:
    - Forestry
    - Tourism Development
    - Ecotourism Development
    - Mineral Exploration
    - Commercial Fishing
    - Trapping
    - Hunting

- Impacts on Natural Environment:
    - Habitat Protection
    - Wildlife Populations
    - Watershed values
    - Fish Populations
    - Heritage Values
    - Protected Areas

3.4.1 Resources Use

Forestry

The southern boundary of the study area generally is at the northern fringe of forests with commercial values in Manitoba. Only the central corridor would provide additional access to Forest Management Units. Terrain conditions are generally such that forest harvesting could occur only in winter and so there is little (if any) incremental benefit of an all season road over a winter road for the forest industry. There may however be a measurable incremental benefit to the industry for the central corridor over the western corridor (which has a winter road) and the eastern corridor which has no commercial forest.

Tourism Development

Conventional tourism is discussed separately from wilderness travel or ecotourism. Conventional tourism is generally considered to be based on the private automobile and /or recreational vehicle. It therefore depends on roads – the better the road the more tourism use it is likely to serve. In this landscape, the combination of large lakes and wilderness suggests measurable benefits to businesses providing goods and services to tourists in both summer and winter. Winter based activities could also be served from the winter road phase. In this consideration there is no incremental benefit for the winter phase for the western corridor. There would, however, be benefits for the winter phase for the other corridors. All corridors would provide the potential of a positive effect on tourism from an all season road.

Ecotourism Development

This assessment assumes that an all season road network may detract from the wilderness experience and so the effect of the summer road for all routes is rated as negative. It is however rated as positive for the winter road phase because the existence of the winter road may permit less expensive resupply of bulk essentials like fuel into remote wilderness resorts without the effect of a summer road diminishing the “wilderness experience”. Also, the development of an all season road network through the region may diminish the wilderness image of the region generally and make lodge and resort based ecotourism to Northern Manitoba more difficult to market.

Mineral Exploration

The effects of a transportation network on mineral exploration will depend on the mineral potential of the region. Consultations in the region provided information on the relative "prospectivity" of the study area. The current exploration activity in northern Manitoba is focused on the area along a common corridor south of the 60th parallel and bordering Hudson Bay. In Nunavut the lands currently under exploration are generally well inland from the northern route alternatives (NRA). Also, the prospectivity of an area changes with both knowledge and interpretation of the regional geology and the global market for minerals. What may not be of any geological interest today may be highly prospective in the future. The rating for incremental benefit to mineral exploration is positive for both winter and all-season roads for all options with the exception of the existing winter road on the western route which is neutral.

Commercial Fishing

Commercial fisheries operate in both Manitoba and Nunavut. Commercial fishing occurs in both summer and winter. In Manitoba the commercial fishery depends on the road network with receiving stations at Kinoosao (northwest of Lynn Lake) and at Leaf Rapids. In Nunavut commercial fish catches are moved by boat in summer and by snowmobile in winter. The latter fishery is largely for local consumption. To the extent that a winter road and an all-weather road would provide road access to more commercial quotas in both Manitoba and Nunavut, both have potential positive effects on commercial fishing generally.

Trapping

In Manitoba, trapping is managed by assigning registered traplines to specific trappers (does not apply to Dene Territory). A winter and all season road would improve access to trappers whose lines are suitably situated relative to the alignment selected. In Nunavut, fur from large carnivores is hunted with trapping occurring when fox pelt prices are high. The effect of an all-weather road on trapping in Nunavut would be marginal.

Hunting

It is generally accepted that increased roads through undisturbed wilderness increases hunting pressure from local and visiting hunters. This would also apply to this road project for the Manitoba segment but may not be the case for the Nunavut segment. In Manitoba, a new road, both winter and all- season will provide access to a large resident hunting public that does not now hunt in that part of the province. In Nunavut, the area and migratory caribou population made more accessible by the road is already accessible to all the hunters that are likely to engage in hunting activities – mainly caribou hunting. The change in Nunavut that may occur is that the geographic and seasonal pattern of hunting may change with the road providing a corridor of year round access through the range of the Qamanirjuaq caribou herd. The potential effects of a new road on the Qamanirjuaq caribou herd , regardless of the final route selected, will be a major issue as this project proceeds to review and permitting. The overall effect of an all season road on caribou would likely include increased harvesting in both Manitoba and Nunavut.

3.4.2 Impacts on the Natural Environment

Habitat Protection

The risk of positive or negative effects of a winter road on habitat values is negligible as demonstrated by the present winter road north of Lynn Lake on the Western Corridor. That changes dramatically for an all-season road for which the risk of wild fire in both forest and tundra would increase significantly. While wild fire is a significant element in the natural cycle of ecosystems, its frequency is likely greater in wilderness areas frequented by humans, posing risks that are greater than those associated with the natural cycle without an all season road. This risk is also reflected in ratings for wildlife and watershed values below. All corridors face the same risks with regard to wild fire.

Wildlife Populations

There are direct incremental risks to wildlife populations from hunting; all new roads change access and may change hunting patterns and so represent risk whether hunting pressure increases or not. All corridors face the same risks in this regard.

Watershed Values

Winter roads are notorious for contributing to spills (mainly fuel) from tankers. The summer risk reflected in the risk rating is related to forest fire effects on watersheds. All corridors face the same risks in this regard.

Fish Populations

Access to lakes and water courses in both summer and winter will introduce an increased harvesting effort and so both winter and all-season roads represent an incremental risk to fish populations within reach of whatever corridor is selected. All corridors face the same risks in this regard.

Heritage Values

A winter road, provided that it does not obliterate or destroy a heritage site does not pose a risk to heritage resources in that they are inaccessible to the scavenging traveller. In summer heritage resources are accessible to all who travel the road. Scavenging sites becomes a risk that is impossible to mitigate. All corridors face the same risks in this regard.

Protected Areas

If Protected Areas are established to reduce the risk of the effects of people, then providing access for people to the vicinity of these lands poses a risk to Protected Areas. The risk is negligible from a winter road, but the risk of summer wild fire increases along all-season roads through wilderness lands. As all corridors pass near protected areas, all corridors pose the same risks in this regard.

The benefits and risks related to the resource use and natural environment discussed will be key to the Multiple Account Evaluation of the route alternatives in the next phase of this study.

3.5 NATIONAL/REGIONAL ECONOMY AND INTERESTS

National/regional economy and interests are important considerations in the route selection study since they provide the strategic context for the evaluation of the route alternatives. The strategic functions of the proposed road can be defined from our understanding of the perspectives of the project sponsors: the Government of Canada, the Government of Manitoba, the Government of Nunavut and the Kivalliq Inuit Association (KIA).

Government of Canada:

The Government of Canada, represented by the Department of Indian and Northern Affairs Canada (INAC) and Transport Canada, is a major sponsor of the Route Selection Study. The proposed road between Rankin Inlet and Manitoba will serve the national interest of Canada in the following aspects:

1. Reinforce Canada's national transportation strategy:
   - Connect Nunavut to Canada's National Highway System, the North America Trade Corridor and the sea port of Churchill
   - Improve access to necessary commodities and reduce isolation for the Kivalliq Region

2. Promote Canada's sovereignty and national economy:
   - Support Canada's assertion of sovereignty
   - Enhance development of Canada's north for improved access and trade opportunities to world markets
   - Support achievement of Canada's national economic and social goals
   - Provide long-term economic benefits to the Nunavut territory

3. Promote partnership opportunities between First Nations communities and public/private organizations.

Government of Manitoba:

Based on Manitoba's Transportation Vision[15] and its northern transportation strategy, the province's strategic objectives for the proposed corridor can be outlined as follows:

1. Reinforce Manitoba as the Service Centre for the Kivalliq Region:
   - Provide efficient, cost-effective and reliable supply of dry goods, perishables and fuel to the Kivalliq communities
   - Provide specialty medical services to Kivalliq and other Nunavut communities
   - Increase competitiveness with other regional gateways in Quebec, Ontario and Saskatchewan.

2. Provide integration of Manitoba as part of Nunavut's Road Initiative:
   - Increase Canada's presence along/within the Arctic Ocean
   - Connect northern development efforts to Canada's main trading corridors (Mid-Continent Corridor and Western Trade Corridors)

[15] Source: "2020 – Manitoba Transportation Vision: Strategic Directions Report", Manitoba Transportation and Government Services.

- Leverage Manitoba's geographic proximity to Nunavut: Manitoba is the only province in Canada with direct overland connection to Nunavut
- Logical extension of the National Highway System via Provincial Trunk Highway 6 at Thompson

3. Enhance the role of Churchill as Canada's international gateway in the Arctic Ocean:
   - Develop Churchill into an international gateway of trade in the arctic region
   - Integrate road infrastructure with existing rail and seaport facilities
   - Promote development of the Marine Arctic Bridge to Russia, Europe and Asia
   - Promote two-way trade between northern Canada, Europe and other world markets

4. Provide equitable treatment and services to the northern communities:
   - Provide all-weather road access to remote communities
   - Improve standard of living
   - Promote healthy and self-reliant communities

Government of Nunavut:

As concluded in the Nunavut Transportation Strategy (2001), the road connection between Rankin Inlet and northern Manitoba is expected to provide the following benefits to the region and affected communities:

1. Enable large-scale resource development:
   - Particularly in the areas of mining and tourism
   - Provide improved access to granular materials

2. Provide improvements to the regional economy:
   - Increase employment, small business development and training opportunities
   - Provide improved access to subsistence harvesting and less dependence on imported foods

3. Improve standard of living:
   - Lower costs for most dry goods, fuel and community resupply
   - Improve transportation links for medical emergencies and healthcare provisions
   - Improve access to education institutions in regional centres
   - Increase inter-community travel opportunities for family and community events

4. Encourage Nunavut-Manitoba travel, trade, community and cultural ties:
   - Reduce dependence on Yellowknife as regional capital in Northwest Territories
   - Reinforce cultural ties between the Inuit communities in northern Manitoba and the Kivalliq Region

Kivalliq Inuit Association (KIA)

Kivalliq Inuit Association (KIA) represents the Inuit of the Kivalliq Region in the development, protection, administration and advancement of their rights and benefits as an aboriginal people and works to promote their economic, social, political and cultural well being.

The development of the proposed Nunavut-Manitoba road corridor will be guided by the following KIA goals:

- To preserve Inuit heritage, culture and language
- To manage Inuit owned lands in the region and provide information to and consult with land claims beneficiaries on land use
- To protect arctic wildlife and the environment, thereby preserving traditional uses for current and future generations.
- To assist Inuit in the Kivalliq region in training and preparation for their new territorial responsibilities.

These objectives and priorities are essential to the Multiple Account Evaluation of the route alternatives in the next phase of this study.

4.0 NEXT STEPS

4.1 TASKS B, C AND D

As described in Section 2.0, Tasks B, C and D are required to select the preferred route for the Nunavut-Manitoba road link, to confirm and refine the alignment of the preferred route, and to document all findings in a Final Report for presentation to the Project Working Group and Project Steering Committee. Key findings will be conveyed to the public in a final newsletter. The outstanding work and deliverables in these tasks are described in more details below.

4.1.1 Task B: Route Selection

B1- Evaluation of Route alternatives:
This includes an evaluation of route alternatives and the selection of a preferred single route. The technical evaluation uses a multiple account evaluation (MAE) approach to identify on a technical basis, quantitative and qualitative impacts, benefits and costs for each of the feasible route alternatives. The purpose of the MAE is to make a comparative evaluation of route alternatives. The accounts include the following:

- *Financial Costs* – lifecycle cost expressed in the net present value, including capital cost, annual maintenance and salvage value.
- *Customer Service* – includes estimates of transportation benefits in terms of savings in freight and passenger transport costs associated with each alternative. These are also calculated as lifecycle costs and expressed as present values.
- *Social/Community/Environmental* – documents external effects of the road project on the communities, social values and the environment. Sub-accounts may be modified to reflect local issues where necessary. Typical accounts include wildlife habitat, fish and fish habitat, land requirements, archaeological impacts, social and community impacts.

The general approach is to establish weights for each account and scores for each alternative. The sum of weighted scores for each alternative is used to rank the alternatives. The weights for each account and qualitative scores for each alternative are established in an MAE Workshop, involving the Project Working Group and the consultant team, as described below:

- Confirm that the route alternatives identified by the consultant team provide the most appropriate solution at the lowest lifecycle cost;
- Identify any other feasible alternatives that will add value, enhance constructability or minimize risk
- Develop a technical preference for just one alternative

As a consequence of the MAE, the Project Working Group/consultant team is to jointly develop a technical preference for just one all-weather route connecting Rankin Inlet to the Manitoba all-weather system together with a cross link to Churchill. The consultant team confirms this route with the Project Steering Committee and meets with the Project Advisory Council, followed by another round of public consultation meetings.

Deliverables: Newsletter No. 2 is prepared, along with a series of exhibits illustrating the preferred route and the decisions leading to this preference. These exhibits are to be presented to the Project Advisory Council and the general public at the second round of consultation meetings.

B2- Selection of Preferred Route:
After the endorsement of the Project Steering Committee, the second round of public consultation is to be conducted in strategically located communities. Newsletter No. 2 is to be posted on the project website in synchronicity with meeting the Project Advisory Council and conducting the community consultations. After synthesizing the results of the second round of consultation meetings, the consultant team will develop firm recommendations for the location of the new route linking Rankin Inlet to the existing transportation network in Manitoba, together with a link to Churchill.

Deliverables: The deliverables from this stage of Task B will include the results of the Project Advisory Council meetings and the second round of public consultations, and the rationale for the consultant team's recommendations.

4.1.2 Task C: Refinement of Preferred Route

C1- Input Stage:
Using existing acquired high-level photography, confirm the topographic maps together with the geological and terrain typing along the preferred route. The preliminary planning and design criteria for winter roads and 1-to-2-lane all-weather roads will be reviewed and confirmed, along with the social, economic and environmental issues and opportunities along the preferred route.

Deliverables: Airphotos and/or topographic maps at an appropriate scale illustrating the preferred route.

C-2 Refine Preferred Route:
Documentation will be provided on the geometric characteristics of the preferred alignment along the selected route; its capital cost and annual operating and maintenance costs; social and economic impacts and benefits; potential environmental impacts and mitigation strategies.; staging of winter road and all-weather phases of the project; and identification of potential implementation partners. The rationale for the preferred alignment will be described in terms of how well it responds to the engineering, social, economic and environmental issues and opportunities associated with locating a fixed link between Rankin Inlet, Churchill and Manitoba

all-weather road system. Some feasible alignment options within the preferred route may be described along with their advantages and disadvantages.

Deliverables: The results of Tasks B and C will be documented in Milestone Report B, including results of the MAE, the preferred route and alignment, the preliminary implementation package, and the results of the consultations with the Project Advisory Committee and the communities. The report will include air photos or topographic maps showing the alignment of the preferred route together with, in some instances, a number of other alignment options.

4.1.3 Task D- Final Reporting

Detailed documentation of the technical and consultation aspects of the study will be provided for the clients' records and as a reference if required by other levels of government, stakeholders and the general public.

The Final Report will initially be presented in draft form to the Project Working Group and the Project Steering Committee for approval. It will include a draft Final Summary Report and extracts from the previously issued draft Milestone Reports A and B. After the draft Final Report has been presented to the previously referenced groups, a final newsletter, Newsletter No. 3, will be distributed.

Deliverables: The Final Report will merge Milestone Reports A and B and address all of the items listed in the RFP, including:

- Documentation of the results of the stakeholder and public consultations;
- Providing a guide on environmental issues to be considered during the following stages of work by others, for both a winter road and an all-weather road;
- Capital and operating costs;
- The geometry of the preferred alignment based on a generalized visual classification from airphotos;
- A discussion on the financial and social merits of building an all-weather road between Manitoba and Nunavut; together with the feasibility of road development within 10-year and 20-year planning horizons.
- Staging of the road development, including the feasibility of an initial winter road, followed by a single-lane, all-weather road, then a two-lane, all-weather road.
- Discussion on the business case for the road development, including potential partnership and procurement opportunities, economic opportunities that are currently available or would be made available as a result of the road, and associated economic spin-offs and benefits.
- The final newsletter that will inform all stakeholders and the general public as to the study results, seek input and reactions, provide rationale for decisions taken and, via a questionnaire, provide for final gap analysis.

The milestones and schedule for the outstanding work in Tasks B, C and D are summarized in Table 4-1 below.

Table 4-1: Project Next Steps – Milestones and Schedule

Activity	Scheduled Completion Date
Tasks B and C - Route Selection and Refinement of Preferred Route:	
• Multiple Account Evaluation Workshop with Project Working Group	October 11-12, 2006
• Presentation of Preferred Route to Project Working Group and Project Steering Committee	November 6, 2006
• Presentation of Preferred Route to Deputy Ministers	November 7, 2006
• Perform Due Diligence on: Traffic Projections, Cost Estimates and Transportation Benefits	January 2007
• Meetings with Manitoba Conservation and Manitoba Hydro	January 2007
• Consultation with Mining Interests in Nunavut and northern Manitoba	January 2007
• Meetings with Nunavut Wildlife Board, Water Board, Impact Review Board, Planning Commission and Environmental Commission	January 29-Feb 2, 2007
• Issue Newsletter #2 and Update Project Website	January 29-Feb 2, 2007
• 2nd Meeting with Project Advisory Council	January 29-Feb 9, 2007
• 2nd Public Consultations	January 29-Feb 9, 2007*
• Finalize Preferred Route Option and Alignment	February 2007
• Issue Milestone Report B	February 28, 2007
Task D – Final Reporting:	
• Prepare Draft Final Report	March 2007
• Presentation of Draft Final Report to Working and Steering Groups	March 21, 2007
• Publish Final Report	April 23, 2007
• Issue Newsletter #3 and Update Project Website	April 23, 2007

*Note: 2nd Public Consultation dates assumes opening of winter road (Lynn Lake-Brochet-Lac Brochet-Tadoule Lake) on February 1, 2007.

4.2 LONG-TERM STRATEGY & PROGRAM

In the Study Final Report, the consultant team may, if required by the client, prepare a long-term strategy and prioritized program for winter and all-weather road development to eventually link all un-serviced communities in the study area. The consultant team will also discuss the following in the Final Report:

- Environmental licensing requirements
- Land tenure issues
- Future training requirements
- Jurisdictional licensing and funding responsibilities
- Business case criteria.

APPENDIX 1

Alternative Route Selection
Terrain Mapping and Borrow Location

(J.D.Mollard & Assoc., Ltd, June 26, 2006)

APPENDIX 2

Bridge Sites on ERA and CRA Road Routes

(J.D.Mollard & Assoc., Ltd, Sept 28, 2006)

APPENDIX 3

Bridge Sites on Western Route Alternative

(J.D.Mollard & Assoc. Ltd, Oct 20, 2006)

APPENDIX 4

Search for Alternative Bridge Crossing Sites on the Churchill River

(J.D.Mollard & Assoc. Ltd, Nov 6, 2006)

APPENDIX 5

Initial Public Consultation Summary Report

(SNC-Lavalin Inc., October 31, 2006)

APPENDIX 6

Social and Economic Scoping Findings Report

(D. Witty, October 24, 2006)

APPENDIX 7

Ecological Values and Related Issues

(Hubert and Associates Ltd., November 2006)

APPENDIX 8

Exhibits for Stakeholder and Public Consultation Meetings

(Exhibits 1 to 4, 10)

APPENDIX 9

Powerpoint Presentation for Stakeholder and Public Consultation Meetings

APPENDIX 10

Newsletter Issue 1 Volume 1

APPENDIX 11

Resolution by First Nations

(February 14, 2006)

APPENDIX 12

Letter from Manitoba Conservation Parks and Natural Areas

(February 17, 2006)

APPENDIX 13

Letter from Beverly and Qamanirjuaq Caribou Management Board

(November 14, 2006)

APPENDIX 14

List of Project Meetings:

Project Working Group and Project Steering Committe

Appendix 3. Initial Public Consultation

NUNAVUT MANITOBA
ROUTE SELECTION STUDY

KIVALLIQ INUIT ASSOCIATION
GOVERNMENT OF NUNAVUT
PROVINCE OF MANITOBA

INITIAL PUBLIC CONSULTATION

SUMMARY REPORT

NKSL Project No. 016259
October 31, 2006

NISHI-KHON/SNC◆LAVALIN

NISHI-KHON/SNC◆LAVALIN	**INITIAL PUBLIC CONSULTATION SUMMARY REPORT** DOCUMENT NO.: 016259-0000-30RA-0001	Date: October 31, 2006 Revision No.: 0

CLIENT: **KIVALLIQ INUIT ASSOCIATION**

PROJECT: **NUNAVUT-MANITOBA ROUTE SELECTION STUDY**

	Name	Title	Signature
Prepared by:	Phoebe Cheung, P.Eng.	Project Engineer	
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	Ben Hubert	Consultation Coordinator	
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	David Witty, Ph.D.	Social, Economic and Community Planning	
	Mike Patterson, P.Eng.	Project Liaison	
Approved by:	Tony Wachmann, P. Eng.	Project Director	ARWachmann

REVISION INDEX

Revision No.	Prepared Date	Reviewed Date	Approved Date	Pages Revised	Remarks
PA	October 20, 2006	October 27, 2006	October 27, 2006	N/A	1st Draft for Internal and Client Review
0	October 31, 2006	December 8, 2006	December 11, 2006	ES, Section 3.2	Includes Whale Cove Consultation; Submitted as Appendix in Milestone Report A

EXECUTIVE SUMMARY

Background

The governments of Nunavut and Manitoba, together with the Kivalliq Inuit Association (KIA), are carrying out a two-year multidisciplinary study to determine the best location for a surface transportation route linking the community of Rankin Inlet in Nunavut to the existing all-weather surface transportation network in Manitoba. The purpose of this study is to select a route for a potential fixed link all-weather road, and to evaluate the financial/social/economic/environmental opportunities and issues of constructing and operating a roadway servicing stakeholders in the region. As shown in the key plan in Figure 1, three possible locations within Manitoba for the southern terminus of the new route are considered: Lynn Lake, Thompson and Gillam. A cross-link to the Port of Churchill is a common feature of all route alternatives.

In parallel with the Technical Process to identify the location of the preferred route, a Consultation Process is undertaken to inform and consult the major stakeholders, the affected communities and the general public of the progress of the study. Two rounds of public consultation will be conducted as part of the Route Selection Study: i) initial public consultation with all major stakeholders and communities to introduce the study scope, approach, methodology, schedule and project team, and to discuss and receive public input on project issues and opportunities; ii) final public consultation with the affected stakeholders and communities to present the selection of the preferred route with supporting analysis, rationale for key decisions, and to discuss and receive public input on issues and opportunities for the refinement of the preferred route. This report summarizes the results of the initial stakeholder and public consultations conducted by the Nishi-Khon/SNC-Lavalin (NKSL) Consultant Team and the Project Working Group between April 2005 and October 2006.

Consultation Scope And Schedule

During the initial round of consultation, meetings were held between the NKSL Consultant Team, the Project Working Group and the following stakeholder and public groups:

A. Project Advisory Council (see Appendix 1 for the attendees of these meetings):
- First Meeting: Rankin Inlet, NU, November 1, 2005
- Second Meeting: Thompson, MB, November 3, 2005

B. Communities along or affected by the potential route alternatives in Manitoba and Nunavut, including:

• Tadoule Lake, MB	January 31, 2006
• Lac Brochet, MB	February 2, 2006
• Brochet, MB	February 3, 2006
• Lynn Lake, MB	February 6, 2006
• South Indian Lake, MB	February 7, 2006
• Thompson, MB	February 8, 2006
• Nelson House, MB	February 9, 2006
• Split Lake, MB	February 10, 2006
• Gillam/Fox Lake, MB	February 11, 2006

• Baker Lake, NU	February 27, 2006
• Rankin Inlet, NU	March 1, 2006
• Arviat, NU	March 3, 2006
• Churchill, MB	March 4, 2006
• Chesterfield Inlet, NU	April 10, 2006
• Whale Cove, NU	October 18, 2006

C. Government/Non-Government Organizations and First Nations, including:

- Nunavut Day: Winnipeg, MB, April 27, 2005
- Hudson Bay Neighbours Regional Round Table (HBNRRT): Rankin Inlet, NU, May 18, 2005 and Gillam, MB, October 5, 2005
- Beverly and Qamanirjuaq Caribou Management Board (BQCMB), Rankin Inlet, NU, May 27, 2005 and Winnipeg, MB, Nov 24, 2005
- NorMan Regional Development Corporation (NMRDC): Flin Flon, MB, September 9, 2005; Winnipeg, MB, November 24, 2005; and Snow Lake, MB, February 24, 2006
- MB Conservation: Thompson, MB, November 3, 2005; Winnipeg, MB, November 4, 2005
- Keewatin Tribal Council: The Pas, MB, February 14, 2006
- Kivalliq Chamber of Commerce: Rankin Inlet, NU, March 28, 2006

D. Social and Economic Scoping Study

In addition to the above consultation meetings, a Social and Economic Scoping Study was conducted for the communities located along a potential new route (Arviat, Brochet, Churchill, Lac Brochet, Tadoule Lake and Whale Cove) or at the terminus of a potential new route (Gillam, Bird, Lynn Lake, Rankin Inlet and Thompson). Two approaches were used for the Social and Economic Scoping Study: i) Assessment of Place and ii) State of Community.

- Assessment of Place: individual communities were asked to conduct a self-evaluation of the positive and negative implications of a fixed link upon their community's social/cultural, economic and ecological variables.
- State of Community: key community indicators were identified in the State of Community Base Information Table that summarized the economic, social and cultural conditions of each community in terms of current conditions and potential future conditions with or without a fixed link. The Base Information Table was prepared and follow-up telephone calls were made to key respondents identified for each community.

Consultation Feedback Summary

A. Project Advisory Council

Members of the Project Advisory Council indicated that the overall study process should be clear and transparent, and that public consultation is very important in the regulatory approval phase of the project. Major issues related to the route selection raised at these meetings included: caribou protection, current land claims in the region, environmental impacts, regional land use, connection to communities, resource extraction, cost of goods/standard of living in remote communities, construction costs and project funding. Some of the First Nations representatives expressed the need for resources to participate in the study and undertook to write a letter to Indian and Northern Affairs Canada (INAC) regarding funding for Dene participation to the study group.

B. Community Consultations

After meeting with the Project Advisory Council, the NKSL Consultant Team scheduled and conducted consultations in communities along the route alternatives. In the Kivalliq region, community liaison officers were used as a resource to arrange the consultation meetings and to provide advice with respect to local customs, meeting venues and appropriate community officials to be consulted. Consultation materials were prepared in English, Cree, Dene and Inuktitut for community review. Members of the NKSL Consultant Team facilitated the consultation process with the help of local interpreters as required to ensure that the presentation materials were understood by uni-lingual residents. Consultation with the First Nations and community elders was conducted with sensitivity, to elicit Traditional Knowledge, and to flag cultural and environmental issues at the initial round of the consultation process. To effectively capture the community consultation feedback and input into the evaluation of the route alternatives, the community comments and issues were summarized as they related to Social/Community, Natural Environment and Economy/National Interest concerns (see Table 1 for the summary of feedback from each community). The community comments were also used to inform the Social and Economic Scoping Study as discussed below.

C. Government/Non-Government Organizations and First Nations

The NKSL Consultant Team received several invitations to attend meetings of government/non-government organizations (NGOs) and First Nations organizations to brief them on the status of the study. During these meetings, exhibits on the proposed route alternatives were provided and a powerpoint presentation was made to the meeting attendees. The presentations made to the NGOs were similar to those made to the communities to ensure that all consultations were based on the same information about the study. The presentation was generally well received and generated a high level of interest among all meeting participants. Most participants were in favour of the new road and would like it to service their communities. The issues raised at these meetings were largely similar to those at the Project Advisory Council and Community Consultation meetings. Specific questions were asked about the decision-making process of the route selection, as well as the scope, funding and timing of the road construction. A resolution letter was sent from the Keewatin Tribal Council Chiefs giving support for an all-weather and permanent road through the northwest region of Manitoba to Nunavut (a western route alternative) to service the Barren Land, Northlands and Sayisi Dene First Nations.

D. Social and Economic Scoping Study

A review of the community feedback indicates that the communities have identified a number of positive and negative effects resulting from a fixed link connection to the Manitoba road network (see Table ES-1 for a summary of these findings). Overall, there appears to be a neutral to positive view by community members of the Nunavut-Manitoba route proposal. There is widespread agreement that a fixed link will bring economic benefits, but there are some concerns about the social issues (principally an expected increase in drugs and alcohol use) that might arise. Community concerns about the environment were generally negative (impacts on caribou and increasing hunting), resulting in a negative impression of the fixed link upon the environment.

The State of Community study findings were summarized in Table ES-2 based on telephone interviews with the key respondents in each community. The scoping of social and economic considerations for the Nunavut-Manitoba Route Selection Study has confirmed that the majority of communities support a fixed link connection, but that the greatest support exists in four communities studied: Arviat, Churchill, Gillam/Bird, Lynn Lake, and Rankin Inlet. Potential for increased drug and alcohol use and detrimental effects upon caribou were common concerns in most communities. Tadoule Lake expressed particular vulnerability issues around social and environmental considerations. Other communities of Brochet and Lac Brochet expressed cautious support for a fixed link. In all communities, there was considerable recognition that a fixed link would reduce cost of goods and provide greater flexibility for construction of houses and other buildings. The findings of this work will be included in the evaluation of the route alternatives as part of the overall Route Selection Study.

Table ES-1: Summary of Self-assessment of Fixed Link Effects[1]

Community[2]	Economic	Environment	Social	Overall assessment
Arviat	+	-	+	**+**
Bird	+	o	o	**o/+**
Brochet	+	-	o/-	**o/-**
Churchill	+	o	o/+	**+**
Gillam	+	o	o/+	**+**
Lac Brochet	+	-	-	**-**
Lynn Lake	+	o	o/+	**+**
Rankin Inlet	+	-	o/-	**o/-**
Tadoule Lake	o	-	-	**-**
Whale Cove	+	o	o	**o/+**
OVERALL	**+**	**-**	**o**	**o/+**

Where: + is positive; o is neutral; - is negative

Table ES-2: Key Respondent Feedback by Community

Community[3]	Key respondents					
	CEO/CAO/Band Manager	**EDO**	**Health Care Worker**	**School Principal**	**Other**	**Overall**
Arviat	n/a	+	n/a	+	n/a	**+**
Brochet	n/a	n/a	+	n/a	n/a	**+**
Churchill	+	+	+	+	n/a	**+**
Gillam	+	none	+	+	n/a	**+**
Lac Brochet	o	none	o	+	+	**o/+**
Lynn Lake	+	+	+	+	n/a	**+**
Rankin Inlet	+	+	o	+	n/a	**+**
Tadoule	-	+	-	+	+	**o**
Whale Cove	+	+	+	+	n/a	**+**
Overall	**+**	**+**	**+**	**+**	**n/a/+**	**+**

Where: n/a is not available; + is positive; - is negative; o is neutral; none means no such position

[1] As stated by community members at the community meetings.
[2] Thompson is not included in this study since its effects are considered positive and equal in all scenarios of a fixed link.
[3] Thompson is not included in this study since its effects are considered positive and equal in all scenarios of a fixed link.

TABLE OF CONTENTS

1.0 PROJECT OVERVIEW

The governments of Nunavut and Manitoba, together with the Kivalliq Inuit Association (KIA), are carrying out a two-year multidisciplinary study to determine the best alignment for a surface transportation route linking the community of Rankin Inlet in Nunavut to the existing all-weather surface transportation network in Manitoba. The purpose of this study is to select a route for a potential all-weather road and to evaluate the financial/economic opportunities and social impacts of constructing and operating a roadway network servicing known and potential stakeholders in the region. The study also includes a preliminary evaluation of the environmental issues related to staging the road development from an initial winter road to an ultimate all-weather road. As shown in the key plan in Figure 1, three possible locations within Manitoba for the southern terminus of the new route were considered: Lynn Lake, Thompson and Gillam. A cross-link to the Port of Churchill is a common feature of all route alternatives.

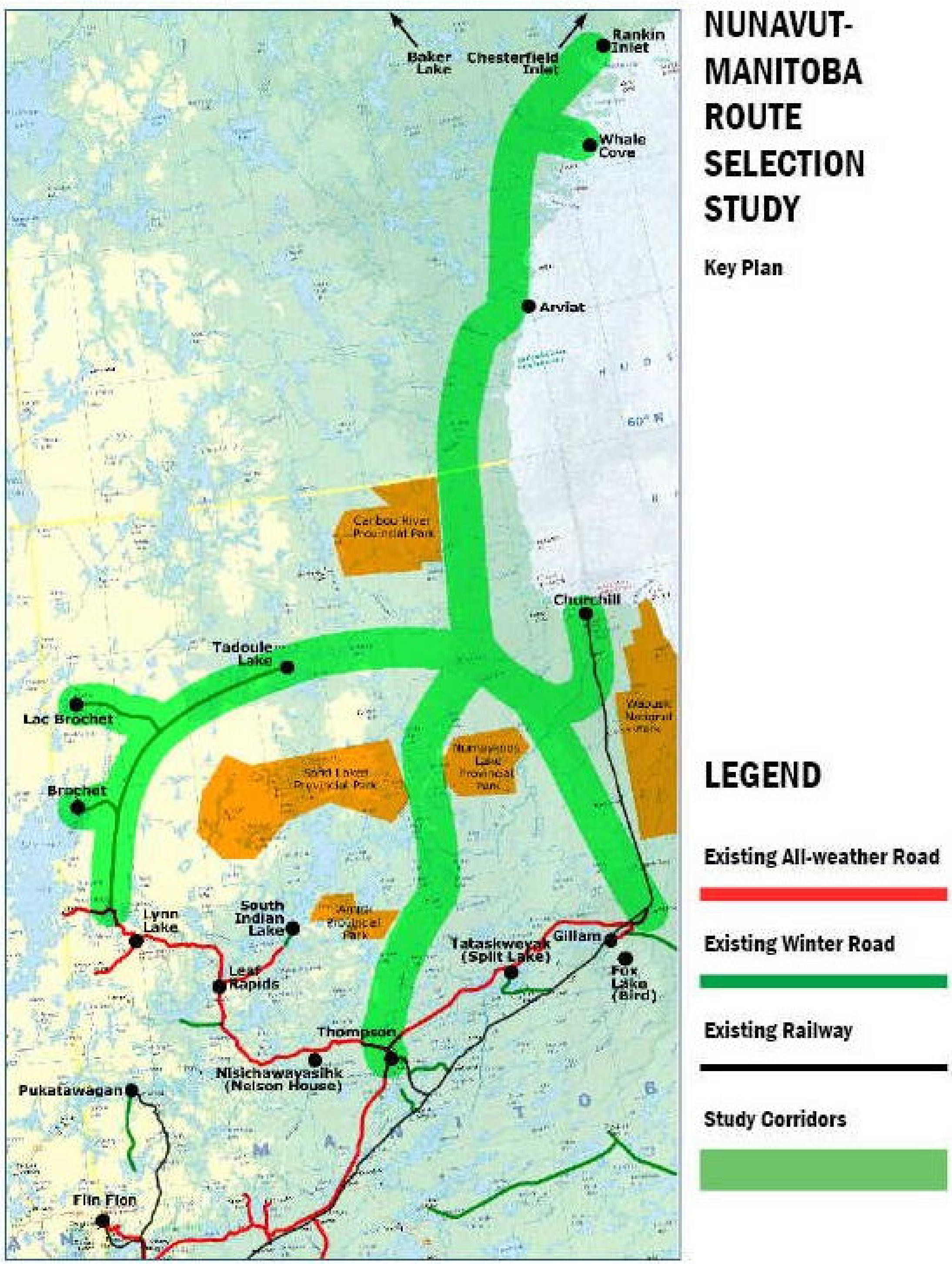
Nishi-Khon/SNC-Lavalin (NKSL) was retained to undertaking this study. The study is being carried out under four task headings:

- Task A: Initial public consultations, social, economic and environmental assessment of corridors, road development standards.
- Task B: Corridor and route selection.
- Task C: Refinement of selected route.
- Task D: Final Reporting

The study processes are broken into two main streams – the Technical Process and the Consultation Process. The former refers generally to the technical work of the NKSL Consultant Team (in conjunction with the Project Working Group) in the collection and synthesis of topographic, physiographic, geological, socio-economic and natural environmental data; generation and evaluation of route and alignment alternatives from a context-sensitive transportation engineering perspective; capital and operating cost estimates; and preparation of technical reports. The Consultation Process refers to meetings with the Project Advisory Council, major stakeholders and the general public, together with the issuance of newsletters which, as the study progresses, informs stakeholders and the public of the results of the technical deliberations and the information being gathered from the ongoing public consultation process. Future newsletters will include questionnaires for public feedback and input. The public consultation for this study will end with the issuance of a final newsletter and questionnaire.

The Consultation Process involves two rounds of stakeholder and public consultations, the initial round as part of Task A, and the final round as part of Task B. This report summarizes the results of the initial stakeholder and public consultations conducted by the NKSL Consultant Team and the Project Working Group between April 2005 and October 2006.

Figure 1: Study Key Plan



2.0 OVERVIEW OF PUBLIC CONSULTATION

2.1 Consultation Objectives

The objectives of the public consultation are:

1. To provide the stakeholders and the general public with a thorough understanding of the study scope and an opportunity to input their issues and concerns into the study process;

2. To allow the NKSL Consultant Team and the Project Working Group to receive input from the stakeholders and the general public to ensure that their input are considered in the selection of the preferred route;

3. To allow the NKSL Consultant Team and the Project Working Group to capture any new concepts not previously conceived; and

4. To provide the Project Working Group with a permanent record of the consultation process including the public concerns raised in each of the communities.

2.2 Consultation Stages, Scope and Schedule

Two rounds of public consultation will be conducted as part of the Route Selection Study:

i. Initial Public Consultation: meetings with all major stakeholders and communities in the input stage of Task A to introduce the study scope, approach, methodology, schedule and project team, and to discuss and receive public input on project issues and opportunities.

ii. Final Public Consultation: meetings with the affected stakeholders and communities to present the selection of the preferred route with supporting analysis, rationale for key decisions, and to discuss and receive public input on issues and opportunities for the refinement of the preferred route.

During the Initial round of consultation, meetings were held between the NKSL Consultant Team, the Project Working Group and the following stakeholder and public groups:

A. Project Advisory Council:

- First Meeting: Rankin Inlet, NU, November 1, 2005
- Second Meeting: Thompson, MB, November 3, 2005

B. Communities along the potential route alternatives in Manitoba and Nunavut, including:

• Tadoule Lake, MB	January 31, 2006
• Lac Brochet, MB	February 2, 2006
• Brochet, MB	February 3, 2006
• Lynn Lake, MB	February 6, 2006
• South Indian Lake, MB	February 7, 2006
• Thompson, MB	February 8, 2006

• Nelson House, MB	February 9, 2006
• Split Lake, MB	February 10, 2006
• Gillam/Fox Lake, MB	February 11, 2006
• Baker Lake, NU	February 27, 2006
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- Nunavut Day: Winnipeg, MB, April 27, 2005
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- Beverly and Qamanirjuaq Caribou Management Board (BQCMB), Rankin Inlet, NU, May 27, 2005 and Winnipeg, MB, Nov 24, 2005
- NorMan Regional Development Corporation (NMRDC): Flin Flon, MB, September 9, 2005; Winnipeg, MB, November 24, 2005; and Snow Lake, MB, February 24, 2006
- MB Conservation: Thompson, MB, November 3, 2005; Winnipeg, MB, November 4, 2005
- Thompson Unlimited, Thompson, February 8, 2006
- Keewatin Tribal Council: The Pas, MB, February 14, 2006
- Kivalliq Chamber of Commerce: Rankin Inlet, NU, March 28, 2006

3.0 CONSULTATION FEEDBACK SUMMARY

3.1 Project Advisory Council

The Project Advisory Council, under the auspices of the Project Steering Committee, provides advice and feedback to the Project Working Group and the NKSL Consultant Team on issues related to the public consultation of the Route Selection Study. Two Project Advisory Council meetings were held in November 2005. The meeting schedule, location and attendance are shown below.

Project Advisory Council Meeting 1
Date: Tuesday November 1, 2005
Time: 3:00 – 7:00 pm (CST)
Location: Bay Shore Conference Centre, Rankin Inlet, Nunavut
Attendees:

NAME:	REPRESENTING:
Lorne Kusugak	Hamlet of Rankin Inlet
John Hodgson	Hamlet of Rankin Inlet
Stanley Adjuk	Hamlet of Whale Cove
Tony Amanyak	Hamlet of Chesterfield
Ray Mercer	Kivalliq Chamber of Commerce
Bryan Purdy	Municipal Planning Engineer

Tongola Sandy Luis Manzo Stephen Hartman	Kivalliq Inuit Association
Alan Johnson Enuk Pauloosie Tom Rogers Robert Connelly	Government of Nunavut Department of Economic Development & Transportation
Amar Chadha	Manitoba Transportation and Government Services
Tony Wachmann Tim Stevens Mike Patterson Ben Hubert John Hickes	Nishi-Khon/SNC-Lavalin

Project Advisory Council Meeting 2

Date: Thursday November 3, 2005
Time: 3:00 – 7:00 pm (CST)
Location: Council Chambers, City Hall, Thompson, Manitoba
Attendees:

NAME:	REPRESENTING:
Mike Spence	Town of Churchill
Glenn McLean	Hamlet of Baker Lake
Jerome Deneghe	Lac Brochet
John Danfouze	Lac Brochet
Joe Danttouze	NCB Lac Brochet
Joe Guy Wood	Manitoba Keewatinook Ininew Okimowin (MKIO)
Pauline Detlanik Keaze	Northlands First Nations
Joe Hislop	Northlands First Nations
Reg Meade	NACC
Jim Goymer	Town of Gillam
Morley Moore	NCN
Dennis Fenske	City of Thompson
Tim Johnston	City of Thompson
Judy Kolada	City of Thompson/NorMan RDC
Audie Dulewich	Town of Lynn Lake
Bruce Bodie	Tolko Industries Ltd.
Rylan Reed	Manitoba Housing Renewal Corp.
Judy Prescott	Town of Leaf Rapids
Iris Thornton	Omnitrax
Amar Chadha	MB Transportation & Govt Services
Doug McMahon	MB Transportation & Govt Services
Alan Johnson	Government of Nunavut

Kerri Thomas	Aboriginal & Northern Affairs
Cory Young	
Archie Enakwinnure	
Tony Wachmann	Nishi-Khon/SNC-Lavalin
Tim Stevens	
Mike Patterson	
Ben Hubert	
Dan Highway	

Prior to meeting with the Project Advisory Council, a newsletter was prepared in English, Cree, Dene and Inuktitut (in Roman and syllabic characters) to provide the project background, location, schedule, overall description of route alternatives, and criteria for the route selection (see Appendix A for the newsletter in English version). Exhibits were also displayed at the meetings showing the western, central and eastern alternative all-weather routes, together with all alternatives generated from a review of surficial geology, bedrock geology and topographical maps (see Appendix B). A powerpoint presentation (Appendix C) was also made by the NKSL Consultant Team to the meeting attendees to provide a project overview and work status to date.

The feedback and input from the members of the Project Advisory Council during the meetings are summarized as follows.

<u>Kivalliq Inuit Association (KIA):</u>

- The Lands Manager of KIA indicated that the consultation process and records should reflect a transparent process; the consultation report will be very important in the regulatory phase as community consultation is a requirement of the processes of the Nunavut Water Board, the Wildlife Management Board, Department of Fisheries and Oceans, Nunavut Impact Review Board, and the Nunavut Land Claims agreement.
- The Lands Manager further mentioned that caribou protection will be a major issue. APGs (Agencies of Public Government) in the Nunavut Land Claims Agreement do not have the capacity or tools to conduct comprehensive technical analyses of each project application; KIA has these tools and can link them into the process. KIA still lacks a database on Traditional Knowledge[4]. The next step would include developing a project specific database for environmental screening purposes that shows that the project is in conformity with the regional land use plan. Public online access to KIA databases is a few weeks away.
- When asked at what point the CLARCs should be involved (CLARCs are Community Land And Resource Committees that review all applications for land use on Inuit Owned Lands, IOLs), the Lands Manager responded that they should be involved from the beginning of the study. He then outlined the CLARC organization and review process

[4] "Traditional Knowledge" generally refers the matured long-standing traditions and practices of the indigenous communities. Community elders are the custodians of this knowledge which is handed down from generation to generation by word of mouth. Its subject matter may range from the history of the community, to spiritual beliefs, moral values, traditional ways of hunting, fishing, harvesting, and sacred sites. Traditional Knowledge maybe enshrined in stories, legends, forklore, rituals, songs and laws.

when a development application for IOL is received. He confirmed that given timely notice, meetings with CLARCs can be arranged by his office.

Manitoba Transportation and Government Services (MTGS):

- The Director of MTGS Transportation Systems Planning and Development indicated that the study process must be clear; public consultation is only the first of many steps; the project will only proceed on a favourable environmental review and funding.
- The Director suggested that the number of communities connected is an important factor in advancing the overall project.
- The Director commented that the alignment alternatives in Nunavut were few compared to alternatives in Manitoba and asked whether this might be influenced by external factors like a prospective mine or IOLs. The KIA Lands Manager then reviewed KIA's mandate relative to surface and subsurface interests.

Kivalliq Chamber of Commerce

- The Kivalliq Chamber of Commerce representative suggested the project team should provide a finer-scale map for community meetings and to not underestimate the knowledge that the people have of the land. He suggested that the benefits in reducing transportation costs would go far beyond the end of the road, by reducing landed costs on goods destined for other communities. He mentioned that mining is spending more and more in the region and the mining industry needs to be consulted on this project.
- The representative indicated that the study cannot solve all of Northern Manitoba's road issues with a single route; some of the routes added a lot of trucking costs to the Nunavut consumers and could add up to a significant sum year after year. He emphasized that there must be a rationale and justification for the cost of the road.

Government of Nunavut Department of Economic Development & Transportation

- One government representative suggested that the consultation reports should be public and that routes should be shown in the presentation materials.
- Another representative asked how routes favoured by Nunavut will be weighted as opposed to route favoured by Manitoba, and what would be the process of selecting the final alignment. The Director from MTGS replied that a systems approach will produce a recommendation but in the end it is a political process.
- The representative also asked how large is the Treaty Land Entitlements (TLE) issue in Manitoba. One member of the Consultant Team explained that the TLE is a designation confirming that specific communities have outstanding Treaty Land Entitlements that remain to be resolved by a three way process involving the community and the federal and provincial governments.

Hamlet of Chesterfield

- The representative suggested that it is important from the beginning to indicate that this is a plan, not a project.

Northlands First Nations

- One representative advised of the land claim in the context of upcoming activities, indicating that consultation in Dene communities (Tadoule and Lac Brochet) could be compromised without funding to undertake Traditional Knowledge work.
- The representative suggested the need to recognize the Northlands claim and show it on the project study maps. Northlands is not opposed to the project, but its interests in the land (traditional Dene territory that includes a large area in Nunavut) must be recognized, and funding for Traditional Knowledge will improve the study outcome.
- The Northlands First Nations negotiator spoke on behalf of two communities (Tadoule and Lac Brochet) and expressed the need for resources to participate in the study. He stated that the project cannot be imposed on the communities; Northland wants to work with NTI (Nunavut Tungavik Inc.) to resolve outstanding issues in disputed territory (area of overlapping aboriginal land interests). He asked how the Dene traditional territory issue could be resolved. The Director of MTGS outlined the consultation process, including the State of Community study to be completed with the communities themselves. He also explained that the study is not equipped to deal with aboriginal land claim issues. The study's mandate is to assess which corridor is the best to connect Nunavut and Manitoba by way of a scoping study of route selection, construction and operations.

Town of Lynn Lake

- The representative suggested that the benefits of the western route should include forest cover; pre-existing alignment is already in place with some upgrading in place as far as Tadoule Lake.
- The representative mentioned the upgraded hydro line to Lynn Lake done 10 years ago, and asked if there would be any consultations with Manitoba Hydro. The Director of MTGS stated that Manitoba Hydro is represented in the Project Steering Committee through a member of the Manitoba Chamber of Commerce.

Lac Brochet

- One representative reiterated that his community wants a road but they also want to do it right. They want to be treated equally and are requesting funds to do a proper assessment.
- Another representative expressed urgency for the road and stated that if climate precludes the construction of a winter road, delivery of diesel would be a problem. He is also concerned the price of commodities in the next 10 years (milk is currently $15 for 4 litres).
- The Dene Councillor indicated that anything that involves them and their land requires meaningful discussions and agreement; and that the communities have to benefit. He mentioned that projects have pros and cons; the study is being done with funding from government, and government knows they will be affected. The Councillor further suggested that since the project crosses Dene territory, they should play a bigger role.

- One representative stated that the Dene should determine the route not the Steering Committee. He pointed out that Dene land interests were ignored in the formation of Nunavut. The MTGS Director indicated that recommendations will be made by the project team based on objective analysis of study information. The study objectives are outlined under the NU–MB Memo Of Understanding (MOU). He further described the funding structure for the study: KIA 50%; Nunavut Government 25%; Manitoba Government 25%.
- The representative emphasized that the elders should also be present since they have a lot of Traditional Knowledge.

Manitoba Keewatinook Ininew Okimowin (MKIO)

- The Director indicated that MKIO speaks for 31 Manitoba communities; he suggested that consultation must be meaningful; project economics must include training; standard of living in the communities must improve; the study mandate may have to be revisited; and participation by people in planning is essential.
- The MKIO Director indicated that MKIO is development oriented; the people are environmentalists but also want development; elders must be advisors to the project. He mentioned that they can work together as long as the study input is not one sided.
- The MKIO Director stated that too often there have been activities without First Nations input and they have suffered for it. He asked if the Dene were consulted prior to the MOU. He stated that they are not taken seriously with issues that affect their lives and wanted to know how many Dene are on the Project Advisory Council.

Town of Churchill

- The representative observed that KIA is on the Steering Committee and MKIO should be as well. The Director of MTGS explained that the Steering Committee is comprised of representatives of the project sponsors and KIA is the largest funding partner as the conduit for federal funds.

City of Thompson

- The representative suggested that, in addition to the elected body, it might be appropriate to add the three northwest Manitoba communities to the Project Advisory Council to improve opportunities for dialogue with Tadoule and Lac Brochet. One member of the NKSL Consultant Team suggested to invite the Chiefs to attend or to nominate a representative of their choosing.
- The representative asked what the expectation was for members of the Project Advisory Council. The MTGS responded that they are expected to attend and participate in the public meetings.

After dinner, the NKSL Consultant Team led the study team and the Dene representatives in a traditional sharing circle in which everyone had an opportunity to speak their mind on the issues raised in the previous discussion. Their issues were raised again in a constructive atmosphere with some emphasis and elaboration. A First Nations Chief undertook to write a letter to Indian and Northern Affairs Canada (INAC) regarding funding for Dene participation to the study group.

After the Project Advisory Council meetings, a resolution letter was sent to the NKSL Consultant Team from the Keewatin Tribal Council Chiefs giving support for an all-weather and permanent road through the northwest region of Manitoba to Nunavut (a western alignment) to service the Barren Land, Northlands and Sayisi Dene First Nations (see Appendix D).

3.2 Community Consultations

Upon the confirmation of the Project Working Group and the Project Steering Committee, the NKSL Consultant Team scheduled and conducted consultations in communities along the route alternatives. In the Kivalliq region, community liaison officers were used as a resource to arrange the consultation meetings and to provide advice with respect to local customs, meeting venues and appropriate community officials to be consulted. Consultation materials were prepared in English, Cree, Dene and Inuktitut for community review (see Appendices A and B), including:

- Project location, schedule, overall description and route alternatives
- Potential environmental interactions and impacts
- Potential changes in land use.

Communities of interest were advised of the consultation schedules by advertisements in local newspapers, municipal/band offices, and radio stations (see Appendix E for a sample newspaper advertisement for the consultation meetings). Consultation meetings were held on separate days over a three-month period from January to April 2006 (see the schedule of community consultation in Section 2.2). Members of the NKSL Consultant Team facilitated the consultation process with the help of local interpreters as required to ensure that the presentation materials were understood by uni-lingual residents. Consultation with the First Nations and community elders was conducted with sensitivity, to elicit Traditional Knowledge, and to flag cultural and environmental issues at the initial round of the consultation process. Due to extreme weather conditions, consultation with the community of Whale Cove was postponed and was conducted on October 18, 2006.

To effectively capture the community consultation feedback and input into the Multiple Account Evaluation (MAE) of the route alternatives, the community comments and issues are summarized in Table 1 as they relate to the Social/Community, Natural Environment and Economy/National Interest accounts of the MAE.

The issues in feedback and input from the community consultation meetings are summarized for each community as follows.

<u>Tadoule, MB</u>

- Concerned about alcohol and drug problems associated with new road
- Need opportunities for education, training and employment
- Need compensation for loss of culture and livelihood
- Need management changes to address harvesting practice and land use with specific emphasis on caribou hunting
- Treaty Land Entitlement issues need to be settled

- Need to understand the extent of impacts on and compensation for wildlife and fish
- Dene should get economic benefits from new route; cost of living expected to improve

Lac Brochet, MB

- Social impacts include drugs and alcohol which could lead to more mental health problems
- Young people should be trained on wildlife, environmental and ecosystem studies; community needs funding for training
- Concerned about impacts on traditional land use (traditional gathering area near Sandy Lake)
- Better road may bring in more unwanted hunters from the south
- Heritage sites include traditional camp and burial sites near Little Duck Lake Post and Nejanilini Lake
- Dene will not benefit from eastern route alignment
- All routes go through Dene territory which is under active land claim negotiations
- Concerned about project destroying the caribou calving grounds in Nunavut and migration routes
- Need protection for water quality
- Marten is primary fur species in the area
- New road will benefit economic development of the community (eg. tourism, eco-tourism and recreation)
- Cost of living expected to improve with all-weather road

Brochet, MB

- New road will provide benefit in education and allow students to go to high school in Lynn Lake and Leaf Rapids
- Need to ensure community rights to commercial fishing sites made accessible by new road
- Need land use management for logging and mining rights
- New road will benefit commercial fishing and other businesses by reducing the cost of freight transport
- Cost of housing and construction should decrease

Lynn Lake, MB

- Study should consider Flin Flon for southern terminus to connect to Manitoba and Saskatchewan road networks
- Important to consider number of communities connected

- Western route would provide better healthcare from Lynn Lake to Tadoule, Brochet and Lac Brochet
- Western route will open up land but bring in hunters from the south
- Polar bears in Churchill could be impacted by new road
- Northern sovereignty requires route to be from the west; no need for double route (rail and road) on the east. A reduced role for Churchill could make Lynn Lake an attractive supply point for the north.
- A road to Tadoule would open up new country for mineral exploration (eg. Seal River, Reindeer Lake)

South Indian Lake, MB

- New road should connect to Saskatchewan through Fox Mine
- Suspect that route has been decided to go through Gillam for lowest cost; Alcohol and drug abuse are major community concerns
- Need training for young people before new road is built
- Big Sand Lake Lodge, owned by South Indian Lake Band, will be impacted if new road goes near it
- All routes will go through caribou range; caribou do not have to cross roads now except for Gillam and Split Lake
- South Indian Lake is located here to be near traditional caribou wintering area and migration route
- Central route will provide new access to lakes for winter commercial fisheries
- South Bay (south end of South Indian Lake) has 75 sq. km mineral exploration
- Study should include a generating station in Missi Falls and hydro line to the grid; only reason for this study is to access new mines in Nunavut and to provide hydro line from Manitoba Hydro
- Gasoline is now $1.225/L and there is no competition

Thompson, MB

- What are impacts on Hayes River (heritage river)?
- Concerned about new road bringing hunters from the south
- Will De Beer’s exploration be a factor in the route selection?
- Want to maximize business and economic development benefits for First Nations communities (want to be part of the road construction and maintenance)

Nelson House, MB

- Concerned about hunters and fishers from the south

- What are impacts on existing trapline owners?
- Are there studies on Nunavut Caribou migratory routes?
- Fish spawning and migration could be affected by water crossings
- What are impacts on water quality?
- How would lake water levels affect the route selection?
- Communities are interested in money and economic development
- Nelson House has the trades and skills to build road, but not equipment

Split Lake, MB

- Negative social impacts (drugs and alcohol) are inevitable and must be managed
- Caribou came through the area until a few years ago; caribou range will be impacted by new road
- Some areas of economic development should be reserved for First Nations
- Will railway be useless when new road is built?
- New road to Grand Rapids had realized economic benefits

Gillam/Fox Lake, MB

- Eastern route provides shorter access between communities/service centres (easier for snow clearing and maintenance)
- Eastern route would benefit commercial and community link between Gillam and Churchill
- Traplines from Sundance to Wapusk would not be affected; Impacts on Caribou herds would be least on eastern route
- Should build alongside railroad tracks to minimize impacts on local trappers
- Manitoba Hydro is sponsoring environmental and social impacts training which can also be applied to any road development
- Route through Gillam is probably shortest and most economical
- Gillam is growing to be a major service centre for travellers and road maintenance· Gillam is stable and more sustainable than western communities
- Western route would impose additional 200 km of travel on very trip going to/from Nunavut
- First Nations in area are prepared for partnering in road construction, maintenance and operations
- Incremental benefits to Thompson by (Central Route Alternative) would be small compared to those to Gillam by Eastern Route Alternative (ERA)

Churchill, MB

- Will a technical vocational institute be justified by this project?
- Churchill River crossing is too close to important heritage sites; it should cross upstream of Deer River or Harriot Creek
- Will there be compensation to trapline owners?
- What are impacts on polar bear industry?
- Polar bears currently cross the rail tracks from the west
- Don't want to go through Tadoule to get to Thompson (via western route)·
- Can route follow existing rail line or hydro line?
- What vehicles will be allowed on the new road? Will there be seasonal restrictions?

Baker Lake, NU

- Arviat and Churchill should decide how the road should connect the two communities; same for Whale Cove and Arviat
- Alcohol is a concern but not everyone will be affected
- New road will enable people to travel and visit families
- Development will benefit employment and education for young people
- Wildlife officers will look after hunting in the road area
- A train might be better than a road to bring in supplies
- Baker Lake will benefit from lower costs of supplies and more access to goods

Rankin Inlet, NU

- Trip to Whale Cove is short; more meaningful to have new road to Chesterfield Inlet
- Road to Meliadine is a small factor in route selection since it's only 20 km to Meliadine camp (a mineral exploration site)
- New road will increase employment and retain people with higher education
- Drug and alcohol problems will increase; need to know how to manage these
- Concerned about impacts on caribou and fur-bearing animals
- Road to Whale Cove should avoid big lakes and esker running to the south west
- Should break up construction to packages and give work to local companies
- May be cheaper to build railroad from Rankin Inlet to Churchill
- Nunavut communities want the shortest and most economic route to the south; Western route adds 400 km of travel to Thompson

Arviat, NU

- New road will connect communities and benefit people with families in other communities· Alcohol and drug problems will be worse
- Way of life is changing; must prepare young people for these change
- Lots of snow in the winter; winter road maintenance will provide jobs for local people
- Concerned about road going too close to Kaminuriak Lake where caribou have their calves
- Concerned about spills into the water killing animals
- All rivers must be considered as some are very shallow
- Concerned about spills to rivers and clean-up plan
- New road is supported as it will increase local employment and businesses
- New road will increase access to goods as sealift is sometimes late
- Uranium mining will happen in the region
- Arviat is the closest NU community to Churchill and supports this road; want to promote tourism and trade to Churchill
- All routes should go closer to Churchill for better trade connections

Chesterfield Inlet, NU

- Local communities have local knowledge of their own roads and some have started extending their roads
- Using Inuit Qaujimajatuqangit (knowledge) would benefit both communities and businesses since they know specific sites that cannot be harmed (eg. graves, heritage sites, rivers, lakes)
- If Inuit Qaujimajatuqangit (knowledge) would be used, construction would be faster and wildlife (polar bear dens, caribou calving, egg nesting) would not be harmed by the construction

Whale Cove, NU

- Need better opportunities for youth travel to other communities
- Concerned about increased drug and social problems
- New road will provide access to hunting and fishing
- Limited education opportunities for children due to high travel costs
- Existing medical travel cost is too high
- Need to train own people for jobs in the future
- Will there be funding for vocational training for women?

- Should use Traditional Knowledge from the region
- Concerned about who will use the road – helicopters will scare away wildlife
- Concerned about inter-community trade and sending products south (high air travel cost and limited service)
- New road may open mine sites and provide lower costs of goods
- Need new road as soon as possible to reduce current cost of living

Table 1: Summary of Community Consultation Comments

Community	Social/Community Concerns					Natural Environment Concerns						Economy/National Interest
	Access to Communities (Positive and Negative)	Health Care and Education	Protect Traditional Land Use & Local Culture	Protect Archaeological & Cultural Artifacts	Land Impacts (Dene, IOL, TLE, IR)*	Caribou Protection	Fish and Fish Habitat	Bird Sanctuaries	Parks/ Special Areas (ASI)*	Water Pollution	Other	
Tadoule Lake, MB **Jan 31, 2006**	• Concerned about alcohol and drug problems	• Need opportunities for education, training and employment	• Need compensation for loss of culture and livelihood • Need management changes to address harvesting practice and land use		• TLE issues need to be settled	• Need to understand the extent of impacts on, and compensation for wildlife and fish						• Dene should get economic benefits from new route • Cost of living expected to improve
Lac Brochet, MB **Feb 2, 2006**	• Social impacts include drugs and alcohol which could lead to more mental health problems	• Young people should be trained on wildlife, environmental and ecosystem studies • Community needs funding for training	• Concerned about impacts on traditional land use (traditional gathering area near Sand Lakes) • Better road may bring in hunters from the south	• Heritage sites include traditional camp and burial sites near Little Duck Lake Post and Nejanilini Lake	• Dene will not benefit from eastern route alignment • All routes go through Dene territory under active land claim negotiations	• Concerned about project destroying the caribou calving grounds and migration routes				• Needs protectio n for water quality	• Marten is primary fur species in the area	• New road will benefit economic development of the community (e.g. tourism, eco-tourism and recreation) • Cost of living expected to improve with all-weather road
Brochet, MB **Feb 3, 2006**	• May encounter social problems first 5 years, but should settle down afterwards • New road will benefit community mental health by removing sense of isolation and enabling sports events	• New road will provide benefit in education and allow students to go to high school in Lynn Lake and Leaf Rapids	• Need to ensure community rights to commercial fishing • Need land use management for logging and mining rights									• New road will benefit commercial fishing and other businesses by reducing the cost of freight transport • Cost of housing and construction should decrease
Lynn Lake, MB **Feb 6, 2006**	• Should consider Flin Flon for southern terminus to connect to Manitoba and Saskatchewan road networks • Important to consider number of communities connected	• Western route would provide better health care from Lynn Lake to Tadoule, Brochet and Lac Brochet	• Western route will open up land but bring in hunters from the south								• Polar bears in Churchill could be impacted by new road	• Northern sovereignty requires route to be from the west; no need for double route (rail and road) on the east • A reduced role for Churchill could make Lynn Lake an attractive supply point for the north • A road to Tadoule would open up new country for mineral exploration (e.g. Seal River, Reindeer Lake)

*Notes: IOL = Inuit-owned Land; TLE = Treaty Land Entitlement; IR = Indian Reserve; ASI = Area of Special Interest.
WRA = Western Route Alternatives connecting to Lynn Lake; CRA = Central Route Alternatives connecting to Thompson; ERA = Eastern Route Alternatives connecting to Gillam.

Table 1: Summary of Community Consultation Comments (Cont'd)

Community	Social/Community Concerns					Natural Environment Concerns						Economy/National Interest
	Access to Communities (Positive and Negative)	Health Care and Education	Protect Traditional Land Use & Local Culture	Protect Archaeological & Cultural Artifacts	Land Impacts (Dene, IOL, TLE, IR)*	Caribou Protection	Fish and Fish Habitat	Bird Sanctuaries	Parks/ Special Areas (ASI)*	Water Pollution	Other	
South Indian Lake, MB **Feb 7, 2006**	• New road should connect to Saskatchewan through Fox Mine • Suspect that route has been decided to go through Gillam for lowest cost • Alcohol and drug abuse are major community concerns	• Need training for young people before new road is built			• Big Sand Lake Lodge, owned by South Indian Lake Band, will be impacted if new road goes near it	• All routes will go through caribou range; caribou do not have to cross roads now except for Gillam and Split Lake • South Indian Lake is located here to be near traditional caribou wintering area and migration route						• Central route will provide access to lakes for winter fishery • South Bay (south end of South Indian Lake) has 75 sq. km mineral exploration •Study should include a generating station in Missi Falls and hydro line to the grid; only reason for this study is to access new mines in Nunavut and to provide hydro line from Manitoba Hydro •Gasoline is now $1.225/L and there is no competition
Thompson, MB **Feb 8, 2006**			• What are impacts on Hayes River (heritage river)? • Concerned about new road bringing hunters from the south									• Will De Beer's exploration be a factor in the route selection? • Want to maximize business and economic development benefits for First Nations communities (want to be part of the road construction and maintenance)
Nelson House, MB **Feb 9, 2006**			• Concerned about hunters and fishers from the south • What are impacts on existing trapline owners?			• Are there studies on Nunavut caribou migratory routes?	• Fish spawning and migration could be affected by water crossings			• What are impacts on water quality?	• How would lake water levels affect the route selecti on?	• Communities are interested in money and economic development • Nelson House has the trades and skills to build road, but not equipment
Split Lake, MB **Feb 10, 2006**	• Negative social impacts (drugs and alcohol) are inevitable and must be managed					• Caribou came through the area until a few years ago; caribou range will be impacted by new road						• Some areas of economic development should be reserved for First Nations • Will railway be useless when new road is built? • New road to Grand Rapids had realized economic benefits

*Notes: IOL = Inuit-owned Land; TLE = Treaty Land Entitlement; IR = Indian Reserve; ASI = Area of Special Interest.
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Table 1: Summary of Community Consultation Comments (Cont'd)

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	Access to Communities (Positive and Negative)	Health Care and Education	Protect Traditional Land Use & Local Culture	Protect Archaeological & Cultural Artifacts	Land Impacts (Dene, IOL, TLE, IR)*	Caribou Protection	Fish and Fish Habitat	Bird Sanctuaries	Parks/ Special Areas (ASI)*	Water Pollution	Other	
Gillam/ Fox Lake (Bird), MB **Feb 11, 2006**	• Eastern route provides shorter access between communities/service centres (easier for snow clearing and maintenance) • Eastern route would benefit commercial and community link between Gillam and Churchill					• Traplines from Sundance to Wapusk would not be affected • Impacts on caribou herds would be least on eastern route • Should build alongside railroad tracks to minimize impacts on local trappers					• Manitoba Hydro is sponsoring environmental and social impacts training which can also be applied to any road development	• Route through Gillam is probably shortest and most economical • Gillam is growing to be a major service centre for travellers and road maintenance • Gillam is stable and more sustainable than western communities • Western route would impose additional 200 km of travel on every trip going to/from Nunavut • First Nations in area are prepared for partnering in road construction, maintenance and operations. • Incremental benefits to Thompson by CRA would be small compared to those to Gillam by ERA
Baker Lake, NU **Feb 27, 2006**	• Arviat and Churchill should decide how the road should connect the two communities; same for Whale Cove and Arviat • Alcohol is a concern but not everyone will be affected • New road will enable people to travel and visit families	• Development will benefit employment and education for young people				• Wildlife officers will look after hunting in the road area						• A train might be better than a road to bring in supplies • Baker Lake will benefit from lower costs of supplies and more access to goods

*Notes: IOL = Inuit-owned Land; TLE = Treaty Land Entitlement; IR = Indian Reserve; ASI = Area of Special Interest.
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	Access to Communities (Positive and Negative)	Health Care and Education	Protect Traditional Land Use & Local Culture	Protect Archaeological & Cultural Artifacts	Land Impacts (Dene, IOL, TLE, IR)*	Caribou Protection	Fish and Fish Habitat	Bird Sanctuaries	Parks/ Special Areas (ASI)*	Water Pollution	Other	
Rankin Inlet, NU **Mar 1, 2006**	• Trip to Whale Cove is short; more meaningful to have new road to Chesterfield Inlet • Road to Meliadine is a small factor in route selection since it's only 20 km to Meliadine camp	• New road will increase employment and retain people with higher education • Drug and alcohol problems will increase; need to know how to manage these				• Concerned about impacts on caribou and fur-bearing animals					• Road to Whale Cove should avoid big lakes and esker running to the south west	• Should break up construction to packages and give work to local companies • May be cheaper to build railroad from Rankin Inlet to Churchill • Nunavut communities want the shortest and most economic route to the south; western route may add up to 400 km of travel to Thompson
Arviat, NU **Mar 3, 2006**	• New road will connect communities and benefit people with families in other communities • Alcohol and drug problems will be worse	• Way of life is changing; must prepare young people for these changes • Lots of snow in the winter; winter road maintenance will provide jobs for local people				• Concerned about road going too close to Kaminuriak Lake where caribou have their calves	• Concerned about spills into the water killing animals				• All rivers must be considered as some are very shallow • Concerned about spills to rivers and clean-up plan	• New road is supported as it will increase local employment and businesses • New road will increase access to goods as sealift is sometimes late • Uranium mining will happen in the region • Arviat is the closest NU community to Churchill and supports this road; want to promote tourism and trade to Churchill • All routes should go closer to Churchill for better trade connections

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Churchill, MB **Mar 4, 2006**		• Will a technical vocational institute be justified by this project?	• Churchill River crossing is too close to important heritage sites; it should cross upstream of Deer River or Harriot Creek			• Will there be compensation to trapline owners?					• What are impacts on polar bear industry? • Polar bears currently cross the rail tracks from the west	• Don't want to go through Tadoule to get to Thompson (via western route) • Can route follow existing rail line or hydro line? • What vehicles will be allowed on the new road? Will there be seasonal restrictions?
Chesterfield Inlet, NU **Apr 10, 2006**	• Local communities have local knowledge of their own roads and some have started extending their roads		• Using Inuit Qaujimajatuqangit (knowledge) would benefit both communities and businesses since they know specific sites that cannot be harmed (e.g. graves, heritage sites, rivers, lakes)			• If Inuit Qaujimajatuqangit (knowledge) would be used, construction would be faster and wildlife (polar bear dens, caribou calving, egg nesting) would not be harmed by the construction						
Whale Cove, NU **Oct 18, 2006**	• Need better opportunities for youth travel to other communities • Concerned about increased drug and social problems • New road will provide access to hunting and fishing	• Limited education opportunities for children due to high travel costs • Existing medical travel cost is too high • Need to train own people for jobs in the future • Will there be funding for vocational training for women?	• Should use Traditional Knowledge from the region			•					• Concerned about who will use the road – helicopters will scare away wildlife	• Concerned about inter-community trade and sending products south (high air travel cost and limited service) • New road may open mine sites and provide lower costs of goods • Need new road as soon as possible to reduce current cost of living

*Notes: IOL = Inuit-owned Land; TLE = Treaty Land Entitlement; IR = Indian Reserve; ASI = Area of Special Interest.
WRA = Western Route Alternatives connecting to Lynn Lake; CRA = Central Route Alternatives connecting to Thompson; ERA = Eastern Route Alternatives connecting to Gillam.

3.3 Government/Non-Government Organizations and First Nations

The NKSL Consultant Team received several invitations to attend meetings of government, non-government and First Nations organizations to brief them on the status of the study. The meetings attended are shown in Section 2.2. Exhibits on the proposed route alignments were provided and a powerpoint presentation was made to the meeting attendees by the NKSL Consultant Team (see Appendices B and C). The presentations made to these organizations were generally similar to those made to the communities to ensure that all consultations were based on the same information about the study.

The feedback and input from these consultation meetings are summarized as follows.

<u>Nunavut Day</u> (Winnipeg, MB; April 27, 2005)

- The President of the Kivalliq Inuit Association (KIA) introduced a PowerPoint slide presentation on this project given by the Project Manager of the NKSL Consultant Team. The presentation briefly described the 2-year project goals; study organization, funding, and management; and the public consultation process; social, economic transportation and environmental issues and opportunities; and reporting requirements.
- Questions and comments raised by the audience after the presentation included the following:
    - Will any studies on Traditional Knowledge be done?
    - What effects will global warming have on the duration of the road?
    - How will the rise of fuel prices impact the viability of the road?
    - Amount of snowfall seems to be increasing. Timely snow clearing will be an issue. The authorities need to know this and take it into account (concern of lady from Coral Harbour). Several requests for copies of presentation.
- Additional information was provided during discussion on related topics:
    - It was estimated that the value of caribou harvest is $17 million per year.
    - Forest fire is a hazard in the Manitoba wildlife management areas.
    - Need better identification of calving and post-calving areas since the calves are vulnerable for 3 weeks after birth.
    - Protection measures are required for spring and fall migration to minimize habitat destruction outside the calving and post-calving grounds; these measures need to be included in the regional land use plans.
    - Exploration industry is worth $170,000,000 in Nunavut; need coordination with Hudson Bay Neighbours Regional Round Table (HBNRRT) consisting of 12 communities in Nunavut and northern Manitoba.

<u>Hudson Bay Neighbours Regional Round Table (HBNRRT)</u> (Rankin Inlet, NU, May 18, 2005)

- The President of the Kivalliq Inuit Association (KIA) introduced a PowerPoint slide presentation on this project given by the Project Manager of the NKSL Consultant Team.
- Questions and comments raised by the audience after the presentation including the following:

  - Would stakeholders such as trucking companies be included in the Project Advisory Council?
  - Cumberland Resources are developing a site 100 km from Baker Lake. The project is subject to a Nunavut Impact Review Board (NIRB) hearing, consultations and quarry studies. Scheduled start-up is Spring 2006. The construction methodology for the access road would be of interest to the NU-MB Route Selection Study.
  - A meeting participant has been a contractor for the winter roads from Lac Brochet to Tadoule Lake for 5 years. He mentioned that Dene's are not opposed to a road through their territory; money is what it is all about; there are minerals in this virgin territory; mining companies have dollars; people around HBNRRT do not have dollars.
  - Caribou are important; calving and post-calving areas must be taken care of. There are more communities north from Lynn Lake. The Robinson esker can be used for materials. The high ground is good for winds.
  - Some participants commented that they liked the presentation; they need funding for the road; and that people in northern Manitoba and Kivalliq must support it. A major benefit from the road will be an improved standard of living. Instead of $15/litre milk, it should only cost $4/litre as in Winnipeg. There is a land claim pending.

<u>Hudson Bay Neighbours Regional Round Table (HBNRRT)</u> (Gillam, MB; October 5, 2005)

- Presentation was well received. Some of the questions raised were:
  - When will a decision be made?
  - Will the distance be the main deciding factor in the route selection?
  - What will become of the railroad if the road is built?
  - Why not abandon the railroad and build a road on the exiting railroad bed?
  - What is the next step in the route selection process?

<u>Beverly and Qamanirjuaq Caribou Management Board (BQCMB)</u> (Rankin Inlet, NU; May 27, 2005 and Winnipeg, MB; November 24, 2005)

- Presentations were well received and generated a high level of interest. Most participants were in favour of the new road and would like it to service their communities.
- Questions were raised as to who was responsible for selecting the three northern Manitoba terminals. The NKSL Consultant Team responded that the three terminals were specified in the Study Terms of Reference and represented the most northern communities with existing road links to the rest of Manitoba.
- Some respondents asked why a winter road option was not studied. The NKSL Consultant Team replied that the costs of establishing and maintaining this length of winter road on an annual basis for a narrow window of operation would probably not be feasible. Staged development would probably include sections of winter road but the ultimate objective would always be an all-weather road.

- Responding to the question of when a go/no-go decision on this road, the NKSL Consultant Team mentioned that the current study will not provide enough information for such a decision. A pre-feasibility study would have to be done and maybe even a full feasibility study and environmental approvals obtained. Given that this study would end in April 2007, a go/no go decision would be at least two years away.
- Other questions raised included:
  - Why were these terminals selected before public consultation?
  - Why is the link to Churchill necessary for every alternative?
  - Concern over postponement of public consultations (too many decisions will be made before community input)
  - How much will the road cost? Will there be any funds available for participating organizations?
  - Will routing decision be based on price?

The representative from the Department of Environment, Government of Nunavut, requested to receive electronic files of the routes onto which the latest caribou migration patterns and calving areas could be superimposed.

<u>NorMan Regional Development Corporation</u> (Flin Flon, MN; September 9, 2005)

- Participants asked why Lynn Lake was chosen as a destination point and not Flin Flon. The NKSL Consultant Team responded that having a termination point at Lynn Lake satisfies the mandate of a road linking Nunavut and Northern Manitoba. Other links within the province would be dealt with by Manitoba Transportation and Government Services as they would be solely within Manitoba.
- Participants also asked why Flin Flon was not one of the communities included in the Public Consultations. The NKSL Consultant Team responded that Flin Flon would not be directly affected by any of the route corridors but they would certainly be welcome to attend any of the session. The Norman Regional Development Board mentioned that they will consider drafting a resolution to that effect and sending a representative.
- One of the attendees expressed skepticism at the idea of the winter road avoiding lakes, as winter road routes usually favour the flat open terrain presented by the frozen lake surface. The NKSL Consultant Team responded that the intention was to route the winter road as close as feasible to the all-weather-road alignment to reduce the risks of environmental spills contaminating the lakes and to facilitate the transition from winter road to all-weather-road.
- One participant asked whether there were any other competitive proposals for a north-south overland link The NKSL Consultant Team mentioned that there was previously some thought of a road across Nunavut and Northwest Territories to connect to the Yellowknife/Alberta, but this would not be competitive because of its length and minimal community benefits.

<u>NorMan Regional Development Corporation</u> (Snow Lake, MB; February 24, 2006)

- The PowerPoint presentation shown at the Public Consultation meetings was shown.

- The attendees were generally positive about the prospect of the road. Some of the questions asked were:
    - Why wasn't the Fox Lake community given adequate notice of the Public Consultations in Gillam?
    - Why were no Public Consultations held in Grand Rapids?
    - Would the road be a part of the North South road from the equator to the Arctic Circle?
    - Are we working with the mining companies to select a route with mutual benefits?

<u>MB Conservation</u> (Thompson, MB, November 3, 2005; Winnipeg, MB; November 4, 2005)

- Subsequent to meetings on November 3 and 4, 2005, the Head of the Park Systems Planning, Manitoba Parks and Natural Areas Branch provided a letter on February 17, 2006 with comments on each of the route alternatives (see Appendix F).
- Overall, an eastern alternative is preferred, given that the Bradshaw Lake area of special interest (ASI) could be avoided.
- Concerns with the western route were raised due to possible conflicts with a rare feature in Goldsand Lake ASI, the crossing of the Seal Heritage River corridor, Caribou River and Nejanilini Lake.
- Concerns with the central routes were associated with the Amisk Park Reserve, Caribou River and Numaykoos Provincial Park.

<u>Thompson Unlimited</u> (Thompson, MB, February 8, 2006)

- Members of the NKSL Consultant Team attended a board meeting of Thompson Unlimited, Thompson's Development Corporation, and provided a brief presentation on the Nunavut to Manitoba Road Study. The meeting was attended by 10 members of the board including the General Manager of Thompson Unlimited.
- The meeting participants observed that Thompson would be a focal point regardless of which Northern Manitoba route was selected (ERA, CRA or WRA). A brief discussion was held regarding the direct and indirect business opportunities that would be created by the project if it came to fruition. The group was positive about the prospect of the road and speculated only on the benefits of potential business opportunities.

<u>Keewatin Tribal Council</u> (The Pas, MB; February 14, 2006)

- A copy of "All Weather and Permanent Road through Northwest Region of Manitoba" Resolution was received (see Appendix D) requesting support for the road to go through the Lac Brochet, Brochet and Tadoule Lake (Western Route Alternative, WRA).
- One Grand Chief suggested that serious considerations be given to bring all-weather roads to all communities
- The Chief of the Barren Lands First Nations supported the WRA with the following justifications:
    - An all-weather road has been under discussion for the past 5 years
    - $2.05 per litre gas brought in by winter road

  - Medivac watch for 12 hours or more could be eliminated
  - Schooling – instead of going further south, an all-weather road will provide easier access to high schools in Lynn Lake or Leaf Rapids.
- The Association of Manitoba Chiefs (AMC) priorities are:
  - health (impact of diabetes);
  - supporting a Diabetes Centre of Excellence
  - supporting the Kelowna Accord
  - meeting Manitoba Conservation concerns (Conservatives prefer to work with Iqaluit rather than Churchill)
  - considerations for people whose land and way of life would be affected
  - road vs railway should be considered
  - Traditional Knowledge and land use
  - cost of living, shipping costs, etc. need to be analyzed
- One Chief suggested that the Inuit would support any decision that is made
- Another Chief mentioned that he is interested in Gillam, but would support WRA; also needs information on gas prices, etc

Kivalliq Chamber of Commerce (Rankin Inlet, NU; March 28, 2006)

- The President of the Kivalliq Chamber of Commerce asked what the response was from the communities regarding the new route. The NKSL consultant representative responded that the community response was positive; the issue was about trade-offs between the benefits and negative impacts of the new road; the northern concerns were mostly related to the environment, the land, water, wildlife (caribou) and how the road will create barriers and opportunities for businesses.
- The Chamber President asked if there was enough interest to move the project forward. The NKSL consultant representative replied that people in the communities recognize that if the road is not built, there will be on-going problems of isolation and high transportation costs. He summarized the community needs for the new road as follows:
  - Ability to travel from Winnipeg to Baker Lake for the cost of gas
  - Option to retire up north (lower costs of housing, fuel, food, etc)
  - Access to sports and education for children in the north
  - Job opportunities for youth
- The Chamber President asked if there is any indication of support from the federal government. The KIA President responded that the study is to identify the location of the route with funding from the three governments; they are concerned about the feasibility of the route, not about the exact route at this time.
- The MLA from Rankin Inlet North asked whether government funding was provided over the entire two-year study period and who would receive the study reports.

- One participant asked how the social well-being of the communities (e.g. effects of drugs and alcohol) would be evaluated in the study.
- One participant asked how the Conservative government thinks about this road. The Member of Parliament (MP) representative responded that the Opposition would ensure that previous agreements are honoured and will press for this with the Minister of Indian Affairs in the new government. The MP further suggested for the lead person dealing with the federal government to outline former commitments and follow through, and that her office will work with both KIA and Government of Nunavut and help to follow up.
- The Chamber President asked whether the Chamber should pass a resolution regarding the funding for this project and to support the new road. The audience indicated general agreement, but no concrete answer.

4.0 NEXT STEPS

A final round of public consultation will be conducted once the Multiple Account Evaluation (MAE) of the route alternatives is completed. The results of the MAE will be presented to the Project Steering Committee for endorsement prior to this round of public consultation. After the endorsement and guidance by the Project Steering Committee, the MAE results will be presented to the Project Advisory Council and conveyed to the general public by conducting consultation meetings in strategically located communities. The Manitoba Métis Federation will also be invited to attend the Project Advisory Council presentation. Another newsletter will be posted on the project website in synchronicity with the community consultations. It is expected that the consultation meetings will be scheduled in the fall of 2006.

APPENDIX A:

NUNAVUT-MANITOBA ROUTE SELECTION NEWSLETTER

ISSUE 1 VOLUME 1 2005 (ENGLISH VERSION)

APPENDIX B:

PUBLIC CONSULTATION EXHIBITS

APPENDIX C:

PUBLIC CONSULTATION

POWERPOINT PRESENTATION

APPENDIX D:

RESOLUTION BY FIRST NATIONS

(FEBRUARY 14, 2006)

APPENDIX E:

COMMUNITY CONSULTATION NEWSPAPER ADVERTISEMENT

(JANUARY/FEBRUARY, 2006)

APPENDIX F:

Letter from Manitoba Conservation Parks and Natural Areas

(February 17, 2006)

APPENDIX G:

Social and Economic Scoping - Findings Report

Appendix 4. Milestone Report B

NISHI-KHON/SNC◆LAVALIN

March 23, 2007

BY EMAIL

Kivalliq Inuit Association
P.O. Box 340
Rankin Inlet, NU
X0C 0G0

016259-30RA

Attention: Dawn Brigham, Project Manager

Dear Ms Brigham:

Re: Nunavut-Manitoba Route Selection Study: Milestone Report B (Draft)

We are pleased to submit for your review this draft Milestone Report B for the Nunavut-Manitoba Route Selection Study.

This report summarizes the work undertaken since the completion of the first round of public consultations and information sessions in October 2006, as documented in Milestone Report A (draft issued on December 20, 2006). Based on the project work plan, the following work has been completed under Tasks B and C, and is described in this report:

- Multiple Account Evaluation on the three route alternatives (western, central and eastern alternatives, all in combination with the single northern alternative)
- Selection of the preferred route
- Second public consultations and information sessions
- Refinement of the preferred route

The study next steps under Task D are briefly discussed and the results of the subsequent tasks will be presented in the Final Report. This Final Report will be presented in draft form to the Project Working Group and Project Steering Committee for approval and endorsement.

We respectfully request you and other members of the Project Working Group to please provide us with your review comments on this draft report by April 10, 2007. We anticipate this report to remain a draft working document until its incorporation into the Final Report for the project.

Yours truly,

SNC◆LAVALIN INC.

T. Stevens

Tim Stevens, P. Eng.
Project Manager

Enclosures

DISTRIBUTION LIST

Project Steering Committee:

Methusalah Kunuk	Assistant Deputy Minister, Transportation, Nunavut Department of Economic Development & Transportation
Tongola Sandy	President, Kivalliq Inuit Association
John Spacek	Assistant Deputy Minister, Transportation Policy & Regulation. Manitoba Infrastructure and Transportation
Ken Vipond	Agreements Coordinator, Manitoba Aboriginal & Northern Affairs

Project Working Group:

Amar Chadha, P.Eng.	Director, Transportation Systems Planning & Development, Manitoba Infrastructure and Transportation
Alan Johnson	Manager, Transportation Planning Nunavut Department of Economic Development & Transportation
Dawn Brigham	Project Manager, Kivalliq Inuit Association
Lorraine Sourisseau	Regional Manager, Coordination Initiatives, Transport Canada

Others:

Alex Campbell	Deputy Minister, Nunavut Department of Economic Development and Transportation
Andrew Horosko, P.Eng.	Deputy Minister, Manitoba Infrastructure and Transportation
David Duncan, P.Eng.	Senior Transportation Planning Consultant Manitoba Infrastructure and Transportation
Lance Vigfusson, P. Eng.	Assistant Deputy Minister Engineering and Operations Manitoba Infrastructure and Transportation
Luis Manzo, P.Ag.	Director of Lands, Kivalliq Inuit Association

NKSL Consultant Team:

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Ben Hubert	Environmental Planning/Public Consultation
Dan Highway	Manitoba Liaison
John Hickes	Nunavut Liaison
Dr. Jack Mollard, P.Eng.	Route Engineering
George Mollard, P.Eng.	Route Engineering
Don Kuryk	Cost Estimating and Staging
Dr. David Witty	Social, Economic and Community Planning
Peter Lyall	Benefit Cost Analysis
NKSL Central Filing	

NISHI-KHON/SNC◆LAVALIN	MILESTONE REPORT B	Date: August 17, 2007
	DOCUMENT NO.: 016259-0000-30RA-0004	Revision No.: 0

CLIENT: **KIVALLIQ INUIT ASSOCIATION**

PROJECT: **NUNAVUT-MANITOBA ROUTE SELECTION STUDY**

	Name	Title	Signature
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Approved by:	Tony Wachmann, P. Eng.	Corporate Sponsor/ Director	ARWachmann

REVISION INDEX

Revision No.	Prepared Date	Reviewed Date	Approved Date	Pages Revised	Remarks
PA	Mar 23, 2007	Mar 23, 2007	Mar 23, 2007	N/A	1st Client Submission
PB	Apr 13, 2007	Apr 13, 2007	Apr 13, 2007	Sections 2.1, 2.6, 4.2	Final Draft
0	Aug 17, 2007	Aug 17, 2007	Aug 17, 2007	Section 2, Appendices 2 and 3	Issued as Final

COVER LETTER

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1.0 INTRODUCTION

Nishi-Khon/SNC-Lavalin (NKSL) was commissioned by the Kivalliq Inuit Association (KIA), along with the governments of Nunavut (NU) and Manitoba (MB), to conduct a two-year multidisciplinary study to determine the best location for a road route linking the community of Rankin Inlet to the Port of Churchill and the existing all-weather road transportation network in Manitoba. Kivalliq is the region within which the Nunavut portion of the route selection study is located. The study is being carried out under four task headings:

- Task A: Initial public consultations[1], social, economic, transportation and environmental analysis of corridors, and preparation of road development standards
- Task B: Route selection
- Task C: Refinement of preferred route
- Task D Final reporting

The work under Task A was completed and documented in Milestone Report A (first draft issued on December 20, 2006). This report summarizes the work completed under Tasks B and C, including:

- Multiple Account Evaluation on the three route alternatives (western, central and eastern alternatives, all in combination with the single northern alternative)
- Selection of the preferred route
- Second public consultations and information sessions
- Refinement of the preferred route

1.1 DEVELOPMENT OF ROUTE ALTERNATIVES

As described in Milestone Report A, three groups of all-weather route alternatives (western, central and eastern route alternatives) were generated in the route engineering and analysis process. These groups of alternatives were shown by the Consultant Team to the communities they visited in northern Manitoba and southern Nunavut during the initial public consultations from January to October 2006. The responses from the general public regarding the locations of the routes were as follows:

- Nunavut communities were looking for the most direct route to the south, to Churchill and to Manitoba's all-weather road system. They did not express a preference as to whether the road should be closer or further away from the coast in situations where we were showing such sub-options.
- Manitoba communities in the northwest stated a preference for the routes in the western corridor; people who attended the public meetings in Tadoule Lake, Lac Brochet and Brochet indicated their primary interest was in a direct route to the south. Communities in

[1] The public consultations undertaken in this study consisted of public information sessions, where a two-way flow of information occurred between the NKSL Consultant Team/Project Working Group and the general public living and working in communities within the study area. Additional information sessions have been held with government agencies, non-government agencies and First Nations. "Consultations" have a special meaning and involve a formal process for First Nations. Accordingly, First Nations representatives attending project meetings have noted that the sessions we have held and observations made, do not comprise "consultation" as they understand the term.

northeast Manitoba preferred routes in the eastern corridor. However, the public who attended the community meetings in Manitoba did not express a preference for one sub-option over another within the western or eastern corridors.

The Keewatin Tribal Council, following a presentation to them by a NKSL Consultant Team member on February 14, 2006, passed a resolution in favour of an all-weather route through Tadoule Lake, Lac Brochet and Brochet connecting Nunavut to Manitoba's all-weather road system. However, they did not express a preference for one sub-option over another within the western corridor. We also note that prior to the Project Advisory Council held in Thompson on November 3, 2005, the Consultant Team received a letter from the Sayisi Dene expressing their interest in a swath of territory between the boundary of Manitoba and Saskatchewan and the west shore of Hudson Bay. This area of interest also extended into southern Nunavut. Since all route alternatives connecting Rankin Inlet to Churchill and Manitoba's all-weather road system passed through this area of interest, we did not feel that it was a factor in favouring one route alternative over another.

The above considerations enabled us to eliminate all route sub-options in the western, central, eastern and northern corridors[2] and focus on the best route in each corridor, the latter being the one that was short-listed in terms of its engineering feasibility; the directness of its connectivity to population centres; and its avoidance, where possible, of parks and environmentally sensitive areas.

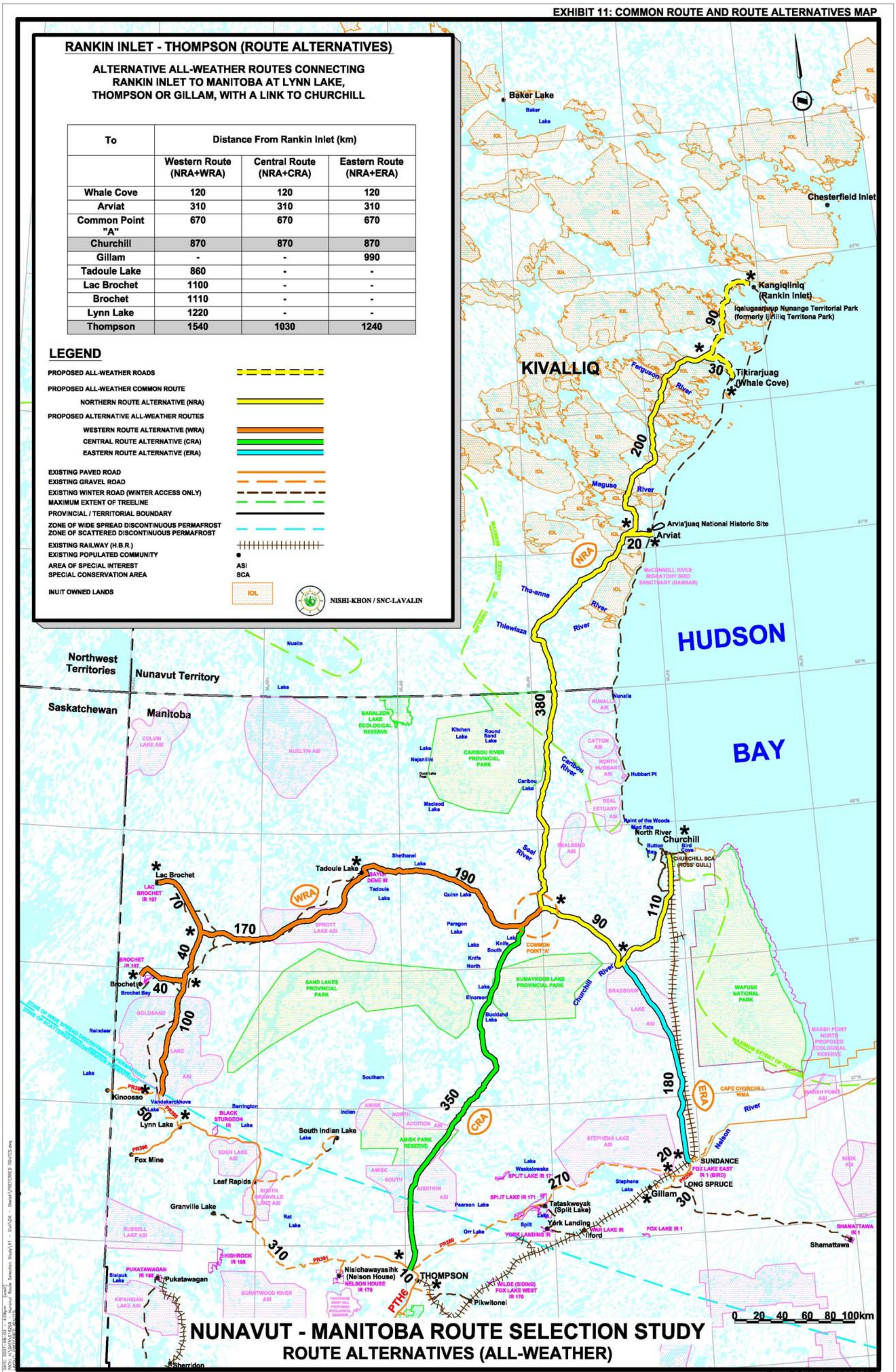
The Consultant Team met with the regional representatives of Manitoba Conservation in Thompson on November 3, 2005 and head office staff in Winnipeg on November 4, 2005. As a follow-up to these meetings, Manitoba Conservation noted in particular:

- All protected areas (i.e. provincial parks and Areas of Special Interest (ASIs)) should be avoided if possible
- The crossing of the Seal River, a Heritage River, would require special planning
- A preference for an eastern route alternative from Gillam to Churchill, but avoiding Bradshaw Lake ASI, and from Churchill to the north located east of Caribou River Provincial Park and west of the ASIs located along the west shore of Hudson Bay.

For the Multiple Account Evaluation, four single routes were therefore selected to represent, from an engineering, natural and social environmental perspectives, the most feasible all-weather road routes within each of the above groups, i.e. the western, central, eastern and northern corridors. These routes are shown in Figure 1-1 and are described in more detail below.

[2] The northern corridor refers to the corridor encompassing route alternatives in the Kivalliq portion of the project study area and connecting into Manitoba in the vicinity of Caribou River Provincial Park.

Figure 1-1: Common Route (NRA) and Route Alternatives (WRA, CRA and ERA) Map



To	Distance From Rankin Inlet (km)		
	Western Route (NRA+WRA)	Central Route (NRA+CRA)	Eastern Route (NRA+ERA)
Whale Cove	120	120	120
Arviat	310	310	310
Common Point "A"	670	670	670
Churchill	870	870	870
Gillam	-	-	990
Tadoule Lake	860	-	-
Lac Brochet	1100	-	-
Brochet	1110	-	-
Lynn Lake	1220	-	-
Thompson	1540	1030	1240

1.2 COMMON ROUTE (NORTHERN ROUTE ALTERNATIVE, NRA)

Between Rankin Inlet and Churchill, two alternative routes were initially developed, one to the east and the other to the west of the Caribou River Provincial Park. Through the Kivalliq public consultation process, it became evident that the objective for this portion of the Nunavut-Manitoba road was to provide the shortest and most direct route between the communities of Rankin Inlet, Whale Cove, Arviat and the Port of Churchill. The preferred location for the northern route was therefore considered to be the one to the east of the Caribou River Provincial Park. This is designated the Common Route, or Northern Route Alternative (NRA), from Rankin Inlet to Churchill in the northern portion of the proposed all-weather road. The route connects near Whale Cove to a proposed all-weather road route from Rankin Inlet that was the subject of an earlier study. A 30-km long spur road is proposed to connect Whale Cove to the Northern Route Alternative (NRA). From Whale Cove south to the Nunavut/Manitoba border, the route is located fairly close to the coast, but far enough inland to avoid, just south of Arviat, the McConnell River Migratory Bird Sanctuary. A 20-km long spur road is proposed to connect Arviat to the route. The Nunavut portion of the route crosses several major rivers: the Ferguson, Maguse, Tha-anne and Thlewiaza Rivers. From just north of Whale Cove to just north of Arviat, the northern route is located within the Caribou Protection Area, but east of the known caribou calving area. This means that, unless approval is given beforehand, no road activities would be permitted between May 15 and July 15 in any year. The route also crosses extensive parcels of Inuit Owned Lands (IOL), administered by the Kivalliq Inuit Association between Rankin Inlet and a point just south of Arviat.

South of the Nunavut/Manitoba border the route is located along the east boundary of the Caribou River Provincial Park, where there are exposed bedrock sources for roadfill. This inland location avoids a series of Areas of Special Interest (ASIs) flanking the west coast of Hudson Bay. From the boundary of the park where it crosses the Caribou River to the Common Point “A”, the route follows a fairly straight north-south line of discontinuous esker segments, crossing the Seal River (a Heritage River) but avoiding the Seal Bend ASI, and then following a major beach ridge from the Common Point to the Churchill River crossing. From here the route follows the topside of the Churchill River valley, and then northerly over permafrost-affected peatland and lesser marine silt and sand to the Port of Churchill. The total length of the common northern route from Rankin Inlet to Churchill, including the spurs to Whale Cove and Arviat as shown in yellow in Figure 1-1, is 920 km (575 miles).

A more direct route from the north into Churchill was not preferred for several reasons:

- Difficulty in avoiding the above referenced ASIs
- Difficulty in crossing the lower reach of the Churchill River. This includes the fairly long and wide stretch of water that backs up behind the Churchill weir.
- Extensive and fairly deep deposits of peat along this more direct route alternative segment to Churchill settlement.

Three single route alternatives were identified as the most feasible south of the Common Route or Northern Route Alternative (NRA). These are termed the Western Route Alternative (WRA) shown in red, the Central Route Alternative (CRA) shown in green, and the Eastern Route Alternative (ERA) shown in blue.

1.3 WESTERN ROUTE ALTERNATIVE (WRA)

From Common Point “A”, this route alternative proceeds west across the Seal River towards Tadoule Lake and Lac Brochet, then south towards Brochet, and terminates at the end of the existing Manitoba Provincial Road 398 (PR398), 50 km northwest of Lynn Lake. An extensive section of this route from west of the Common Point “A” to west of Tadoule Lake is located within an area claimed by the Sayisi Dene. Between Tadoule Lake and Lynn Lake, this all-weather route is in the same corridor as the existing winter road, but deviates from it in order to take advantage of granular terrain. The route passes through the Sprott Lake and Goldsand Lake ASIs, which are also penetrated by the existing winter road between Tadoule Lake and Lynn Lake. This would be the longest route from Rankin Inlet to Manitoba’s all-weather road system, and would provide all-weather service to Tadoule Lake and, via spurs, to Lac Brochet (length of spur 70 km) and Brochet (length of spur 40 km). Subject to further site investigation there would likely be merit in relocating portions of the winter road to follow the future all-weather route, in order to secure more reliable winter operations. The total length of the western route from the Common Point to PR398, including the spurs to Lac Brochet and Brochet, is 610 km (380 miles). Traffic from the western route to Thompson would use PR 398, a gravel road connecting to Lynn Lake, and PR 391, a partially paved road. The distance from the south terminal of the western route to Thompson is 370 km (230 miles).

1.4 CENTRAL ROUTE ALTERNATIVE (CRA)

This route alternative would proceed from Common Point “A” across the Churchill River directly to Thompson in the south. The route cuts through corners of Numaykoos Lake Provincial Park as well as the Amisk Park Reserve. It also bisects the Amisk South Addition ASI. Furthermore, the route crosses a number of forest management units between the Churchill River and Thompson, thus opening up the possibility of easier access for timber harvesting. Most of the route is located within Northern Flood Agreement Settlement Lands and as such crosses the Split Lake and Nelson House Resource Management Areas (RMAs). A short section of the route just south of the Common Point “A” is located within an area claimed by the Sayisi Dene. While this route provides the most direct connection from Common Point “A” to Provincial Trunk Highway 6 (PTH6) near Thompson, there are no existing communities between Common Point “A” and Thompson. The topography of this route alternative is mostly difficult, as it follows a high ridge with unstable ground conditions on either side. The significant grades along this route would be challenging in terms of construction, particularly to achieve a high travel speed. Material availability is not an issue through this corridor due to the alternating sand, gravel and till deposits. The total length of the central route from the Common Point “A” to PR391 near Thompson is 350 km (220 miles).

1.5 EASTERN ROUTE ALTERNATIVE (ERA)

This route starts just south of the Churchill River crossing required for the common northern route and connects to Manitoba Provincial Road 290 (PR290) on the north side of the Nelson River, near the siding of Bird on the Hudson Bay Railway, 50 km to the northeast of Gillam. PR290 is a paved road that services the Manitoba Hydro generating stations on the Nelson River at Kettle, Long Spruce and Limestone dams. Its eastern extension will also service the proposed Conawapa generating station further downstream of the Nelson River. Almost three quarters of the eastern route, from Bird north, is located within Northern Flood Agreement Lands and as such crosses the Split Lake Resource Management Area (RMA).

Of the three alternative routes, the eastern route (ERA) is located on the best terrain and is easiest and least expensive to construct. The route follows a large beach ridge (the Great Beach) running southeast from the Churchill River crossing through the Bradshaw Lake ASI, and then roughly parallels the Hudson Bay Railway to join PR290 near Bird. Relocation to the east around this ASI would place the route in significantly poorer soil conditions, similar to those experienced by the railway where ground ice occurs in extensive peatlands. Along the Great Beach, the eastern route crosses under the 138 KV power line that extends from the vicinity of Gillam to the Port of Churchill. The southern section of this route crosses short sections of bouldery silty sand (till) material with a short distance of thin peat with sporadic ice north of PR290. The total length of the eastern route from the Churchill River crossing to PR290 is 180 km (110 miles). Traffic from the eastern route to Thompson would use PR290 and PR280, a gravel road that connects Gillam to Thompson. The distance from the south terminal of the eastern route to Thompson is 300 km (185 miles).

2.0 MULTIPLE ACCOUNT EVALUATION

In consultation with the Project Working Group, a Multiple Account Evaluation (MAE) framework was developed by the Consultant Team to evaluate the three route alternatives for an all-weather road from Rankin Inlet in Nunavut to northern Manitoba. Since NRA is the Common Route for all route alternatives, the three alternatives being evaluated were defined as:

- Western Alternative (NRA+WRA)
- Central Alternative (NRA+CRA)
- Eastern Alternative (NRA+ERA)

Each of the route alternatives were evaluated under five accounts:

I) <u>Financial Account</u>
- This is the present value of the capital, maintenance and rehabilitation costs and salvage values over a 25-year project life at a discount rate of 6% for each route alternative.

II) <u>Transportation Benefits Account</u>
- This includes project benefits in passenger travel (in time and vehicle operating costs), freight transport costs, and safety benefits calculated as a present value over a 25-year project life for each option.

III) <u>Social/Community Account</u>
- This documents the external effects of the proposed Nunavut-Manitoba road on the communities and their social values as perceived by the communities. Evaluation criteria include access to communities (positive and negative), health care and education, land use impacts, and the protection of archaeological and cultural artifacts.

IV) <u>Natural Environment Account</u>
- This account is intended to provide an overview assessment of the project impacts on the natural environment. Criteria under this account include habitat protection, wildlife populations, watershed values, fish populations, heritage values and protected areas.

V) <u>Economy/National Interest Account</u>
- This is intended to evaluate the route alternatives in meeting the strategic functions of the proposed Nunavut-Manitoba road. Criteria under this account include regional

economy/resource use, sovereignty and security, staging, regional network (population served), reliability, Port of Churchill and enhanced inter-jurisdictional trade.

The general approach of the MAE was to establish weights for each account and scores for each route alternative. The sum of weighted scores for each alternative was used to rank the alternatives such that a preferred route could be identified. An MAE workshop was held on October 11-12, 2006 with representatives from the Project Working Group and the Consultant Team. The purpose of the workshop was to discuss the findings from the technical and consultation processes undertaken for the route alternatives to date, and to conduct the MAE of these alternatives for the selection of a preferred route (see Appendix 1 for the minutes and proceedings from this workshop).

2.1 FINANCIAL COSTS

In developing the planning-level cost estimates for the proposed all-weather road under each of the route alternatives, two independent analyses were conducted. The first estimate was prepared by J.D. Mollard and Associates Ltd. as part of their route engineering and terrain analysis to locate feasible alternatives for the all-weather road. This estimate was based on unit costs per kilometre for roads and bridges considering the terrain and ground conditions of the route alternatives. The second estimate was conducted by Don Kuryk of Times Development Ltd. who provided a more detailed estimate using a quantity-based approach including road embankments, materials and bridge structures (see Appendix 2a and 2b for the detailed cost estimates prepared for this study). Both estimates assumed a gravelled road with a finished top width of 8 m (26 ft), an average embankment height in the range of 1 to 1.5 m (3-5 ft) and 4.3 m (14 ft) wide, single-lane bridge structures.

As shown in Table 2-1a below, the two sets of capital cost estimates are within 30% of each other and are consistent relative to the terrain conditions along each of the route alternatives. Given that Mollard's estimates were conducted on a more broad-based corridor level and that Kuryk's quantity-based estimates were prepared in the absence of detailed terrain and road profile information, it was decided that the capital cost used for the route selection would be based on an average of the two estimates for each route alternative. The total capital costs include road and bridge construction, mobilization, engineering, and contingency[3].

Table 2-1a: Total Capital Cost Estimates ($ Million in 2006 Dollars)

Route Alternatives	Length (km)	Total Cost – Mollard ($ Million)	Total Cost - Kuryk ($ Million)	Average (Mollard + Kuryk) ($Million)	($Million/km)
NRA+ERA	1,100	1,064	1,296	1,180	1.07
NRA+CRA	1,270	1,229	1,552	1,390	1.10
NRA+WRA	1,530	1,489	1,749	1,619	1.06

[3] The Mollard estimates include a 10% mark-up for engineering and a 25% mark-up for mobilization and contingency on top of the road and bridge construction costs. The Kuryk estimate assumed a lump sum mobilization cost of $50 million for all route alternatives and a 7% mark-up for engineering and 7 % mark-up for contingency based on the total road and bridge construction costs for each route alternatives.

The financial costs of the three route alternatives are shown in Table 2-1b below. Capital costs (including construction and engineering) are calculated from the average costs for each route alternative provided by Mollard and Kuryk as discussed above. The property cost of $10 million is a nominal amount allowed for each alternative to cover the cost of assembling Crown Land, Inuit Owned Land and land under any other jurisdictions needed for the project. This number will of course require re-estimation in further development of the project scope. Maintenance costs are based on an annual maintenance cost of $5,000/km for all-weather road for all route alternatives, less the annual maintenance cost required for the existing winter road between Lynn Lake and Tadoule Lake ($8,000/km for a one-time initial clearing and $3,000/km for annual maintenance) in the case of the Western Alternative. Salvage values of the road and bridge infrastructure at the end of the 25-year study horizon are estimated to be 60% of the initial construction value, discounted back to the present value in 2006 dollars. All costs are shown in the present value in the year 2006 with a discount rate of 6% over a 25-year study horizon. It should be noted that for the purpose of the route selection study, it was assumed that the all-weather road would be completed in 2007 when project benefits would start to accrue. Given the scale and funding requirements of this project, this assumption is not realistic and should be noted as such. Since each alternative is treated the same in this regard, project costs and benefits should be reasonable on a comparative basis. On a similar note, the project costs and benefits are expressed in real terms and no cost escalation or inflation has been accounted for.

Table 2-1b: Financial Costs for All-Weather Road ($million in 2006$)

	Western Alternative (NRA+WRA)	**Central Alternative (NRA+CRA)**	**Eastern Alternative (NRA+ERA)**
Capital (Construction & Engineering)	$1,619	$1,390	$1,180
Property	$10	$10	$10
Maintenance	$79	$81	$70
Salvage	($212)	($182)	($154)
Total	$1,498	$1,300	$1,106

2.2 TRANSPORTATION BENEFITS

Two transportation studies were conducted to estimate the benefits of the proposed Nunavut-Manitoba road in terms of cost savings in freight transport, passenger travel and safety over the life of the project. A traffic analysis was conducted to develop traffic volume forecasts for freight and passenger travel along each of the three route alternatives (see Appendix 3: Traffic Report, SNC-Lavalin Inc.). A benefit cost analysis was conducted to estimate the transportation costs and benefits associated with the proposed all-weather road in terms of freight transport, passenger travel and safety (see Appendix 4: Benefit Cost Analysis, Apex Engineering).

2.2.1 Freight Transport

Based on earlier studies[4], about 75%[5] of all dry cargo for the Kivalliq communities originates in Winnipeg and is transported by either air directly to each community, or road/rail to Churchill where it is trans-shipped for barge deliveries to the local communities in the region (i.e. the road/rail/barge mode). With the proposed all-weather road from Manitoba to Kivalliq, a portion of this freight will be diverted to road transport by trucks. The freight volumes and modal split for all dry cargo from Winnipeg to Rankin Inlet are summarized in Table 2-2 below. It is estimated that over half of the existing road/rail/barge and airfreight will be diverted to trucks via the all-weather road in each of the route alternatives. The Central Alternative (NRA+CRA) will result in the highest diversion to truck travel (53.9%) due to the shortest distance between Thompson and Rankin Inlet, followed by the Eastern Route (53.5%) and the Western Route (52.9%). The differences in diversion, however, are not significant among the three route alternatives.

Table 2-2: Freight Volume and Modes from Winnipeg to Kivalliq: Year 2006

Freight Transport Mode	Existing[6]		Proposed Route Alternatives and Modal Split[7]		
	Freight Volume (Tonne)	% by Mode	NRA+WRA	NRA+CRA	NRA+ERA
Road	-	-	52.9%	53.9%	53.5%
Road, Rail and Barge	10,600	53%	22.2%	21.7%	21.9%
Air	9,400	47%	24.9%	24.4%	24.6%
Total	20,000	100%	100%	100%	100%

For the Manitoba remote communities currently not connected to an all-weather road (i.e. Brochet, Lac Brochet and Tadoule Lake), the current modal split for freight transport is 25% air and 75% winter road[8]. With a proposed all-weather road from Lynn Lake (i.e. the western alternative), it is assumed that all freight currently transported by air or winter road would be diverted to the all-weather road. Based on these assumptions on freight transport modes and a future freight demand of 4.5 tonne per capita[9] for the Kivalliq and Manitoba remote communities, the cost savings in freight transport are summarized in Tables 2-3a and 2-3b below. Due to the long travel distance and high existing freight costs to Kivalliq, it is evident that most of the freight cost savings from the proposed all-weather road is associated with the Kivalliq communities.

[4] Earlier transportation studies/reports relevant to this study include: "Manitoba-Nunavut Transportation Assessment Report" (Prolog, 2000); "Manitoba-Nunavut Transportation Assessment: Road Corridor Sub-Study Report" (DS-Lea Consultants, 2000); "Nunavut Transportation Strategy 2001" (Government of Nunavut, 2001); and "East Side of Lake Winnipeg: All-weather Road Justification and Scoping Study" (Dillon, 2000).

[5] The remaining dry cargo is supplied by the Eastern Arctic Sealift Program (coordinated by the Canadian Coast Guard) from Hudson Bay via Montreal, QC (12.5%) and Moosonee, ON (12.5%).

[6] Existing freight volume is based on "Manitoba-Nunavut Transportation Assessment" (Prolog, 2000), adjusted to the year 2006 based on an annual population growth of 2.4% (Nunavut Transportation Strategy 2001).

[7] Forecast modal split with the new road is based on a Logit Model developed for this study using a utility function based on cost and travel time differences between the various transportation modes from Winnipeg to Rankin Inlet.

[8] Based on "Manitoba Remote Community Consultation" (Feb 2003).

[9] Based on "East Side of Lake Winnipeg: All-weather Road Justification and Scoping Study" (Dillon, 2000) and discussions with Project Steering Committee in November 2006.

The Central Alternative (NRA+CRA) would provide the most cost savings in freight transport to the Kivalliq communities due to the shortest distance of travel (total $365 million in present value over a 25-year project life), followed by the Eastern Alternative (total $347 million in present value), then the Western Alternative (total $329 million in present value). Additional freight cost savings would be provided by the Western Alternative due to its connection to the three remote communities in northwestern Manitoba, resulting in an additional $37.8 million freight savings for Manitoba. Overall, the Western Alternative would provide the most savings in freight transport (i.e. $329 million in Kivalliq and $37.8 million in northwestern Manitoba, for a total of $367 million in present value over a 25-year project life).

Table 2-3a: Freight Costs and Savings- Kivalliq: 2006 to 2031

	Existing Cost	Proposed All-Weather Road NRA+WRA	NRA+CRA	NRA+ERA
Annual Cost ($millions/yr)				
Road	-	$7.0	$5.4	$6.3
Road/Rail/Barge	$7.4	$3.1	$3.1	$3.1
Air	$47.5	$25.1	$24.6	$24.8
Total	$54.9	$35.3	$33.1	$34.2
Annual Freight Cost Savings ($millions/yr)		$19.6	$21.8	$20.7
Present Value of Freight Cost Savings ($millions)[10]				
Normal traffic growth	-	$320	$355	$337
Induced traffic growth	-	$9.0	$10.0	$9.5
Total	**-**	**$329**	**$365**	**$347**

Table 2-3b: Freight Costs and Savings – Manitoba: 2006 to 2031

	Existing Air	Winter Road	Proposed All-Weather Road NRA+WRA
Annual Cost ($millions/yr)			
Lynn Lake to Brochet	$0.618	$0.190	$0.133
Lynn Lake to Lac Brochet	$0.739	$0.261	$0.182
Lynn Lake to Tadoule Lake	$0.677	$0.281	$0.196
Total	$2.034	$0.732	$0.511
Annual Freight Cost Savings ($millions/yr)	-	-	**$2.255**
Present Value of Freight Cost Savings ($millions)[10]			
Normal traffic growth	-	-	$36.8
Induced traffic growth	-	-	$1.0
Total	**-**	**-**	**$37.8**

[10] Present value is calculated using a 6.0% discount rate over a 25-year planning period from 2006 to 2031; normal traffic growth rate = 2.4% per year based on population growth; induced traffic growth rate = 2.9% per year including road-induced traffic (see Appendix 4 for detailed calculations and assumptions).

2.2.2 Passenger Travel

Passenger travel costs savings are associated with the mode shift from air/winter road to the all-weather road in the Kivalliq and Manitoba remote communities. Passenger travel costs consist of vehicle operating costs and time costs. For business travel to and from Kivalliq by air, it was assumed that no diversion to road would occur due to the time benefits of air travel. For personal travel, modal shifts are calculated based on an estimated elasticity of demand as a result of the time and cost differences between air and road travel. Table 2-4 summarizes the savings in vehicle operating cost and time cost as a result of diversion from air to road travel in the Kivalliq and Manitoba remote communities. Vehicle operating cost savings are positive for all three-route alternatives due to the shift from air to road travel; however, timesavings are negative since more time will be spent in road travel than air. The combined vehicle operating and time cost savings are highest for the Central Alternative due to the shortest distance of travel ($29.5 million in present value over a 25-year project life), followed by the Eastern Alternative ($16.7 million in present value), then the Western Alternative ($15.4 million in present value).

Table 2-4: Vehicle Operating and Time Costs and Savings: 2006-2031

	Existing Cost	Proposed All-Weather Road		
		NRA+WRA	NRA+CRA	NRA+ERA
i) Combined Aircraft and Vehicle Operating Costs				
Combined Air and Road Annual Veh. Op. Costs ($millions/yr)	$14.95	$12.88	$11.89	$12.80
Annual Savings ($millions/yr)	-	$2.1	$3.1	$2.1
Present Value of Veh. Op. Cost Savings ($millions)[11]				
Normal traffic growth	-	$33.75	$49.88	$34.98
Induced traffic growth	-	$0.95	$1.40	$0.98
Total	-	**$34.69**	**$51.28**	**$35.97**
ii) Air + Road Travel Time Costs				
Combined Air and Road Annual Time Costs ($millions/yr)	$0.25	$1.40	$1.55	$1.40
Annual Time Cost Savings ($millions/yr)	-	-$1.15	-$1.30	-$1.15
Present Value of Time Savings ($millions)[11]				
Normal traffic growth	-	-$18.7	-$21.2	-$18.8
Induced traffic growth	-	-$0.5	-$0.6	-$0.5
Total	-	**-$19.3**	**-$21.8**	**-$19.3**
Total Cost Savings (Vehicle Operating and Time; $millions)	-	**$15.4**	**$29.5**	**$16.7**

[11] See Note 10.

2.2.3 Safety

The safety impacts of the passenger traffic diversion from air to road were analyzed under each of the three route alternatives. The net impacts on safety are negative since road transport has a higher accident rate per kilometre of travel than air. Average accident costs for this study were estimated to be $0.05 per passenger-kilometre by air and $0.08 per passenger-kilometre by road (see Appendix 4 for detailed assumptions and calculations). As shown in Table 2-5 below, the combined air and road annual accident cost was estimated to increase by $0.40 million, $0.35 and $0.35 million per year respectively for the Western, Central and Eastern Alternatives due to the passenger travel shift from air to the proposed all-weather road. The Western Alternative would have the highest safety disbenefits due to the additional traffic diversion to road travel from the three Manitoba remote communities (i.e. Brochet, La Brochet and Tadoule Lake) as well as the longest overall distance of travel; the Central Alternative would have the least safety disbenefits due to the shortest distance of travel on the proposed all-weather road.

Table 2-5: Safety Costs and Savings: 2006-2031

	Existing	Proposed All-Weather Road		
		NRA+WRA	NRA+CRA	NRA+ERA
Annual Accident Cost by Air ($millions/yr)	$1.21	$0.93	$0.81	$0.90
Annual Accident Cost by Road ($millions/yr)	$0.03	$0.71	$0.78	$0.69
Combined Road and Air Safety Benefits				
Combined Air and Road Annual Accident Costs ($millions/yr)	$1.24	$1.64	$1.59	$1.59
Annual Accident Cost Savings ($millions/yr)		-$0.40	-$0.35	-$0.35
Present Value of Accident Savings ($millions)[12]				
Normal traffic growth	-	-$6.56	-$5.72	-$5.73
Induced traffic growth	-	-$0.18	-$0.16	-$0.16
Total	-	**-$6.74**	**-$5.88**	**-$5.89**

2.2.4 Traffic Projections

Based on the freight and passenger traffic diversion to the proposed all-weather road from Kivalliq to Manitoba, the total annual two-way traffic volumes on each of the route alternatives for the design year 2031 are calculated and shown in Table 2-6 below. The truck volumes between Kivalliq and Winnipeg are based on the forecast freight transport demand on the all-weather road for community resupply while the light vehicle volumes are for long-distance passenger travel to and from Kivalliq. It should be noted that truck volume represents close to 80% of all long-distance traffic on the proposed road under all three-route alternatives. This does not take into account the local travel between communities that will be made available via the all-weather road. Detailed traffic volumes for local travel between communities in Kivalliq and northern Manitoba are reported in Appendix 3: Traffic Report.

[12] See Note 10.

Table 2-6: Annual Traffic Volume for Long Distance Travel: 2031 Design Horizon

	Proposed All-Weather Road		
	NRA+WRA	NRA+CRA	NRA+ERA
Trucks/Year	2,750	2,800	2,780
Light Veh./Year	820	980	910
Total Veh./Year	3,570	3,780	3,690
Avg. Veh./Day	9.8	10.4	10.1

2.3 SOCIAL AND COMMUNITY ASSESSMENT

Based on the consultations and public information sessions conducted by the Consultant Team in 2006, a Social and Economic Scoping Study was completed for the communities located along the route alternatives (Brochet, Lac Brochet, Tadoule Lake, Churchill, Whale Cove and Arviat) or at the terminus of the route alternatives (Lynn Lake, Thompson, Gillam, Bird and Rankin Inlet). Using the findings from this Study (see Milestone Report A Section 3.3), the three route alternatives (WRA, CRA and ERA) were evaluated by the Consultant Team and scored as shown in Table 2-7 below. The perceived impacts of the all-weather road along each route alternative were scored relative to the conditions today (i.e. no road in Nunavut and winter road only for the three communities in northwestern Manitoba).

Table 2-7: Multiple Account Evaluation: Social/Community Account[13]

SOCIAL/COMMUNITY	*WRA*	*CRA*	*ERA*
Tadoule Lake, MB	0	0	0
Lac Brochet, MB	0	0	0
Brochet, MB	1	0	0
Lynn Lake	2	0	0
Thompson, MB	1	1	1
Gillam/Bird, MB	0	0	2
Churchill, MB	2	2	2
Arviat, NU	1	2	2
Whale Cove, NU	1	2	2
Rankin Inlet/Chesterfield/Baker, NU	1	2	2

Where: +2 = significantly better; +1 = better; 0 = neutral; -1 = worse and –2 = significantly worse.

The evaluation of each community's response towards each route alternative can be summarized as follows:

<u>Tadoule Lake:</u>

- Mixed response: Community self-assessment indicated neutral response regarding economic impacts of the proposed road, but negative regarding environmental and social impacts. Key respondents in the community[14] expressed concerns about negative impacts on traditional

[13] Based on "NU-MB Route Selection Study - Social and Economic Scoping Findings Report" (D. Witty, October 24, 2006).

[14] Key respondents interviewed in each community typically included Chief Economic Officers, Chief Administration Officers, Band Managers, Economic Development Officers, Health Care Workers and School Principals.

livelihood, caribou migration, drugs and alcohol, but recognized the potential benefits of a connection to the south on costs of goods, education and employment for youths.

Lac Brochet:

- Mixed response: Both community self-assessment and key respondent feedbacks were similar to Tadoule Lake, but with less negative sentiments towards the proposed road.

Brochet:

- Favoured WRA: Overall more positive feedback than Tadoule and Lac Brochet. Community recognized the benefits of the road in improving access to the south and reducing costs of living; WRA was more favoured than the other two alternatives.

Lynn Lake:

- Strongly favoured WRA: Community supported WRA since it would increase Lynn Lake's role as the distribution and service centre for the north; economic implications were expected to be significant, including potential for increased mineral exploration and development.

Thompson

- Thompson was not included in the Social and Economic Scoping Study since the effects were considered positive and equal in all scenarios of a fixed link between Kivalliq Region and Manitoba. The scoring for Thompson is therefore "1" for all route alternatives in the MAE since Thompson will likely benefit equally from any one of the alternatives.

Gillam/Bird

- Strongly favoured ERA: Community supported ERA since it would increase Gillam's role as the service, distribution and education centre for the Nunavut communities in the north. Economic benefits were believed to be the most significant to the community in the case of ERA.

Churchill:

- Strong support for all three routes: Community showed strong support for all route alternatives and believed that it would be a critical public investment. All routes would connect to Churchill, enabling it to play a major regional role in serving the Nunavut communities as well as being the northern navy base for Canada.

Arviat, Whale Cove and Rankin Inlet:

- Favoured CRA and ERA: All three communities showed strong support for a new road and were eager to be connected to the south; believed that economy would be significantly stimulated, including potential for enhanced mineral exploration and mine development; there were some concerns over increased access to alcohol and drug use, but overall community health would not be detrimentally affected; benefits were expected in health care, education and reduced costs of goods; more support was shown for CRA and ERA due to shorter distance to the south, to Churchill and Manitoba's all-weather system.

2.4 NATURAL ENVIRONMENT

A natural environment analysis was conducted to provide an initial scoping of the ecological values and related issues associated with the proposed Nunavut-Manitoba road link (see Milestone Report A Section 3.4). The impacts on the natural environment associated with each of the alternatives were classified and assessed under each of the following categories: habitat protection, wildlife populations, watershed values, fish populations, heritage values, and protected areas. Based on the analysis by Hubert and Associates, the scores for each route alternative were agreed by the Consultant Team and the Project Working Group during the MAE Workshop in Winnipeg on October 11-12, 2006. These scores are shown in Table 2-8 below.

Table 2-8: Multiple Account Evaluation: Natural Environment Account[15]

NATURAL ENVIRONMENT	*WRA*	*CRA*	*ERA*
Habitat Protection	-2	-2	-2
Wildlife Populations	-1	-1	-1
Watershed Values	-2	-1	-1
Fish Populations	-1	-1	-1
Heritage Values	-1	-1	-1
Protected Areas	0	-2	-1
Emmissions	-2	-1	-2

Where: +2 = significantly better; +1 = better; 0 = neutral; -1 = worse and –2 = significantly worse.

<u>Habitat Protection:</u>

- Negative impacts due to risk of wild fire in an all-weather road scenario in both forest and tundra regions; no distinction in scoring for any of the route alternatives.

<u>Wildlife Populations:</u>

- Risk of direct impacts on wildlife populations due to increased hunting as a result of an all-weather road; no distinction in scoring for any of the route alternatives.

<u>Watershed Values:</u>

- Risk of spilling (mainly fuel) from tankers and forest fire effects on watersheds; more negative impacts were assessed on WRA as it would traverse two ASIs containing lakes: Sprott Lake ASI and Goldsand Lake ASI.

<u>Fish Populations:</u>

- Higher risk to fish populations due to increased harvesting efforts along all-weather road; no distinction in scoring for any of the route alternatives.

<u>Heritage Values:</u>

- Risk of scavenging to heritage sites and resources along proposed all-weather road; no distinction in scoring for any of the route alternatives.

<u>Protected Areas:</u>

[15] Based on “ Nunavut-Manitoba Route Selection Study: Ecological Values and Related Issues Report” (Hubert and Associates Ltd., November 2006).

- Risk to protected areas and wilderness lands due to people access as a result of all-weather road; neutral score for WRA since all-weather road route follows general location of existing winter road through the Sprott Lake ASI and Goldsand Lake ASI; most negative impacts for CRA as it traverses the Numaykoos Lake Provincial Park, Amisk Park Reserve and two ASIs (Amisk North and South Addition ASIs); ERA traverses one ASI (Bradshaw Lake ASI).

Emissions:

- Risk of air pollution and greenhouse gas emissions as a result of all-weather road; WRA and ERA have a higher negative score due to longer road length compared to CRA.

In summary, the Consultant Team and the Project Working Group were of the opinion that, all other environmental impacts being roughly the same, the shorter the route, the smaller would be the cumulative impacts on the natural environment.

2.5 ECONOMY AND NATIONAL INTEREST

The economy and national interest account evaluates how well each of the route alternatives addresses the strategic needs of the Nunavut-Manitoba road. Seven criteria were defined under this account: regional economy/resource use, sovereignty and security, staging, regional network, reliability, Churchill and enhanced inter-jurisdictional trade. The scores for each route alternative under each of these criteria are shown in Table 2-9a below.

Table 2-9a: Multiple Account Evaluation: Economy/National Interest Account

ECONOMY/NATIONAL INTEREST	*WRA*	*CRA*	*ERA*
Regional Economy/Resource Use	1.0	0.8	0.8
Sovereignty and Security	1	2	1
Staging	1	0	2
Regional Network (population served)	2	0	2
Reliability	1	1	2
Churchill	0	1	2
Enhanced Interjurisdictional Trade (Natl Hwy System Connection)	0	1	2

Where: +2 = significantly better; +1 = better; 0 = neutral; -1 = worse and –2 = significantly worse.

Regional Economy/Resource Use:

- Resource use was used as a proxy to indicate the benefits of the proposed road on the regional economy. Resource use under this category included forestry, tourism development, ecotourism development, mineral exploration, commercial fishing, trapping and hunting. The scores for each of the route alternatives indicate the averaged scores based on an evaluation of each of the resource categories under an all-weather road scenario (also see Table 2-9b). A higher score suggests more benefits to the regional economy due to increased resource use as a result of the all-weather road. The scores under resource use for each of the route alternatives are shown in Table 2-9b below. The WRA is expected to deliver more benefits to the regional economy due to increased tourism development, mineral exploration and hunting activities. CRA and ERA have similar, but lower, scores in resource use. CRA was considered more conducive to commercial forestry and ERA more conducive to tourism development and access to existing and planned nationally important hydro development on the Nelson River.

Table 2-9b: Multiple Account Evaluation: Resource Use

	All-Weather Road		
	West	Central	East
Resources Use			
Forest	0	1	0
Tourism Dev.	2	1	2
Ecotourism Dev.	-1	-1	-1
Mineral Expl.	2	1	1
Com. Fishing	1	1	0
Trapping	1	1	1
Hydro Development	1	1	2
Hunting	2	1	1
Average Score	1.0	0.8	0.8

Sovereignty and Security:

- This criterion indicates the benefits to Canada as a result of the road connection to Nunavut and the development of the Churchill port as a northern naval base. The key issue is related to how quickly resources could be moved to or dispatched from Nunavut and Churchill. While all route alternatives would provide benefits under this criterion, CRA was scored the highest due to the most direct route and shortest distance from Manitoba's all-weather road system to Nunavut and Churchill. It should, however, be noted that because of the rugged nature of terrain along the proposed CRA, the actual travel time from Thompson to Churchill may be longer with CRA than with ERA. Furthermore, CRA involves considerably more new road construction than ERA.

Staging:

- This criterion reflects the potential viability of each route alternative for staging its development over time, as funding becomes available. ERA is considered the most beneficial as it has the shortest length of new road construction, with the possibility of completing the work in the shortest period of time. WRA can be built in segments to connect the communities along the route while using the existing winter road for construction staging in the interim period. CRA scores the lowest in this criterion as it does not connect any communities between Common Point "A" and Thompson, and therefore provides less opportunity for effective work staging.

Regional Network

- This criterion measures the connection to communities provided by each of the route alternatives. Using the population served by the route as a proxy for this criterion, WRA and ERA would be more favourable than CRA as the latter would not serve any additional communities between Common Point "A" and Thompson. From a transportation network perspective, WRA would provide a complete loop to the regional network in northern

Manitoba (including the existing Hudson Bay Railway from Thompson to Churchill). ERA, on the other hand, would provide a more direct and shorter route than WRA from Manitoba's all-weather road system to Churchill and the Kivalliq Region.

Reliability:

- This criterion addresses the reliability of the proposed road in terms of potential closure due to structural failure, weather and extraordinary circumstances. Reliability is primarily a function of length and terrain (i.e. potential for slides, motor vehicle accidents, snow, mud slides, flooding, fog[16], etc.). In this regard, ERA is the most favourable due to its short length for new road construction, generally stable terrain and close proximity to urban centres for incident management.

Churchill:

- The Port of Churchill is envisioned to be a strategic gateway for Canada's access to the arctic and world trade markets. The development of this gateway will require effective road connection to the north and south, as well as integration of the road with Churchill's existing rail and port infrastructure. ERA is ranked the most favourable in this criterion due to the shortest distance it provides to Manitoba's existing all-weather road system, together with the shortest travel time to Thompson and Winnipeg. It is also expected that this route will provide the best supplement to the existing railway facility for efficient and cost-effective overland freight movements to and from the Churchill port. WRA is considered the least favourable in this regard as it provides the longest distance between the port and Manitoba's all-weather road system, making the road route the least attractive for overland freight traffic to and from the port.

Enhanced Inter-jurisdictional Trade:

- This criterion measures the effectiveness of the road route as a trade corridor between Nunavut, Manitoba and the rest of Canada, North America and world markets. Enhanced inter-jurisdictional transport will result in improved access to necessary commodities and reduced isolation for northern communities, together with increased trade and travel opportunities for all communities, north and south. The connection from Nunavut to Canada's National Highway System, thereby connection to the North American trade corridor, is a proxy for this criterion. Considering the distance and time of travel, ERA is considered the most favourable for this criterion, followed by CRA, and then WRA.

2.6 SELECTION OF PREFERRED ROUTE

The results of the MAE of the three route alternatives are summarized in Table 2-10 below. The scores for each alternative are based on the analysis under each evaluation account as discussed in Sections 2.1 to 2.5 above. During the two-day MAE Workshop held in Winnipeg, MB (October 11-12, 2006) attended by the Project Working Group and Consultant Team, the relative importance of each account to the overall project was discussed and weights were assigned such that the sub-accounts would add up to 100% under each account, and the five accounts would add up to 100% in the overall ranking. It was decided that 40% of the total weight would be allocated to the quantitative accounts (i.e. the Financial and Transportation Benefits accounts), and that the remaining 60% would be distributed equally among the other

[16] Fog is an important consideration for the northern segment (particularly between Rankin Inlet and Arviat) as it is close to the water.

three qualitative accounts (i.e. Social/Community, Natural Environment and Economy/National Interest).

Based on the overall ranking of the three route alternatives, the Eastern Alternative (NRA/ERA) is considered the preferred route for the proposed Nunavut-Manitoba road. It has the highest benefit to cost ratio (0.32, as compared to 0.30 and 0.25 for the Central (NRA/CRA) and Western (NRA/WRA) Alternatives respectively) due to the lowest construction cost and the shortest length of new road construction. It is the most favourable from a social/community perspective due to the strong support from the affected communities (weighted score of 0.20, as compared to 0.18 and 0.14 for the Central and Western Alternatives respectively). In terms of potential impacts on the natural environment, it is ranked second (weighted score of -0.25) after the Western Alternative (weighted score of –0.24), but more favourable than the Central Alternative (weighted score of –0.28). From the economy/national interest perspective, it is ranked significantly higher than the other two alternatives (weighted score of 0.33, as compared to 0.15 and 0.17 for the Central and Western Alternatives respectively).

The rationale for selecting the Eastern Alternative as the preferred route can be summarized as follows:

- Most effective, safe and reliable route in light of its length, the terrain, the lowest construction and maintenance costs and ease of staging
- Strong support from affected communities
- Moderate environmental impact due to shortest length of new road construction
- Greatest potential for early implementation to address inter-jurisdictional trade opportunities, national sovereignty and security needs.

Table 2-10: Multiple Account Evaluation – Nunavut-Manitoba Route Selection Study (2006 Dollars)

Weights A (Account)	Weights B (Sub-Account)	ACCOUNT	NRA+WRA	NRA+CRA	NRA+ERA
		Winnipeg to Rankin Inlet (km)	*2,278*	*1,768*	*1,978*
		FINANCIAL ($millions)	**Quantitative Accounts**		
		Construction + Engrg.	$1,619	$1,390	$1,180
		Property	$10	$10	$10
		Maintenance	$80	$81	$70
		Salvage	($212)	($182)	($154)
		Total Costs ($millions)	$1,498	$1,300	$1,106
		TRANSPORTATION BENEFIT ($millions)			
		Kivalliq Freight	$328.9	$365.1	$346.8
		Manitoba Freight	$37.8	$0.0	$0.0
		Kivalliq Passenger	$8.0	$28.5	$15.7
		Manitoba Passenger	$7.5	$1.0	$1.0
		Accident Cost Savings	($6.7)	($5.9)	($5.9)
		Total Benefit ($millions)	$375.4	$388.7	$357.6
40%		Benefit/Cost Ratio	0.25	0.30	0.32
		A x Benefit Cost Ratio	**0.10**	**0.12**	**0.13**
20%		***SOCIAL/COMMUNITY***	**Qualitative Accounts**		
	15%	Tadoule Lake, MB	0	0	0
	15%	Lac Brochet, MB	0	0	0
	6%	Brochet, MB	1	0	0
	4%	Lynn Lake	2	0	0
	0%	Thompson, MB	1	1	1
	4%	Gillam/Bird, MB	0	0	2
	11%	Churchill, MB	2	2	2
	15%	Arviat, NU	1	2	2
	10%	Whale Cove, NU	0	0	0
	20%	Rankin Inlet/Chesterfield/Baker, NU	1	2	2
	100%	Sum (A x B x Score)	**0.14**	**0.18**	**0.20**
20%		***NATURAL ENVIRONMENT***			
	20%	Habitat Protection	-2	-2	-2
	20%	Wildlife Populations	-1	-1	-1
	15%	Watershed Values	-2	-1	-1
	10%	Fish Populations	-1	-1	-1
	10%	Heritage Values	-1	-1	-1
	20%	Protected Areas	0	-2	-1
	5%	Emmissions	-2	-1	-2
	100%	Sum (A x B x Score)	**-0.24**	**-0.28**	**-0.25**
20%		***ECONOMY/NATIONAL INTEREST***			
	20%	Regional Economy/Resource Use	1.0	0.8	0.8
	10%	Sovereignty and Security	1	2	1
	10%	Staging	1	0	2
	20%	Regional Network (population served)	2	0	2
	5%	Reliability	1	1	2
	15%	Churchill	0	1	2
	20%	Enhanced Interjurisdictional Trade (Natl Hwy System Connection)	0	1	2
	100%	Sum (A x B x Score)	**0.17**	**0.15**	**0.33**
100%		***OVERALL RANKING***	**0.17**	**0.18**	**0.41**

Where: +2 = Significantly better; +1 = better; 0 = neutral; -1 = worse and –2 = significantly worse.

3.0 SECOND PUBLIC CONSULTATION AND INFORMATION SESSIONS

The second and final round of public consultation[17] for this study was conducted in February 2007 to present the results of the Multiple Account Evaluation and the selection of the preferred all-weather route to the affected stakeholders and communities of the study area. The goals of this round of consultation were to find out if there was concurrence with the preferred route; to find out if the Consultant Team had overlooked any crucial information; to ascertain whether any refinements to the preferred route were needed; and to learn of any other northern transportation issues that needed to be brought to the attention of the governments. Similar to the format of the initial public consultation, meetings were held between the NKSL Consultant Team, the Project Working Group and the following stakeholder and public groups:

A. Project Advisory Council
- First Meeting: Thompson, MB, February 8, 2007
- Second Meeting: Rankin Inlet, NU, February 15, 2007

B. Communities along the preferred route in Manitoba and Nunavut
- Thompson, MB February 9, 2007
- Rankin Inlet, NU February 15, 2007
- Whale Cove, NU February 19, 2007
- Churchill, MB February 20, 2007
- Arviat, NU February 21, 2007

C. Government/Non-Government Organizations
- MB Conservation: Winnipeg, MB, February 7, 2007
- MB Hydro: Winnipeg, MB, February 13, 2007
- Nunavut/Kivalliq Manitoba Infrastructure Development Forum and Nunavut Mining Investment Pre-Conference: Winnipeg, MB, February 12, 2007
- Nunavut Impact Review Board and Nunavut Water Board: Rankin Inlet, NU (teleconference), February 15, 2007
- Nunavut Planning Commission: Arviat, NU, Feb 21, 2007

Prior to the consultation meetings with the general public, a Public Notice was sent to the officials of all affected communities (see Appendix 5) and advertisements were placed in local newspapers and radio stations. During all the consultation meetings, map exhibits were displayed, a powerpoint presentation was made (Appendix 6) and hard copies of Newsletter 2, issued in English, Dene, Cree and Inuktitut, were made available to the meeting participants (see Appendix 7). These materials were also posted in the project website immediately after the consultation meetings for general public access.

[17] In this study, the term "consultation" is used to refer to the communications sessions and meetings conducted by the Consultant Team and the Project Working Group with the project stakeholders and the general public for providing project information and receiving feedback for the selection of the preferred route. The term should not be confused with the formal consultation process with the First Nations involving a vote from members of the communities.

3.1 PROJECT ADVISORY COUNCIL

The Project Advisory Council meetings in Thompson and Rankin Inlet were attended by officials from the towns/municipalities in the study area, a Chief and Grand Chief from the First Nations, and representatives from other stakeholder groups having an interest in the proposed road. The meeting schedules, locations and attendees at these two meetings are shown below.

Project Advisory Council Meeting 1
Date: February 8, 2007 (Thursday)
Time: 6:00-9:00 pm
Location: City Hall, Thompson, MB
Attendees:

NAME:	REPRESENTING:
Al McTavish	Town of Gillam
Mark Reimer	Town of Lynn Lake
Mark Matiasek	Town of Lynn Lake
Leona Olson	Northwest Manitoba CFDC
Steve Danyluk	Manitoba Conservation
Joe Danttouze	Northlands Dene First Nations
Sydney Garrioch	MKIO
Kevin Carlson	MKIO
Doug Hunt	Tolko Industries
Randy Potter	Manitoba Infrastructure & Transportation
Ashley Beck	Manitoba Infrastructure & Transportation
Amar Chadha	Manitoba Infrastructure & Transportation
Tim Stevens	Nishi-Khon/SNC-Lavalin
Dan Highway	Nishi-Khon/SNC-Lavalin

Project Advisory Council Meeting 2
Date: February 15, 2007 (Thursday)
Time: 3:00-6:00 pm
Location: Siniktarvik Hotel, Rankin Inlet, NU
Attendees:

NAME:	REPRESENTING:
Vitaline Tapart	Hamlet of Repulse Bay
Armand Angooteatuk	Hamlet of Coral Harbour
John Patterk	Translator
Tongola Sandy	KIA
Dawn Brigham	KIA
Lorraine Sourisseau	Transport Canada
Al Johnson	Government of Nunavut
Tim Stevens	Nishi-Khon/SNC-Lavalin
John Hickes	Nishi-Khon/SNC-Lavalin

Feedback and discussion among members of the Project Advisory Council was largely focused on the selection of the preferred route being the Northern Route Alternative (NRA) or Common Route segment in combination with the Eastern Route Alternative (ERA). A representative from

Lynn Lake was in favour of the route connection to Lynn Lake and questioned the low traffic projections for this route, the Western Route Alternative. Representatives from First Nations indicated that the proposed all-weather road should go through the remote communities in northwestern Manitoba, providing a direct connection to the Port of Churchill from Tadoule Lake, and promoting partnership opportunities between the federal government and the First Nations. The representatives elaborated that the First Nations communities have come to recognize the need for an all-weather road and would adapt to changes associated with the new road. Furthermore, since all routes go through the traditional Dene territory, First Nations can say which alternative should be selected. Representatives from First Nations would like to be better informed of the route selection decisions via a formal consultation process involving a vote from members of the communities. Some meeting attendants expressed that a route via the Western Alternative would provide economic opportunities for mining and forestry in the region.

3.2 COMMUNITY CONSULTATION

Five public meetings were held in the communities of Thompson, Rankin Inlet, Whale Cove, Ariviat and Churchill in the second round of public consultation. These meetings were facilitated by the NKSL Consultant Team and the Project Working Group, with the services of local interpreters as required. The numbers of attendance at these public meetings are shown in Table 3-1 below and the feedback and comments from the meeting participants are summarized in Table 3-2 on the next page.

Table 3-1: **Second Community Consultation – Attendance at Public Meetings**

Community	Date	Signed Up	Total (Observed)
Thompson, MB	Feb 9, 2007	16	16
Rankin Inlet, NU	Feb 15, 2007	36	51
Whale Cove, NU	Feb 19, 2007	28	41
Churchill, MB	Feb 20, 2007	55	66
Arviat, NU	Feb 21, 2007	40	47

Table 3-2: Second Community Consultation - Summary of Comments

Community	Social/Community Concerns	Natural Environment Concerns	Economy/National Interest	Other Comments
Thompson, MB February 9, 2007	• Alcohol and drugs are existing social issues; communities have to adapt to changes with new road • Road access will benefit the younger generation; more education will mean more choices • First Nations communities want to be part of Canada • Concerned about lack of all-weather road via Brochet, La Brochet and Tadoule Lake		• Need to improve access to natural resources in the area • Lac Brochet has many natural resources to be explored • Connection to highway will provide economic growth opportunities • Beneficial to have hydro-electric development along preferred route	• First Nations communities need formal consultation on proposed road • First Nations communities have come to recognize the need for an all-weather road and would adapt to changes associated with the new road. • They would like to be better informed of the route selection decisions via a formal consultation process involving a vote from members of the communities.
Rankin Inlet, NU February 15, 2007	• Small population not an issue for the new road • Road will be good for younger generation	• Land claim agreements still outstanding	• Roads are essential to public service • Road will reduce rate of unemployment and cost of living • Mining section needs road connection	• Would railway be a cheaper option? • When will road be built?
Whale Cove, NU February 19, 2007	• Road has been talked about for many years, but no money has been available to start on it. • Road is needed to meet national policy.	• Should study caribou calving grounds		• When and where would road start? • Is there a more direct route from Nunavut to Churchill?

Table 3-2: Second Community Consultation - Summary of Comments (Cont'd)

Community	Social/Community Concerns	Natural Environment Concerns	Economy/National Interest	Other Comments
Churchill, MB February 20, 2007	• Strong support for road by community		• Road to Churchill should increase 2-way freight movements at the port • Mining activities currently underway south of Seal River near Churchill	
Arviat, NU February 21, 2007	• Road needed to accommodate population growth (Arviat has highest population growth in Canada) • Road will benefit future generations and bring employment and education opportunities • Will road be safe for children?		• Mining companies have found promising materials in the area • Road will provide major economic benefits (connection to the south will reduce costs of goods) • Provide construction contracts to local people	• Is there a more direct route from Nunavut to Churchill? • Will there be hydro development from Manitoba to Kivalliq? • How to maintain road in extreme weather conditions (drainage problems in spring; blizzards in winter)?

Similar to the stakeholder consultation meetings, comments from the communities were largely focused on the selection of the preferred route through the Eastern Alternative. Compared to the first round of public consultation, there was much stronger support for the proposed Nunavut-Manitoba road and the public was more receptive to the changes that would be brought about by the new road. It was recognized that the new road would bring about social and economic benefits along the connected communities while environmental impacts would need to be identified and mitigated. In the Thompson public meeting, feedback and comments were primarily associated with social/community and economic issues related to the proposed road. There were concerns that the three remote communities in northwestern Manitoba (i.e. Brochet, Lac Brochet and Tadoule Lake) would not be connected by an all-weather road. It was suggested that the need for an all-weather road by the western communities (in addition to an all-weather connection from Nunavut and Churchill to Gillam) be documented even though it might not be a mandate of the Nunavut-Manitoba Route Selection Study.

In Churchill, strong support was shown for the proposed road. It was expected to provide significant economic benefits to the port. Questions were raised regarding the usage of the existing rail for freight transport once the road was built. It was expected that the road to Churchill would stimulate additional north-south imports and exports through the port and that grain and ore would still be best transported by rail.

In the Kivaliq communities, the public was pleased with the study progress and was very supportive of the new road as it was considered essential to public service. Some participants commented that small population should not be an issue for the new road as Canada's national rail and road system were built to low-populated areas initially. Questions were raised regarding a rail option to Nunavut (rather than road). It was noted that the proposed all-weather road could be part of a national mandate to connect Nunavut to Canada's National Highway System. Rail service would not provide the flexibility or level of service as a road would, and a railway might cost more due to the permafrost situation. Some participants questioned if there was a more direct route from Churchill up to Kivalliq, but later recognized the constraints of the Churchill River crossing and the poor ground conditions and ASI's along the coast. Most of the meeting participants were eager to see the road being constructed soon and expressed that inter-community connectivity and access to Churchill and the south were their primary concerns. There were also concerns about the safety and maintenance of the road in extreme weather conditions. Overall, the Kivalliq communities accepted the Eastern Alternative (NRA+ERA) as the preferred route and suggested to proceed to the implementation phase of the road project.

3.3 GOVERNMENT/NON-GOVERNMENT ORGANIZATIONS

In addition to the Project Advisory Council and general public meetings, a number of consultation meetings were arranged with the affected stakeholders of the proposed road. These stakeholders were identified based on the potential issues and opportunities associated with the preferred route in their respective jurisdictions. The meeting schedule, place and attendance from these organizations are summarized in Table 3-3 below.

Table 3-3: Second Public Consultation- Meetings with Government/Non-Government Organizations

MEETING TIME/PLACE	ORGANIZATION	REPRESENTATIVES
February 7, 2007 Winnipeg, MB	MB Conservation	Rick Wilson, Head, Park System Planning
February 13, 2007 Winnipeg, MB	MB Hydro	Jack Wilson, Manager, Major Accounts Bernie Osiowy, Manager, Hydro Power Planning Department
February 12, 2007 Winnipeg, MB	Nunavut/Kivalliq/Manitoba Infrastructure Development Forum and Nunavut Mining Investment Pre-Conference	Conference delegates
February 15, 2007 Rankin Inlet, NU (Teleconference)	Nunavut Water Board	Joe Murdock, Director of Technical Services
February 15, 2007 Rankin Inlet, NU (Teleconference)	Nunavut Impact Review Board	Kevin Buck, Director, Technical Services
February 21, 2007 Arviat, NU	Nunavut Planning Commission	Brian Aglukark, Director, Regional Planning Ronnie Suluk, Land Administrator Bobby Suluk, Land Claims Coordinator

The feedback and comments from the government/non-government organizations during this round of public consultation are summarized as follows.

Manitoba Conservation

A meeting was held between representatives from Manitoba Conservation, Manitoba Transportation and Infrastructure and the NKSL Consultant Team to ascertain Manitoba Conservation's response to the preferred route and to understand if the preferred route through the Bradshaw Lake Area of Special Interest (ASI) is acceptable. Based on the study conducted by J.D. Mollard & Associates on the route alternatives through the Bradshaw Lake ASI (see Appendix 9), a number of location options was identified for the all-weather route within the fairly extensive width of the "great beach" and also along a discontinuous beach ridge to the west. Depending on the actual location of environmentally sensitive features within the beaches, there appears to be sufficient flexibility to select a route that can avoid impacting unique features, while at the same time providing a firm foundation for the road, away from the adjoining ice rich peat plateau bogs. The representative from Manitoba Conservation commented that the Bradshaw Lake area was identified as an ASI during a Canada-wide initiative to protect endangered species in the 1990s and that it is unlikely to become a park. Within the Bradshaw Lake ASI, the north portion of the "great beach" has been identified by Manitoba Conservation as a "rare enduring feature" consisting of "beach deposits/morainal not captured rare" (BD/M NC Rare). The south portion of the "great beach" is identified by Manitoba Conservation as "organic deposits/morainal not captured single" (OD/M NC Single) and therefore consists of a "single enduring feature". It was suggested that a detailed environmental impact assessment be conducted to determine the impacts of the road on these features. Efforts should be made to preserve the gravel ridge flora and fauna in its natural state and to leave the unique features intact where feasible. The representative from Manitoba Transportation and Infrastructure stated that the proposed all-weather road would be a controlled access roadway and that access to these features could be avoided. The representative from Manitoba Conservation further noted that the northern route just north of Latitude 59° N, between the Common Point "A" and the Caribou River, runs close to a "single enduring feature" consisting of "beach deposits /023 not captured single" (BD/023 NC Single); since this is a single occurrence, every effort should be made to avoid this feature. It was agreed that an archaeological and cultural artefacts survey be required in the next phase of the road development project to identify the features to be avoided and mitigation required along the preferred route.

Manitoba Hydro

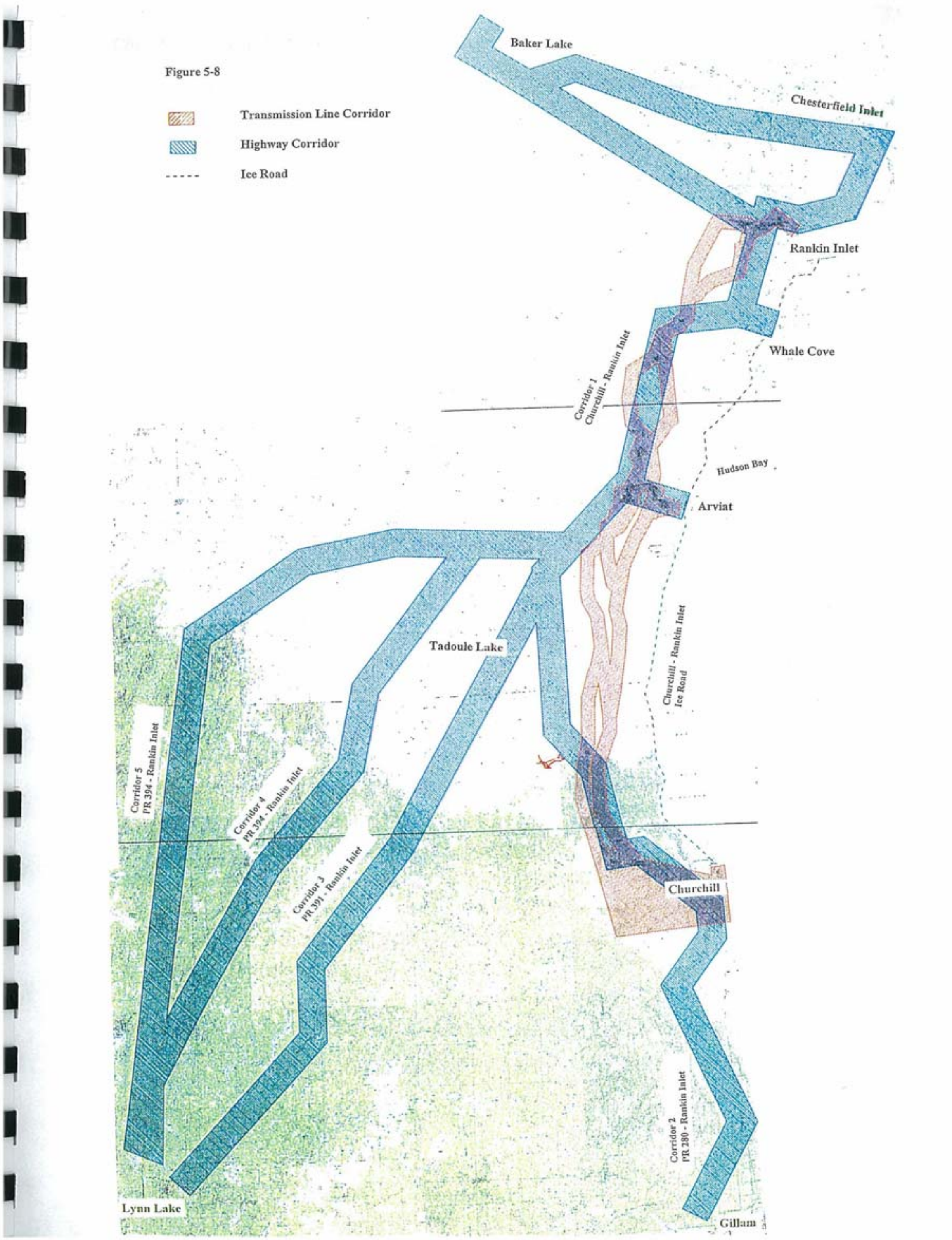
A meeting was held between representatives from Manitoba Hydro, Manitoba Transportation and Infrastructure and the NKSL Consultant Team to discuss Manitoba Hydro's long-range plans for hydroelectric development in the study area and the potential impacts from a new Nunavut-Manitoba winter or all-weather road. In 1999, a "Transmission Pre-Feasibility Study" was completed under the Canada-Manitoba Economic Development Partnership Agreement[18] to evaluate the viability of constructing a transmission line from Manitoba into the Kivalliq Region of Nunavut. The study was based on a transmission line originating at Churchill and terminating at Rankin Inlet for supplying hydroelectric power to the Kivalliq communities. The transmission line corridors would generally follow the coastline along the western shore of Hudson Bay, with a nominal length of 640 km from Churchill to Rankin Inlet. As shown in Figure 3-1, the proposed Nunavut-Manitoba road and transmission line corridors follow independent as well as common routes due to their respective functional, design, construction and operation requirements. As an example, the proposed road must connect with an existing ground transportation network in Manitoba, whereas the transmission line must connect to a strong source point in the electrical network. As concluded by the Transmission Pre-Feasibility Study, while there might be some benefit to having the road in proximity to the transmission line, the benefits were not considered significant enough to warrant a shift in the location of the transmission line. Currently, Manitoba Hydro has no plans to extend transmission lines into Nunavut.

During the meeting with Manitoba Hydro on February 13, 2007, discussion was held regarding the synergy between the road development, possible transmission line development, hydroelectric power development in Nunavut, and potential mining activities along the preferred Nunavut-Manitoba route. It was discussed that while Nunavut may want to develop electric power in conjunction with mining developments in the area, an access road for such development would be expensive and might not justify the development costs by itself. Manitoba Hydro stated that the Eastern Alternative would ensure future road access from Gillam to Churchill, and that if the road were built north of Churchill, a hydro transmission line could, if it were needed, probably follow this route. The NKSL Consultant Team noted that joint corridor use by a road, electrical transmission line and other utilities ensures a single linear impact on the natural environment, as well as providing access for on-going construction and maintenance activities. Manitoba Hydro noted, however, that any extension of transmission lines into Nunavut would be dependent on the development plans of Qulliq Energy (formerly Nunavut Power Corporation). They also noted that potential hydro-electric generation sites identified in the 1999 study along some of the Nunavut rivers (see Figure 3-2) would be relatively small power sources (compared with those in Manitoba) and could be tapped with "in river" turbines, not requiring the construction of reservoirs with associated flooding of the river valleys. Manitoba Hydro noted that they do have plans to construct a new hydroelectric power generation station at Conawapa on the Nelson River downstream from the existing Limestone station. This future station will be accessed from an extension of PR290. There was also discussion regarding the

[18] See "Churchill to Kivalliq Region Transmission Pre-Feasibility Study", Manitoba Hydro, May 1999.

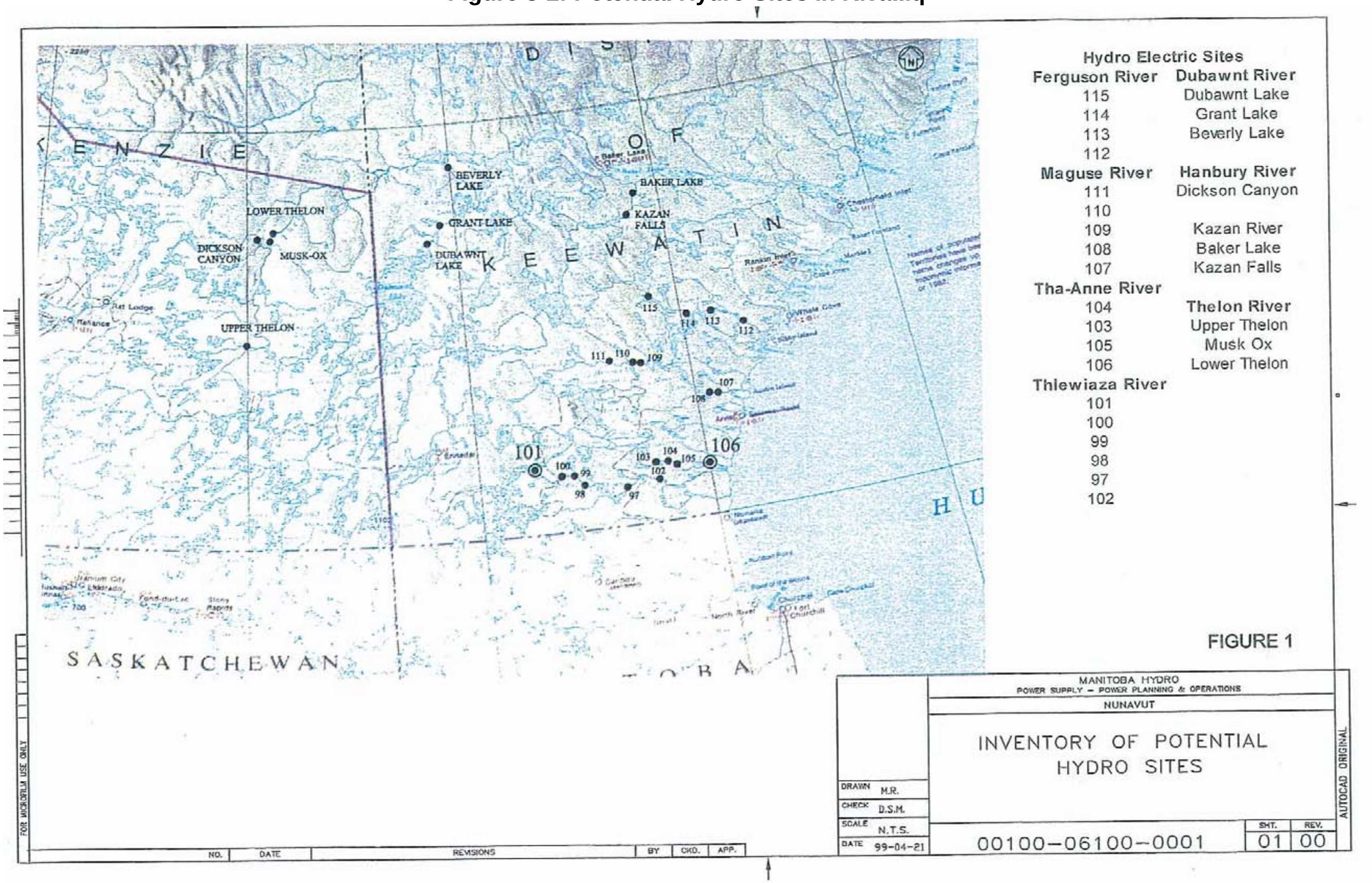
Churchill River crossing by the preferred route and the associated challenges with regards to its flow discharges, fishing and recreational activities.

Figure 3-1: Churchill to Kivalliq Region Transmission Line Corridors



Source: "Churchill to Kivalliq Region Transmission Pre-Feasibility Study", Manitoba Hydro, May 1999

Figure 3-2: Potential Hydro Sites in Kivalliq



Source: "Churchill to Kivalliq Region Transmission Pre-Feasibility Study", Manitoba Hydro, May 1999.

Nunavut/Kivalliq/Manitoba Infrastructure Development Forum and Nunavut Mining Investment Pre-Conference

The objective of the forum was to present the infrastructure development plans for Northern Manitoba and the Kivalliq Region of Nunavut and to compare these plans with the anticipated needs of potential major users in the region.

i) Nunavut-Manitoba Route Selection Study

A presentation was made by the NKSL Consultant Team and the Project Working Group on the Route Selection Study (see Appendix 6 for the powerpoint presentation). Background information was provided by Manitoba Infrastructure and Transportation on the Nunavut-Manitoba Road Initiative; transportation is a high priority to strengthen the social and economic relationship between Nunavut and Manitoba and to improve the community resupply to the Kivalliq Region. Questions were raised from the conference attendees regarding how the scope of the study was defined, and how mining interest in the area was considered in the route selection. The NKSL Consultant Team responded that distribution of resources is widespread in the region, that the proposed road would provide a backbone for access to the region, and that exploration activities would likely increase along the proposed road. There was general agreement among the mining industry representatives that the proposed road would support exploration activities and that mining would address the under employment of the Kivalliq region. There was also strong support that the government and industry should work together in the development of the proposed road.

ii) *Qulliq Energy (formerly Nunavut Power Corporation)*

During the forum, a presentation was made by the Director of Operations and Information Technology of Qulliq Energy, a corporation fully owned by the Government of Nunavut. Qulliq Energy serves a population of 30,000 people located in 26 communities in Nunavut, the largest territory in Canada. The average population density is one person per 100 km^2. Nunavut is mainly dependent on oil for electricity and heat. The 2006/07 fiscal year consumption of oil was 45.5 million litres. Electricity is produced by 92 diesel generation sets (each producing 149 GWh) and a wind turbine in Rankin Inlet (89 MWh). Hospitals and schools in Iqaluit and Rankin Inlet are on distinct heating systems. Nunavut would like to have less reliance on fuel oil and is investigating electricity generation from the following sources:

- Wind turbines
- Tidal power
- Hydro-electric generation
- Hydrogen fuel cells
- Biomass
- Solar energy

A request for proposal is due for a hydro-electricity generation pre-feasibility study. Hydroelectric development potential will be cross-referenced with mining potential in the area.

Nunavut Water Board (NWB)

The Nunavut Water Board (NWB) has responsibilities and powers over the use, management and regulation of inland water in Nunavut and its objects are to provide for the conservation and utilization of waters in Nunavut. A teleconference was held between the NWB, the Nunavut Department of Economic Development and Transportation and the NKSL Consultant Team to discuss the issues and opportunities associated with the proposed Nunavut-Manitoba road. The representative of the Water Board was briefed on the goals and status of the Route Selection Study and asked to provide feedback on the study from the perspective of the NWB.

The representative stated that the Board is responsible for reviewing any potential impacts to fresh water in the territory and for approving and issuing water licences as part of an Environmental Impact Assessment process administered by the Nunavut Impact Review Board. Compliance and enforcement of the water licence would then fall under the jurisdiction of the Department of Indian and Northern Affairs. The representative further stated that it would be important to educate the regulators at an early stage of the project and that funding would be required for the regulatory review and liaison. It was agreed that the Board be kept up to date on the results of the Route Selection Study and be included in the distribution list of all study reports.

Nunavut Impact Review Board (NIRB)

The Nunavut Impact Review Board (NIRB) is responsible for administering the environmental assessment review process under Article 12 of the Nunavut Land Claims Agreement. NIRB's mandate is to conduct the Part 5 review process for environmental issues related to the Nunavut territory. The Part 6 review process is conducted by a Federal Environmental Assessment Panel to address cross-boundary issues among various jurisdictions. The NIRB review process consists of 16 steps from Project and Issue Scoping, submission of a Draft Environmental Impact Statement (DEIS), technical review, NIRB determination, approval by the Department of Indian and Northern Affairs, issuance of Project Certificate, and finally, monitoring and enforcement upon project approval (see Appendix 8 for the detailed NIRB Review Process guidelines). The assessment process could take up to 280 days from the receipt of the DEIS.

A teleconference was held between the NIRB, the Nunavut Department of Economic Development and Transportation and the NKSL Consultant Team to discuss the issues and opportunities associated with the proposed Nunavut-Manitoba road. The representative from NIRB suggested that the proposed road issues would likely include impacts on caribou and wildlife, access to communities, fishery characteristics, river crossings, global climate change, and impacts on Traditional Knowledge. The representative suggested that an eco-system study be conducted (in addition to a scientific study) and that independent Traditional Knowledge consultant be engaged in the Environmental Impact Assessment phase of the study. Issues on land use would also have to be addressed. It was identified that the Kivalliq Inuit Association would be the proponent for the Environmental Impact Assessment process and that the affected communities be involved in the process. This process should be incorporated in the Terms of Reference in the next phase of the project. It was agreed that NIRB be kept up to date on the results of the Route Selection Study and be included in the distribution list of all study reports.

Nunavut Planning Commission (NPC)

The Nunavut Planning Commission (NPC) was established under the Nunavut Land Claims Agreement and is responsible for land use planning (including water, wildlife and offshore areas) and various aspects of environmental reporting and management in the new Territory. A meeting was held between the NPC, the Nunavut Department of Economic Development and Transportation and the NKSL Consultant Team to discuss the issues and opportunities associated with the proposed Nunavut-Manitoba road. The representatives from NPC mentioned that the Keewatin Regional Land Use Plan was approved by the Department of Indian and Northern Affairs and the Nunavut Government in June 2000, and that the current plan is under review by the Institute of Public Government. Any road proposals in the Kivalliq Region would have to meet the conformity requirements outlined in the Regional Land Use Plan (Sections 5.6 and 5.7 under Chapter 6, and Appendices I and J). The proposed road would provide impetus for land use changes, which would need to be amended in the Regional Land Use Plan. The NKSL Consultant Team suggested that the new road would benefit from the application of land use policy and associated access control within the preferred route corridor in order to preserve the functional integrity of the road as a component of the National Highway System. The Consultant Team indicated that they would forward Manitoba's guidelines in this respect to NPC as information. The NPC stated that they would review the road proposal in conjunction with the NIRB and NWP, along with the relevant First Nations groups in Manitoba. It was agreed that the NPC be kept up to date on the results of the Route Selection Study and be included in the distribution list of all study reports.

4.0 REFINEMENT OF PREFERRED ROUTE

Following the selection of the preferred route through the technical and consultation processes, the proposed route (NRA+ERA) was reviewed to confirm and refine its location through the selected corridor. A variety of maps and airphotos were examined and interpreted such that the terrain along the alignment could be described, classified and mapped to a level where roadbed conditions could be confidently evaluated and construction costs estimated. Right-of-way identification is critical because there are many long stretches of route location where moving the alignment laterally as little as 50 to 100 m would result in very different and significantly increased road construction and maintenance costs. Most of the preferred route between Whale Cove and the Caribou River in northern Manitoba consists of long segments of relatively dry, smoothly rolling, bouldery sand-rich till, with a thin, saturated and active layer above continuous permafrost, separated by short, depressional segments of wet till or marine silt where the surface organic layer is thicker. South of the Caribou and Kirk River confluence to the Sundance-Gillam area, the route follows intermittent, wave-reworked, granular deposits in esker ridges and the Great Beach ridge. The detailed terrain types of the preferred route are described in Table 4-1 below and illustrated in Figure 4-1 on the next page. Note that the route description is from Whale Cove to PR280 at the Nelson River where the proposed road connects to Manitoba's all-weather road network. The segment between Rankin Inlet and Whale Cove is the subject of an earlier study[19] where terrain information was described.

Table 4-1: Terrain Descriptions of Preferred Route: Whale Cove to PR290 (Nelson River)

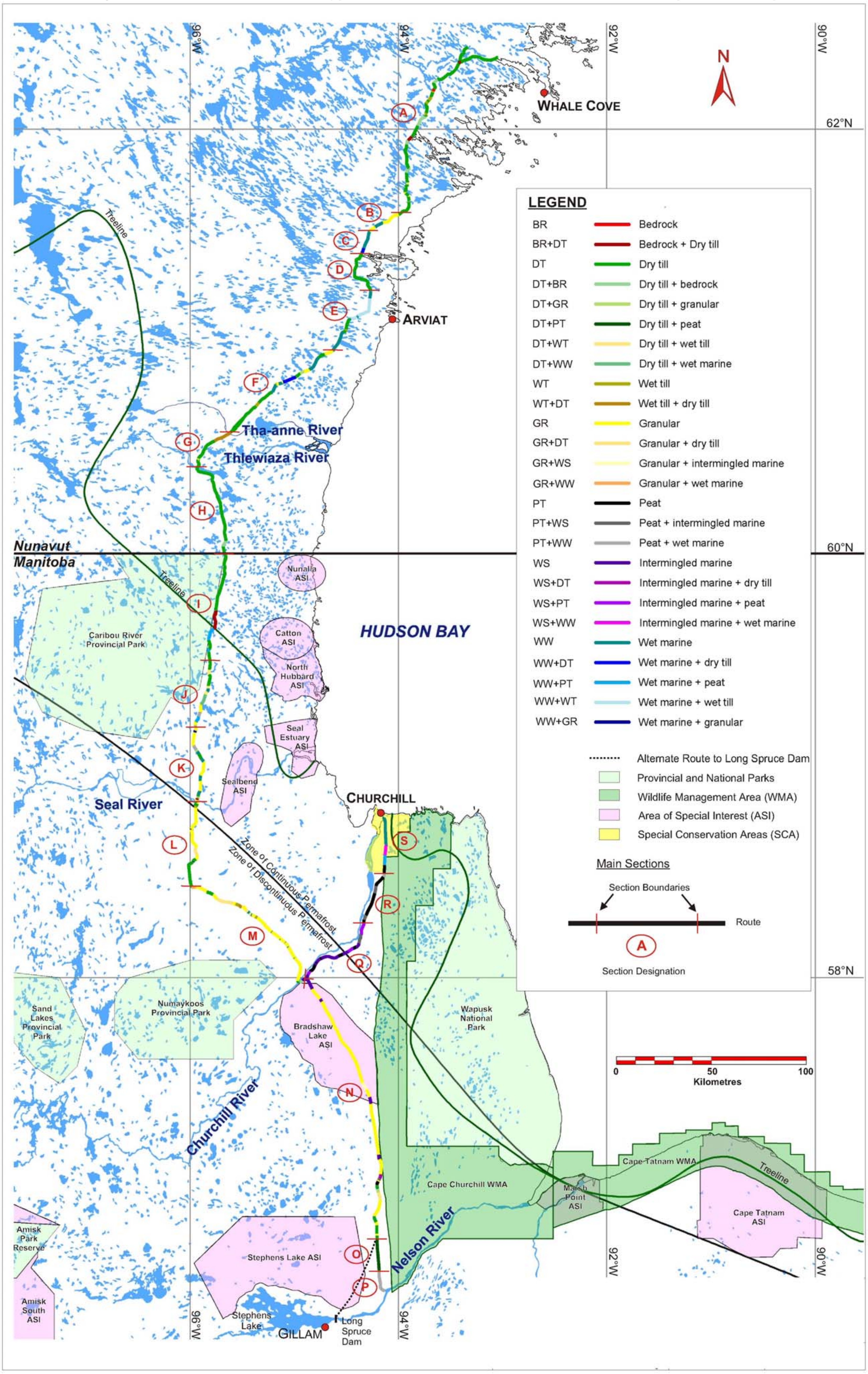
Segment A:	Rolling to locally bumpy dry bouldery sand till. Mostly tight right-of-way location. Route location is largely controlled by a succession of N45°W to N70°W trending long narrow lakes and drumlinoid ridges. Mostly rock borrow available near the route. Crosses the Wilson, Ferguson, Copper needle and Wallace rivers, from north to south.
Segment B:	An essentially level northeast-trending marine sandy gravel beach ridge. Granular material occurs on the ROW.
Segment C:	Wet, flat organic cover, mostly less than 1 m estimated, over dominantly marine silt with many small thermokarst ponds and marshy depressions. Runs from the beach ridge in segment B to the Maguse River. Scattered rock exposures occur in the middle part of this segment.
Segment D:	Maguse River to near the north end of McConnell Migratory Bird Sanctuary. This route segment is controlled by long, narrow N80°W to N90°W trending till ridges and lakes. Mostly relatively dry rolling till terrain with some esker ridges. Note the rock exposures.

[19] See "Route Selection, Terrain Mapping and Estimation of Construction Quantities and Costs of Two Road Route Alternatives from Rankin Inlet to Chesterfield Inlet, Whale Cove and Baker Lake Communities", J.D. Mollard & Associates, August 28, 2003.

Segment E:	South to the McConnell River crossing. Tight location. Mainly flattish, wet finegrained deposits on a marine plain. Shallow thermokarst ponds. Sparse granular material. Rock exposures occur close to Arviat.
Segment F:	From the west end of a long large lake west of Arviat to the Tha-Anne River crossing. This is a long southwest-trending section. Mostly rolling, relatively dry sandy bouldery till. Spotty wet fine-grained marine deposits in depressions. Spotty granular deposits. This route location is controlled largely by lakes. Sparse borrow prospects.
Segment G:	From the Tha-Anne River to Thlewiaza River. Rolling to flattish relatively dry till with minor wet marshy depressions. Some rock exposures off ROW. Few granular deposits. Sparse fill borrow prospects (widely scattered).
Segment H:	The Thlewiaza River to the 60th parallel (Nunavut-Manitoba border). Alternating rolling and flat relatively dry till. Tight location. A large granular deposit occurs near the north end of this segment. Scattered rock exposures near alignment.
Segment I:	From 60th parallel east of the Caribou River Provincial Park (CRPP) to near the confluence of the Caribou and Kirk rivers. The route here lies outside the Park but locally close to it. Several scattered rock exposures. Good rock borrow distribution along and near the preferred route. Mostly rolling, relatively dry bouldery sand-rich till. Locally tight location. Minor wet, fine marine deposits. Opposite the southeast end of CRPP in Manitoba.
Segment J:	From near the Caribou-Kirk rivers confluence to the southeast end of the Park. Tight rolling relatively dry till. Deep peat off ROW, mostly to the east. Minor wet organic deposits along the ROW.
Segment K:	From the Park to Seal River. Alternating level granular material (wave-modified eskers). Minor flat wet marine silt. The route alignment lies just west of the western edge of extensive marine silt and sand and ice-rich peat plateau bogs with thermokarst depressions. Also, the approximate boundary of continuous/discontinuous permafrost.
Segment L:	Seal River to Common Point. Dominantly flattish esker ridge. Minor till.
Segment M:	Common Point to Churchill River crossing. Follows a nearly continuous beach ridge, called the Great Beach.
Segment N:	Churchill River to the Weir River. A good location. Mostly wide and flat. Fine gravelly sand beach ridge, cut by several small creeks and larger Deer, Owl and Weir rivers.
Segment O:	From the Weir River across a fluted (wavy) till surface with narrow wet organics over till in depressions between low ridges. The Tyrrell Sea coastal plain begins approximately 6.5 km north of Sundance.
Segment P:	Peat plateau bog containing ground ice, with horsetail drainage. Mostly peat (1 to 2 m deep). Wet marine silt in drainage courses to near Sundance - the end of the preferred route at PR280 (Nelson River).
Churchill River Crossing To Port Of Churchill	
Segment Q:	Follows the top of the Churchill River valley in marine sand up to 2 m deep, then alternating wet sand and ice-rich peat plateau bog.
Segment R:	Peat plateau bog with ground ice (1 to 1.5 m deep), to where the road route follows alongside of the CNR line to Churchill Port.
Segment S:	Follows wet marine silt, sandy silt and stony clay to the Port of Churchill. Flat and poorly drained.

Source: "Summary Report on Alternate Route Selection, Terrain Mapping and Borrow Location", J. D. Mollard and Associates, June 26, 2006, pp.5-6.

Figure 4-1: Generalized Terrain Types of Preferred Route: Whale Cove to PR290 (Nelson River)



Source: "Summary Report on Alternate Route Selection, Terrain Mapping and Borrow Location", J. D. Mollard and Associates, June 26, 2006, Figure 15.

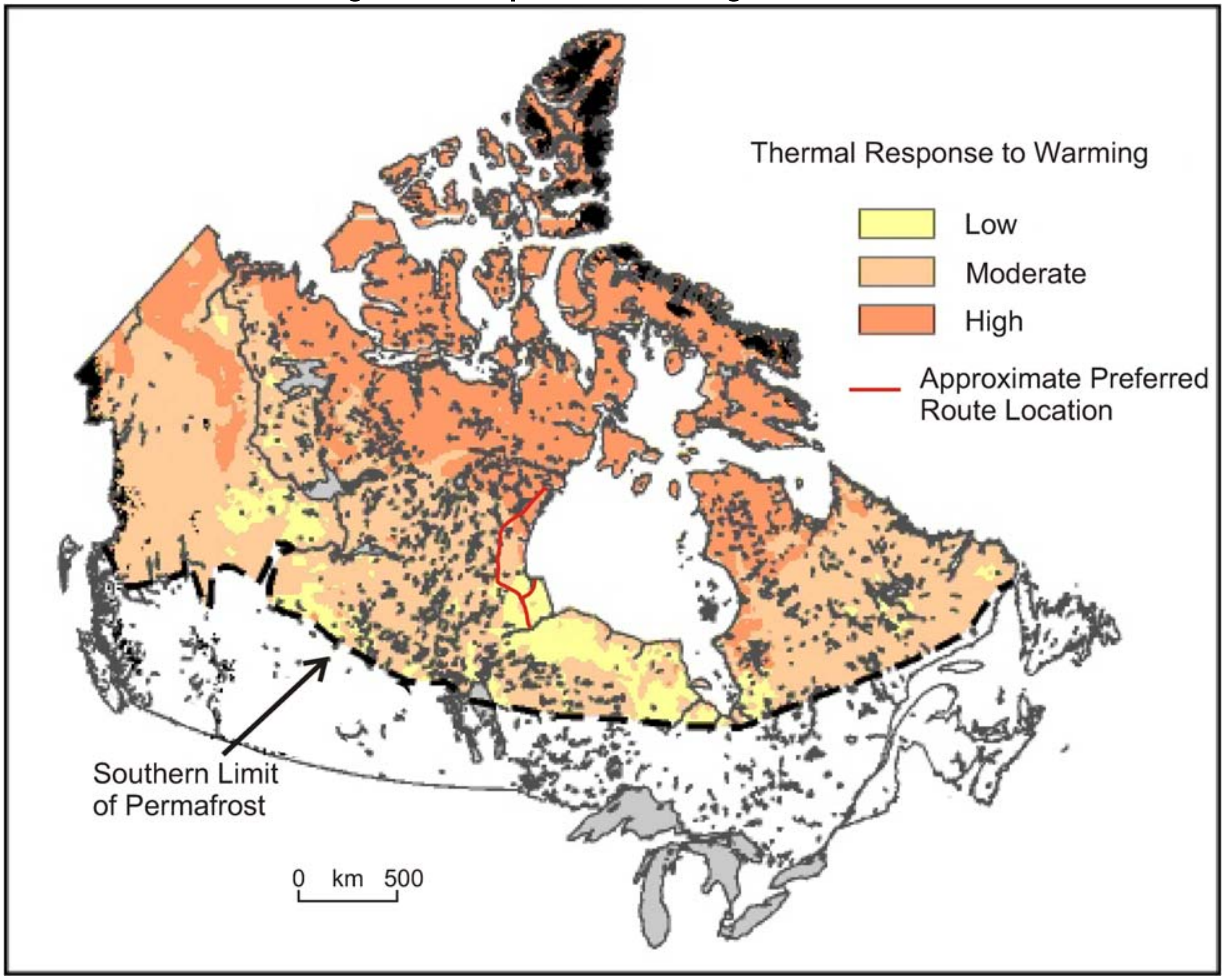
4.1 GLOBAL CLIMATE CHANGE

To understand the potential impacts of global climate and related thaw settlement and erosion issues on the preferred route, permafrost and ground ice conditions were studied in different terrain types in the study area (see Figure 4-2 for the potential impacts of thawing permafrost in the study area). Based on the interpretation of widely scattered borehole log data, available information shown on geologic maps and in reports and small-scale (~1:50,000) stereoscopic air photos, efforts were made to locate a route on relatively ice-poor smooth bedrock (almost none on the proposed right-of-way of the preferred route), ice-poor sand, gravel eskers, beach ridges and low ice-content basal till landforms derived from eroded Precambrian rock types – rather than high ice-content, complexly stratified, mostly fine waterlaid deposits with and without a peat cover. In some areas basal till – by far the most common terrain type preferred on the proposed right-of-way to the Churchill River crossing – is mantled with a discontinuous thin mantle of fine-grained marine deposits. As noted earlier, bedrock on the proposed right-of-way is almost non-existent and granular deposits on the ROW are spotty in occurrence north of the Common Point.

Basal till along the preferred route north of the Common Point contains a relatively low content of fines (silt plus clay), typically ranging from about 5% to 20%. This till has a high content of sand, gravel and cobbles, with surface boulders in places. Basal till is expected to be relatively compact because it was deposited under the weight of thick easterly and southerly advancing ice sheets. Basal till is extensively non-sorted and non-stratified, with only minor and random sorted and stratified pockets. Having a low content of fines, frozen, coarse and compact basal till is expected to contain “dry” permafrost, so is expected to drain fairly rapidly when melted, resulting in significantly lower thaw settlements than in the case of fine stratified alluvial, lacustrine and marine soils with ice in seams (dry permafrost contains neither free water nor ice, only frozen interfacial water around granular particles, where upon melting the ground is thaw stable)

Considerations were also given to locate the route to avoid extensive boulder-pile ridges and hummocky supra-glacial till, released from stagnant ice upon melting. Supra-glacial till in hummocky terrain is less compact (much looser) and commonly contains considerably more ground ice inclusions than does basal till. Short stretches of relatively thin peat and marine silt commonly overlie basal till in shallow undrained depressions north of the Common Point. South of the Churchill River crossing, along the common northern route link to the Port of Churchill, some one-half to three metres of ice-lensed bog peat overlies marine silt and sand. Both the bog peat and the underlying marine silty and fine sandy layers can have significant ice lensing, even massive ice. Most of the peat here occurs in peat plateau bogs and in polygonal (ice-wedge) peat plateau bogs, where melting of ground ice can cause significant thaw settlement and erosion problems. The same peat and marine silt occurs in a short section of the Eastern Route Alternative (ERA) immediately north of Sundance (PR290/Nelson River).

Figure 4-2: Impacts of Thawing Permafrost



Source: "Summary Report on Alternate Route Selection, Terrain Mapping and Borrow Location", J. D. Mollard and Associates, June 26, 2006, Figure 2.

4.2 BRIDGE CROSSINGS ALONG PREFERRED ROUTE

A total of 63 stream or river crossings have been identified along the preferred route (NRA+ERA) of the Nunavut-Manitoba Road. Of these crossings, 48 were located along the NRA segment from Rankin Inlet to Churchill, and 15 were located along the ERA portion from Churchill River to Sundance/PR290. These crossings are identified by J.D. Mollard & Associates in their route engineering analysis and are numbered from north to south starting in Rankin Inlet, NU[20]. For cost estimates, the crossings are classified into 12 types of bridge crossings based on the channel width of each crossing.[21] A summary of the bridge crossings along the preferred route is shown in Table 4-3 while the major bridge crossings (with a channel width of more than 120 m) are shown in Figure 4-3 in the following page.

[20] See "Bridge Sites on ERA and CRA Road Routes", J.D.Mollard & Assoc., Ltd, Sept 28, 2006.
[21] See "Cost Estimate" report by D. Kuryk of Times Development Ltd., Section 4.0.

Table 4-3: Bridge Crossings along Preferred Route (NRA+ERA)

Crossing No.	Name	Top bank (m)	Channel Width (m)	Type	Total Cost ($)
NRA (Rankin Inlet to Churchill):					
1n	Km 17.5		40	C	840,000
2n	Km 20.5		20	B	350,000
3n	Km 70.0		70	F	2,843,000
4n	Km 73.0		50	D	1,417,000
5n	Dianna R. Crossing		40	C	840,000
6n	Char R. Crossing		20	B	350,000
1	Wilson R E	319	50	E	1,668,000
2	Wilson R W	718	60	F	2,105,000
3	Ferguson R	130	130	L	8,623,000
4		75	1	A	120,000
5	Copper Needle R	696	120	L	7,946,000
6		1055	140	L	9,314,000
7	Wallace R	1108	40	C	840,000
8		660	50	D	1,417,000
9	Maguse R	959	135	L	8,977,000
10		393	35	C	748,000
11		1175	25	B	373,000
12		596	60	E	1,992,000
13	McConnell R	570	70	F	2,843,000
14		20	1	A	120,000
15		50	1	A	120,000
16	Tha-ann R	1700	300	L	19,965,000
17	Thlewiaza R	476	170	L	11,281,000
18		1060	100	I	5,155,000
19		652	1	A	120,000
20		499	55	E	1,818,000
21	Kirk R	1000	65	F	2,270,000
22	Caribou R	414	35	C	748,000
23		386	1	A	120,000
24b	Seal R W	1080	460	L	30,525,000
25	N Knife R	788	85	H	4,344,000
26	S Knife R	221	45	D	1,198,000
27	Skromeda C	260	1	A	120,000
28	Matonabee C	446	65	F	2,511,000
29		630	1	A	120,000
30		314	53	E	1,768,000
31	Herriot C	546	1	A	120,000
32		568	1	A	120,000
33		528	1	A	120,000
34		843	1	A	120,000
35		1002	1	A	120,000
36	Chasm C	395	1	A	120,000
37	Churchill R	1645	326	L	21,662,000

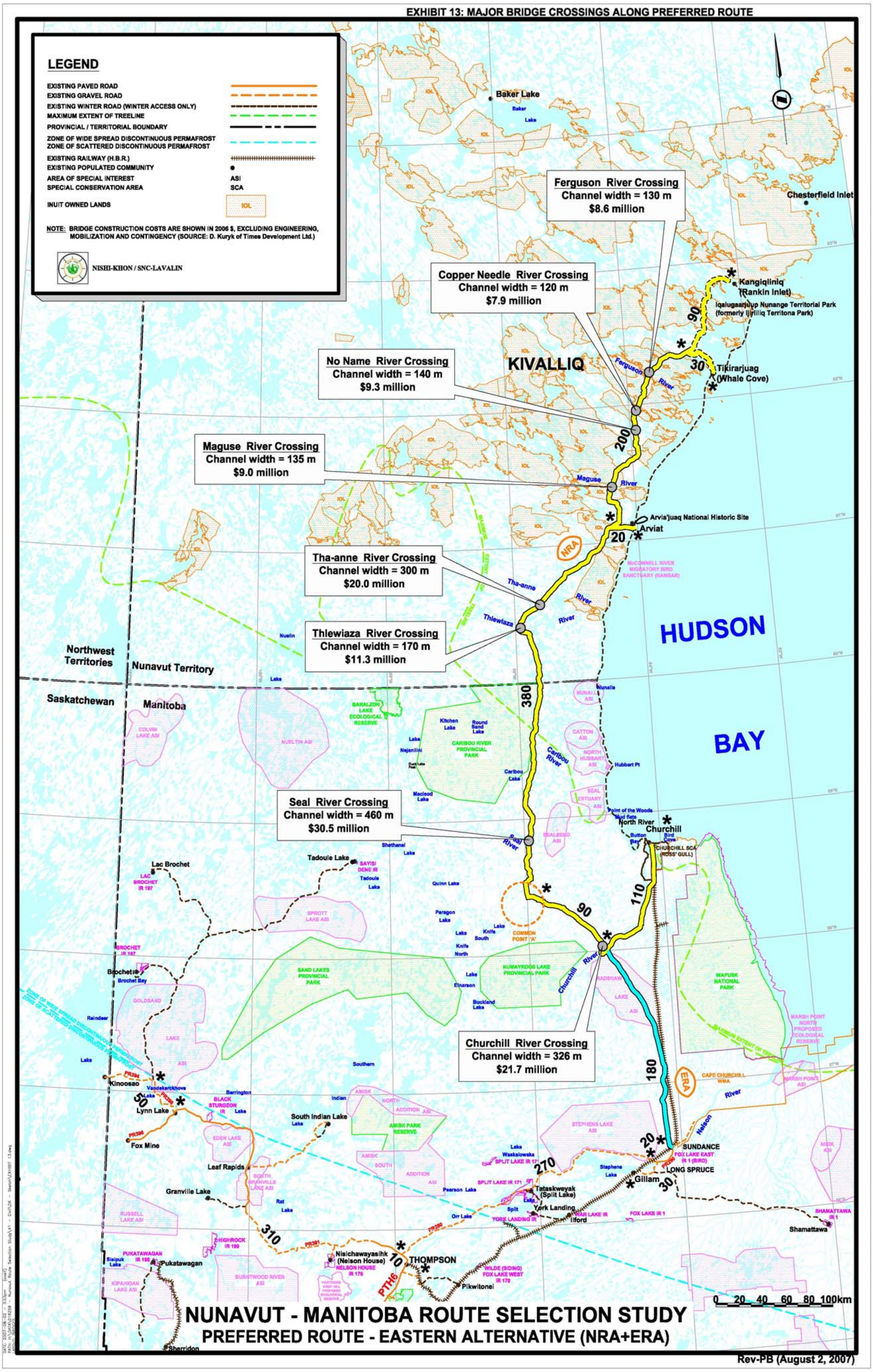
Crossing No.	Name	Top bank (m)	Channel Width (m)	Type	Total Cost ($)
NRA (Rankin Inlet to Churchill, Cont'd):					
53	Goose C	1112	70	F	2,842,000
54		660	25	B	373,000
55	Deer R	577	35	C	748,000
56	56	249	1	A	120,000
57	Crosswell R	268	40	C	841,000
ERA (Churchill River to Sundance/PR290):					
38	Laforte C	348	1	A	120,000
39	Crosswell R	517	1	A	120,000
40		530	1	A	120,000
41	Dog R	581	1	A	120,000
42	Deer R	448	25	B	387,000
43		408	1	A	120,000
44	Lost Moose C	490	1	A	120,000
45	Horn C A	450	1	A	120,000
46	Horn C B	607	1	A	120,000
47	Owl R	573	25	B	373,000
48		488	1	A	120,000
49	Silcox C	437	1	A	120,000
50	Cooper C	812	1	A	120,000
51		658	1	A	120,000
52	Weir R	450	1	A	120,000
	TOTAL (All Crossings)				165,535,000

Note:

Type of Bridge Crossings by Channel Width

A = 5 -20 m
B = 20-30 m
C = 30-40 m
D = 40-50 m
E = 50-60 m
F = 60-70 m
G = 70-80 m
H = 80-90 m
I = 90-100 m
J=100-110 m
K=110-120 m
L = > 120 m

Figure 4-3: Major Bridge Crossings along Preferred Route (NRA+ERA)



4.3 ALTERNATIVE CROSSINGS OF THE CHURCHILL RIVER

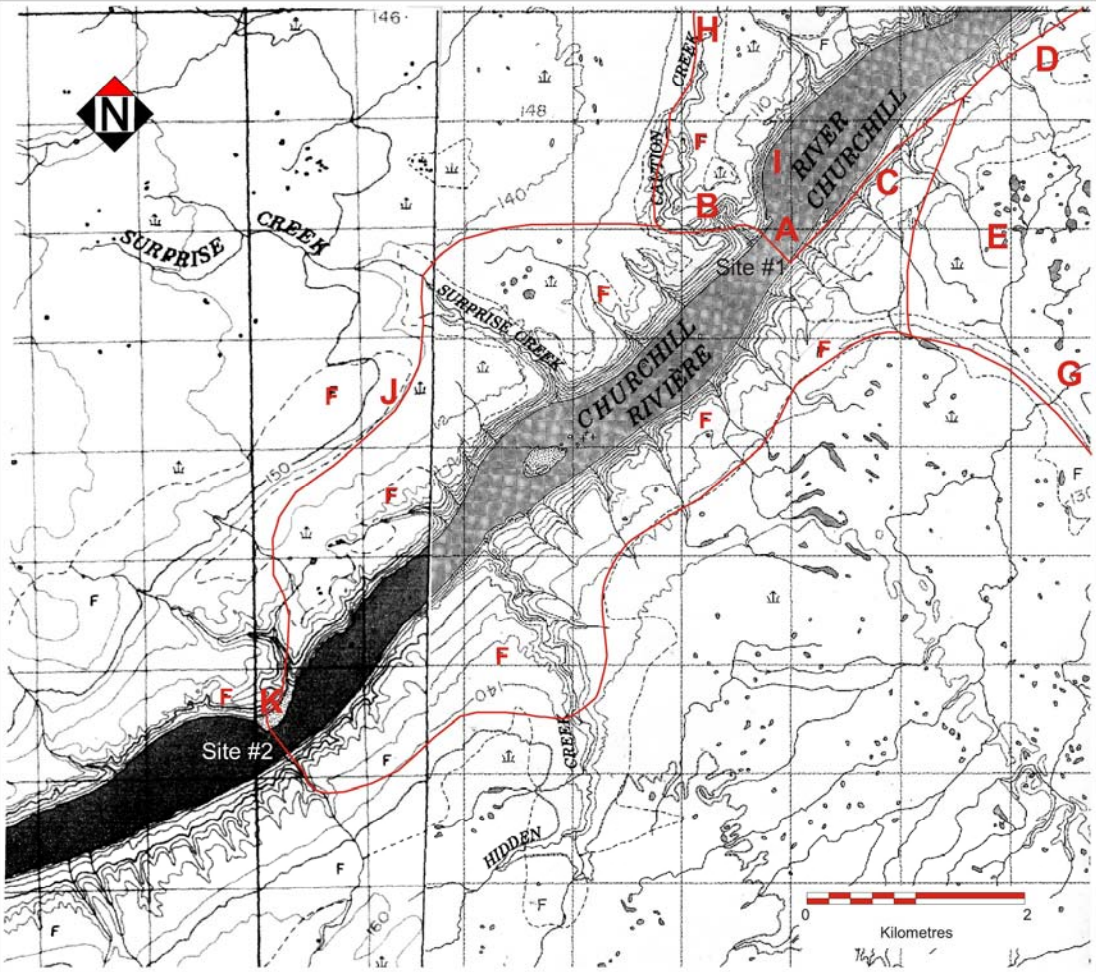
The crossing of the Churchill River presents one of the biggest challenges associated with the location of the preferred route. From the head of the Churchill Lake in Saskatchewan, the river is 1,609 km long and flows east through a series of lakes (Highrock, Granville, Southern Indian and Gauer) before emptying into the Button Bay inlet of Hudson Bay at Churchill, Manitoba. The proposed NRA/ERA crosses the Churchill River near the northern boundary of the Bradshaw Lake ASI where the route to PR290 proceeds south along the Great Beach. The proposed crossing site, called Site 1, or the Great Beach Site, has a channel width of 326 m, a top of bank width of 1645 m and a water elevation at 67 m above mean sea level (AMSL) at the crossing. The north bank is 54.1 m and the south bank 53.8 m above the river level. To ensure that this is the best location for the crossing, a study was undertaken by J.D. Mollard and Associates in search for alternative bridge sites upstream and downstream from this Great Beach crossing site. This study involved the examination of 2 surficial geology maps, 2 bedrock geology maps, maps obtained from Manitoba Hydro that outline the Churchill River weir fore-bay and adjoining protected lands, 1:50,000 and 1:250,000 topographic maps, 1:60,000 and 1:40,000 3D air photos and, finally, satellite imagery (see Appendix 4 of Milestone Report A: "Search for Alternate Bridge Crossing Sites on the Churchill River" by J.D. Mollard & Associates Ltd., November 6, 2006).

The evaluation factors used in selecting the crossing sites included:

- River width, a major site-controlling factor
- Rapids (and lack of rapids) in the river channel
- Types of bedrock in rapids in the Churchill River
- The suitability of bedrock for coffer dam, rock fill, riprap and concrete construction
- Flat-lying river bench of carbonate rock, that narrows the river width
- Character of bridge approach slopes, both sides of the Churchill River
- Desirability of directly opposite deep ravines on the Churchill River valley, to reduce deep bridge approach excavation in lacustrine and marine deposits, till and bedrock
- Valleyside slope stability, where potentially deep cuts and steep side hill are necessary at crossings
- Narrow band of till in valleysides and on the adjoining upland before reaching, laterally, discontinuous ice-rich peatlands (permafrost) overlying fine-grained marine and lacustrine sediments
- Slope failures along the upper Churchill River valley and tributary ravine sides (skin flows and bimodal retrogressive thaw flowslides in permafrost affected terrain
- Length and location of road routes connecting alternative bridge sites to the Great Beach, including route topographic, geologic and foundation conditions along these connecting route segments
- Churchill River weir forebay shoreline and extent of flood-level fluctuations
- Distance to source of granular material for coffer dams, rock fill and concrete for dam construction
- Protected lands outside the weir forebay (Manitoba Hydro maps)

Four alternative crossing sites were identified in this study, two upstream and two downstream of the Great Beach Site. In conclusion, the Great Beach Site was preferred because access to both ends of the bridge can be made with reasonable grades. A cofferdam can be constructed out from the north shore to reduce bridge width. The north side underwater depth should be less owing to incoming sediment from the adjoining ravine. Rock fill for the cofferdam and bridge piers can be hauled economically over river ice in winter. Granular material is available nearby from the Great Beach from both sides of the Churchill River. A significant drawback of this crossing is the near right-angle (90°) route alignment at the southwest end of the bridge at this site. Guardrails will likely be required along the route from river level to the upland. The crossing at this site ties well with the Great Beach on both sides of the Churchill as well as a connection to the Port of Churchill (See Figure 4-4 for the terrain types in the vicinity of Site 1, the Great Beach site).

Figure 4-4: Terrain Types in the vicinity of Churchill River Crossing Site 1



- **A** Narrowed water section at bridge Site #1 (water may also deepen at this crossing).
- **B** Winding ~3% gradient route down the NW valleyside. Looks stable, mainly till.
- **C** Relatively uniform ~3% gradient up stable-looking till along SW valleyside (need guard rail).
- **D** Connecting road route to Port of Churchill.
- **E** Connecting route from Port of Churchill to Great Beach.
- **F** Small "F"s indicate forested, suggesting drier soil and thinner surface organic layer.
- **G** South side Great Beach (granular material).
- **H** North side Great Beach (granular material).
- **I** Anomalous expansion of river which suggests more easily eroded material.
- **J** Haul route for blasted rock fill and riprap.
- **K** Elevated flat limestone bench: 150-m wide x 300-m long (bedrock source).

LEGEND FOR TERRAIN FEATURES, VICINITY OF SITE #1

Source: "Search for Alternative Bridge Crossing Sites on the Churchill River", J. D. Mollard and Associates, November 6, 2006, Figure 7.

4.4 ALIGNMENT ALTERNATIVES CROSSING THE BRADSHAW ASI

To address the concern of the potential impacts of the all-weather road on the Bradshaw Lake Area of Special Interest (ASI), a study was conducted by J. D. Mollard and Associates to examine the location and terrain conditions along alternative road route alignments through the ASI. In this study, 3-D air photos were examined and three additional alternative road routes were identified in addition to the initial alignment (called the Great Beach Red Route) crossing the Bradshaw ASI. The three alternative alignments consist of: a Green Route alignment along the eastern edge of the main Great Beach; a Purple Route alignment along the western edge of the Great Beach; and a Blue Route alignment west of the Great Beach along discontinuous short narrow single beach ridge segments separated by peat plateau bogs containing massive ground ice (see Appendix 9: Alternative Road Route Alignment Crossing The Bradshaw Area Of Special Interest (ASI), J.D. Mollard & Associates Ltd., February 5, 2007).

In comparing the alternative road routes through the Bradshaw Lake ASI, the following were taken into considerations:

- previous routing and terrain analysis related to Hudson Bay Railway from the Pas to Churchill and a possible pipeline route through the Bradshaw Lake ASI
- surface geology, terrain material, topography, drainage courses and the road right-of-way requirements of each of the alternate routes

In conclusion of this study, the original alignment through the Great Beach was selected as the preferred route to minimize construction and long-term road maintenance costs, and to minimize long-term environmental and potential traffic safety effects associated with thaw settlement on the icy peatland off the Great Beach.

5.0 NEXT STEPS

The work under Tasks A, B and C are now completed. Based on the Multiple Account Evaluation of the three route alternatives, the preferred route has been identified to be the northern common route in combination with the eastern route (NRA+ERA). This finding was presented by the Consultant Team and Project Working Group to the Project Steering Committee in November 2006, and subsequently to the Project Advisory Committee and the general public in the second round of public consultation in February 2007. A number of government/non-government organizations were also consulted to discuss the issues and opportunities associated with the preferred route in their respective jurisdiction and to assist in confirming the next steps in the study process.

5.1 TASK D: FINAL REPORTING

The last task of the study involves the documentation and reporting of all the study findings, the compilation of a Final Report and a Final Newsletter for the general public. As outlined in Milestone Report A, the Final Report will merge Milestone Reports A and B and address any outstanding items listed in the study Request for Proposals, including:

- Documentation of the results of the stakeholder and public consultations;
- Providing a guide on environmental issues to be considered during the following stages of work by others, for both a winter road and an all-weather road;

- Capital and operating costs;
- The geometry of the preferred route based on a generalized visual classification from air photos;
- A discussion on the financial and social merits of building an all-weather road between Manitoba and Nunavut; together with the feasibility of road development within 10-year and 20-year planning horizons.
- Staging of the road development, including the feasibility of an initial winter road, followed by a single-lane, all-weather road, then finally, a two-lane, all-weather road.
- Discussion on the business case for the road development, including potential partnership and procurement opportunities, current economic opportunities that would be available as a result of the road, and potential opportunities as a result of the road access and associated economic spin-offs and benefits.
- The final newsletter that will inform all stakeholders and the general public as to the study results, seek input and reactions, provide rationale for decisions taken and, via a questionnaire, provide for final gap analysis.

Recommendations can also be made, if requested by the client, on a long-term strategy and prioritized program for winter and all-weather road development to eventually link all un-serviced communities in the study area. The consultant team may also identify the following in the Final Report:

- Environmental licensing requirements
- Land tenure issues
- Future training requirements
- Jurisdictional licensing and funding responsibilities
- Business case criteria.

APPENDIX 1

MULTIPLE ACCOUNT EVALUATION WORKSHOP

(Value Management Inc., October 2006)

APPENDIX 2A

COST ESTIMATES

Cost Estimates (J.D. Mollard & Associates Ltd, October 12, 2006)

APPENDIX 2B

COST ESTIMATES

(Times Development Ltd., Revised August 17, 2007)

APPENDIX 3

TRAFFIC REPORT

(SNC-LAVALIN Inc., Revised August 17, 2007)

APPENDIX 4

BENEFIT COST ANALYSIS

(APEX ENGINEERING Ltd., February 24, 2007)

APPENDIX 5

SECOND PUBLIC CONSULTATION

– PUBLIC NOTICE

APPENDIX 6

SECOND PUBLIC CONSULTATION

– POWERPOINT PRESENTATION

APPENDIX 7

NEWSLETTER ISSUE 2 VOLUME 1

(ENGLISH, DENE, CREE AND INUKTITUT)

APPENDIX 8

GUIDE TO NIRB REVIEW PROCESS

(Updated November 2006)

APPENDIX 9

ALTERNATIVE ROAD ROUTE ALIGNMENT:

CROSSING THE BRADSHAW AREA OF SPEICAL INTEREST (ASI)

(J.D. Mollard & Associates Ltd., February 5, 2007)

NISHI-KHON/SNC-LAVALIN LIMITED

February 2, 2007

Project: NKSL No. 016259
By: Fax or Email

Dear Project Advisory Council,
Project Steering Committee,
Project Working Group,
Mayors,
Members of Legislative Assemblies,
Members of Parliament and Senator:

Re: Nunavut-Manitoba Route Selection Study: Community Consultations, February 2007

Further to the public consultations in the local communities last year, the Study Team for the Nunavut-Manitoba Route Selection Study will be conducting a second round of community consultations in Northern Manitoba and the Kivalliq region of Nunavut.

As your input and interests are highly valued, we wish to invite you to attend and participate in these consultations. Please feel free to invite anyone else that you feel may be interested to attend these meetings. The locations and dates for the consultations in Northern Manitoba and Kivalliq are as follows:

Community:	Date:	Place:
Thompson	February 9, 2007 (Friday) 1:00 - 7:00 pm	University College of the North
Rankin Inlet	February 15, 2007 (Thursday) 7:00 - 9:30 pm	Siniktarvik Hotel
Arviat	February 16, 2007 (Friday) 3:00 -5:30 pm	Community Hall
Whale Cove	February 19, 2007 (Monday) 7:00 - 9:30 pm	Inuglak School
Churchill	February 20, 2007 (Tuesday) 7:00 -9:30 pm	Town Complex

The goals for the community meetings are:

1. To provide you with an update on the study progress to date

2. To present the engineering, social, economic and environmental analysis conducted so far

3. To present the results of the evaluation of the route alternatives and the Study Team's preferred route

4. To seek your input on the preferred route, and other project issues and opportunities

For more information, you can contact us at this toll-free number 1-866-610-3555, and ask for either Tim Stevens or Tony Wachmann.

We look forward to your attendance at these up-coming community consultations.

Sincerely,

T. Stevens

Tim Stevens, P. Eng.
Project Manager
E-mail: Tim.Stevens@snclavalin.com

A R Wachmann

Tony Wachmann, P. Eng.
Project Sponsor
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Attachment: Distribution List:

- Project Advisory Council
- Project Steering Committee
- Project Working Group
- Consultant Team and Others
- MLAs
- MPs

Distribution List:

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Senators: Nunavut

Willie Adams	Senator for Nunavut		Email: adamsw@sen.parl.gc.ca

NUNAVUT MANITOBA ROUTE SELECTION STUDY
(Selection of the Preferred Route)

Presentation to Project Advisory Council
Thompson, MB: February 8, 2007
Rankin Inlet, NU: February 15, 2007

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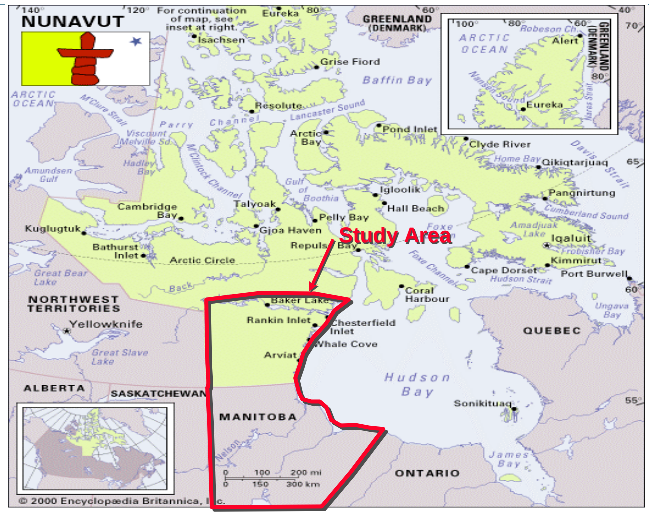
Agenda

- Project Goals and Progress
- Engineering Analysis
  - Road Development Criteria
  - Route Engineering (NRA, WRA, CRA, ERA)
  - Construction Issues
  - Traffic Projections and Transportation Benefits
- Social & Economic Findings
- Natural Environment Analysis
- National/Regional Economy and Interests
- Evaluation of Route Alternatives
- Preferred Route
- Next Steps/Communications/Discussion

Project Location



NISHI-KHON SNC·LAVALIN

3

Project Goals

To answer the following questions:

- Is it feasible to link Rankin Inlet, NU and Churchill, MB by an all-weather road to the National Highway System in MB?
- What is the likely scope of the social and economic benefits and impacts of an all-weather road on northern communities?
- What are the potential natural environment impacts associated with an all-weather road?
- What is the range of construction and maintenance costs for such a road?
- Can an all-weather road be staged initially as a winter road?
- Where is the best route for an all-weather road, taking into account engineering, the natural and social environment, the regional economy and national interests?
- What is the business case for a new road?

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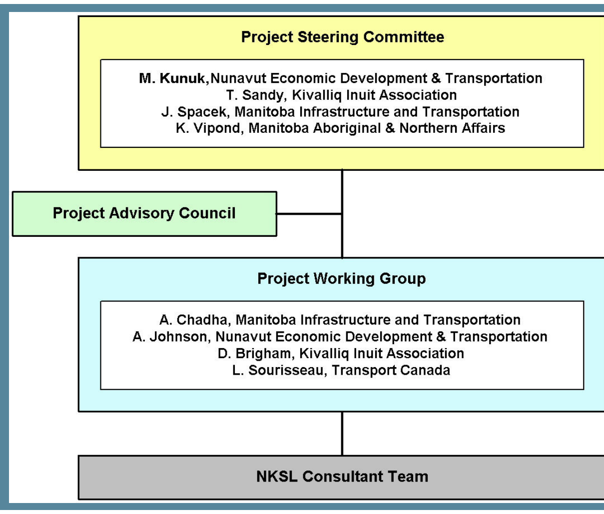
4

Project Organization



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Study Progress

Project Milestones:

Steering Committee Meetings	♦ Sept 27, 2005: Winnipeg, MB ♦ Nov 6, 2006: Winnipeg, MB
Project Advisory Council Meetings	♦ Nov 1, 2005: Rankin Inlet, NU ♦ Nov 3, 2005: Thompson, MB ♦ Feb 8, 2007: Thompson, MB ♦ Feb 15, 2007: Rankin Inlet, NU
Public Consultations	♦ Jan – Oct 2006: - 15 communities in NU and MB ♦ Feb 2007: - 5 communities in NU and MB ♦ Project Website and Newsletters
NGO and First Nations	♦ Apr 2005 – Nov 2006: - Nunavut Day, HBNRRT, BQCMB, NMRDC, MKIO and KCC
Written Responses	♦ Barren Lands First Nation, Nov 7, 2005 ♦ MKIO Resolution, Feb 14, 2006 ♦ MB Conservation, Feb 17, 2006 ♦ BQCMB, Nov 14, 2006

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Study Progress

Reports Prepared to Date:

- Nunavut-Manitoba Road Route Selection Study Summary Report on Alternative Route Selection, Terrain Mapping and Borrow Location, J.D.Mollard & Assoc., Ltd: June 26, 2006
- Manitoba-Nunavut Bridge Sites on ERA and CRA Road Routes, J.D.Mollard & Assoc., Ltd: Sept 28, 2006
- Manitoba-Nunavut Bridge Sites on Western Route Alternative, J.D.Mollard & Assoc. Ltd: Oct 20, 2006
- Nunavut-Manitoba Route Selection Study Initial Public Consultation Summary Report: Draft Sept 29, 2006
- Social and Economic Scoping - Findings Report: Final Draft, Oct 24, 2006
- Ecological Values and Related Issues Report: Intermin Report, Oct 2006
- Milestone Report A: Draft Dec 20, 2006 (contains all above reports as appendices)

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Road Development Criteria

• All Weather Road: RAU 80-100

- Phase 1: Top width: 5 m one lane, one-way with passing opportunities
- Phase 2: Top width: 8 m two lane, two-way
- Fill embankment height: 1-1.5 m crush rock or granular materials
- Side slopes: 3:1 (traversable)
- Ditches: If required
- Design Speed: Use higher design speed for both horiz. and vert.alignment where feasible; use lower design speed for vert. alignment if cost prohibitive

• Winter Road: LVR 30

- Cleared width: dependent on terrain
- Where feasible, use same alignment as for all-weather road

• All Weather Road/Winter Roads

- Structure Clear Width = 4.3 m (14 ft)

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Route Engineering

- **Terrain**
  - Wilderness
  - Flat to rolling near coast
  - Rugged inland from coast
  - Numerous lakes, rivers and streams

- **Soil types/conditions:**
  - Predominantly organic deposits, wetlands, fens, peat plateaus, discontinuous and continuous permafrost
  - Some eskers, moraines, old beach ridges and bedrock outcrops

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9

Typical All-Weather Road

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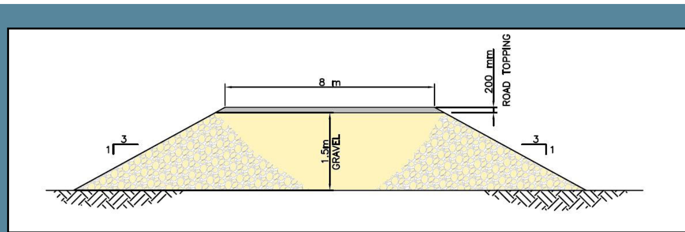
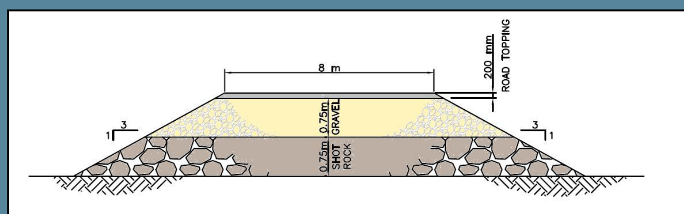
Typical Cross-Sections





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Typical River Crossing

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Route Location Criteria

- Direct route between communities to be served
- Smooth, firm and reliable road foundation
- Proximate granular materials or rock outcrops to build road embankment
- Narrow river crossings away from rapids to avoid fisheries impacts, minimize bridge costs and avoid potential ice jams
- Avoid unique wildlife habitat (flora & fauna), wildlife populations, heritage values and protected areas.
- First find best all-weather route; then assess feasibility of winter road following similar route

Alternative Routes Developed by J.D. Mollard & Associates (JDMA), based on bedrock and surficial geology maps, topographic maps and satellite imagery (see previous exhibits for ARA-1, WRA-1, CRA-1, CRA-2, ERA-1 and ERA-2).

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Global Warming

- Recent studies indicates rise in MAAT (Mean Annual Air Temperature), suggesting that Canada's mainland permafrost may start to thaw in 2067*
- Significant impacts on earth-surface processes; would likely affect stability of engineered structures
- Key question: if permafrost thaws in a given terrain, will the ground be thaw-stable or thaw-unstable?
- Selection of the NU-MB route alternatives has considered:
  - Best foundation materials in permafrost terrains: exposed solid rock; no ice in cracks; clean, non-frost-susceptible and well-drained sand or gravel
  - Bedrock and granular deposits for roadfill materials and thaw-stable road-bed foundations
  - Avoidance of ice-rich peat plateau bogs and stratified fine waterlaid sediments in locating the route alternatives

*Source: Holubec, I. "Review of Climate Warming Along Canadian Mainland Continuous Permafrost Region", March 2006.

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Construction Issues

- **Construction Issues**
  - •Continuous permafrost
  - •Discontinous permafrost
  - •Organic deposits, wetlands, fens, peat, muskeg
  - •Eskers
  - •Bedrock outcrops
- **Issues for All-Weather Roads**
  - •Locate on firm ground: granular materials or bedrock
  - •Avoid organic deposits
  - •Locate close to granular sources or rock outcrops: needed for embankment construction
  - •Build embankment to height 1-1.5 m to reduce accumulation of drifting snow
  - •Design drainage to minimize ice build-up next to road
  - •Provide pull-offs (lay-bys) every 100 km or so

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Construction Issues

- **Issues for Winter Roads**
  - Follow all-weather route if feasible (I.e. on firm ground)
  - Avoid large bodies of water: safety, pollution risks
  - Permanent river and stream crossings
  - Locate within tree line to reduce snow blowing/drifting
  - Clear trees, up to 30 m wide
  - Difficult and costly to maintain on bare tundra
- **Issues for River and Stream Crossings**
  - Choose narrow river and stream crossings away from rapids, but close to aggregate sources needed for piers, abutments and scour protection
  - Avoid construction within wetted area if possible
  - Where feasible, for spans < 107 m (350 ft), use pre-fabricated Meccano or Acrow (Bailey) bridges for economy and ease of construction
  - Design for full highway loadings (62.5 Tonnes), wide enough to accommodate over-sized loads up to 4 m wide
  - Build in winter to minimize environmental impacts and to facilitate construction
  - Locate to accommodate winter and all-weather roads

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Population and Existing Transportation Services

Community	Population (2006)	Public Transportation Service: Air	Marine	Rail	Winter Road	All-weather Road
Tadoule Lake, MB	700	✓			✓	
Lac Brochet, MB	900	✓			✓	
Brochet, MB	900	✓			✓	
Lynn Lake, MB	800	✓		✓		✓
South Indian Lake, MB	900	✓	✓			✓
Thompson, MB	16,000	✓		✓		✓
Nelson House, MB	1,900					✓
Split Lake, MB	1,800	✓	✓			✓
Gillam/Bird, MB	1,360	✓		✓		✓
Churchill, MB	1,000	✓	✓	✓		
Arviat, NU	2,000	✓	✓			
Whale Cove, NU	400	✓	✓			
Rankin Inlet, NU	2,500	✓	✓			
Chesterfield Inlet, NU	450	✓	✓			
Baker Lake, NU	1,900	✓	✓			

*** Population based on "First Nations Community Profiles Manitoba Region 2004-05" and Canada Census 2001, all adjusted to the current year 2006, cross-referenced with information provided by Government of Nunavut for this study.**

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Transportation Benefits

- **Very limited transportation infrastructure in NU**
  - **Absence of roads; communities generally depend on air and seasonal marine service for goods transport and passenger travel (privately operated winter road on sea ice, west side of Hudson Bay)**
- **Remote communities in northwestern MB generally accessible only by air and winter roads**
- **NU-MB fixed link will provide savings to freight and passenger traffic**

Freight Transport Costs (2006$; $/Tonne)

	Nunavut: Winnipeg to Kivalliq	Manitoba: Lynn Lake to Tadoule Lake
Air	$ 3,520	$ 860
Road/Rail/Barge	$ 500	-
Truck (Existing Winter Road)	-	$ 211
Truck (AWR) - Western Route	$ 548	$ 55
Truck (AWR) - Central Route	$ 445	-
Truck (AWR) - Eastern Route	$ 447	-

*** Transport Costs based on KIA and "NU-MB Transportation Assessment" (Prolog, 2000) adjusted to 2006$ with 4% increase/year.**

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Traffic Shift to All Weather Road

- Traffic shift to the new road based on Logit Model relative to cost and travel time differences

Cargo from Winnipeg to Rankin Inlet for Community Resupply

	Existing Cargo by Mode (2006) (Tonne/Yr)	Existing Model Split	Forecast Model Split (AWR)		
			Western Route	Central Route	Eastern Route
Trucks (AWR)	-	-	53%	54%	54%
RB	7,100	36%	22%	22%	22%
RRB	3,500	18%	-	-	-
Air	9,400	47%	25%	24%	25%
Total	20,000	100%	100%	100%	100%

Notes:
- RB = Road (Winnipeg-Thompson) + Rail (Thompson-Churchill) + Barge(Churchill-Rankin Inlet)
- RRB = Road (Winnipeg-Thompson) + Rail (Piggyback Thompson-Churchill) and Barge(Churchill-Rankin Inlet)
- Cargo volume based on "NU-MB Transportation Assessment" (Prolog, 2000) adjusted to 2006 with 2.4% population increase/year.
- Modal Split based on Logit Model using Utility Function based on Cost and Travel Time

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Traffic Projections

- Annual Traffic Volume: All Weather Road (2031 Design Horizon)

	Trucks/Year	Light Veh./Year	Total Veh./Year	Avg.Veh./Day
Western Route	2,750	820	3,570	9.8
Central Route	2,800	980	3,780	10.4
Eastern Route	2,780	910	3,690	10.1

Notes:
- Based on Gravity Model, Existing Volumes (2005) projected to 2031 for long distance travel demand
- Excludes induced demand due to opening of All-Weather Road and potential mining activities in the area

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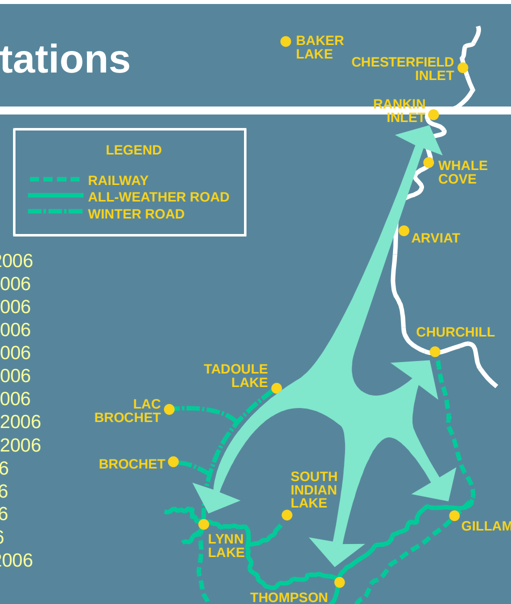
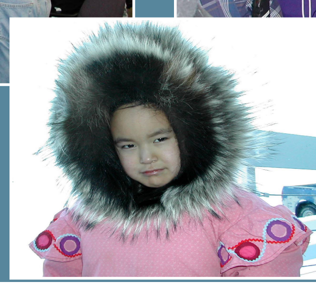
Community Consultations



Tadoule Lake, MB	January 31, 2006
Lac Brochet, MB	February 2, 2006
Brochet, MB	February 3, 2006
Lynn Lake, MB	February 6, 2006
South Indian Lake, MB	February 7, 2006
Thompson, MB	February 8, 2006
Nelson House, MB	February 9, 2006
Split Lake, MB	February 10, 2006
Baker Lake, NU	February 27, 2006
Rankin Inlet, NU	March 1, 2006
Arviat, NU	March 3, 2006
Churchill, MB	March 4, 2006
Chesterfield Inlet, NU	April 10, 2006
Whale Cove, NU	October 18, 2006

Community Consultations



Social and Economic Findings

- Guiding Principles
  - Community-centred approach
  - Social and economic considerations (integrated view model)
  - Understanding context
  - Precautionary principle
  - Valuing and using Traditional Knowledge with respect

- Process
  - Community meetings
  - Local community representatives in Consultation Team
  - Telephone follow-up with key respondents
  - Assessment of Place
  - State of Community

See "Social and Economic Scoping Findings Report "(Final Draft Oct 24, 2006, D. Witty)

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Assessment of Place: Self-Assessment Findings

- Neutral to positive view by NU-MB community members
- Agreement that fixed link will bring economic benefits
- Concerns about the social issues (mainly drugs and alcohol use)
- Negative impression of the fixed link upon the environment: caribou and increasing hunting

Table ES-1: Summary of Self-assessment of Fixed Link Effects[1]

Community[2]	Economic	Environment	Social	Overall assessment
Arviat	+	-	+	**+**
Bird	+	o	o	**o/+**
Brochet	+	-	o/-	**o/-**
Churchill	+	o	o/+	**+**
Gillam	+	o	o/+	**+**
Lac Brochet	+	-	-	**-**
Lynn Lake	+	o	o/+	**+**
Rankin Inlet	+	-	o/-	**o/-**
Tadoule Lake	o	-	-	**-**
Whale Cove	+	o	o	**o/+**
OVERALL	**+**	**-**	**o**	**o/+**

Where: + is positive; o is neutral; - is negative

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State of Community: Findings

- Majority of communities support fixed link - greatest support in: Arviat, Churchill, Gillam/Bird, Lynn Lake, and Rankin Inlet
- Tadoule Lake expressed particular vulnerability issues around social and environmental considerations.
- Brochet and Lac Brochet expressed cautious support for a fixed link.
- All communities recognized fixed link would reduce cost of goods and provide greater supply flexibility

Table ES-2: Key Respondent Feedback by Community

Community[1]	Key respondents					
	CEO/CAO/Band Manager	EDO	Health Care Worker	School Principal	Other	Overall
Arviat	n/a	+	n/a	+	n/a	+
Brochet	n/a	n/a	+	n/a	n/a	+
Churchill	+	+	+	+	n/a	+
Gillam	+	none	+	+	n/a	+
Lac Brochet	o	none	o	+	+	o/+
Lynn Lake	+	+	+	+	n/a	+
Rankin Inlet	+	+	o	+	n/a	+
Tadoule Lake	-	+	-	+	+	o
Whale Cove	+	+	+	+	n/a	+
Overall	+	+	+	+	n/a/+	+

Where: n/a is not available; + is positive; - is negative; o is neutral; none means no such position

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Public Feedback on Alternatives Road Routes

- NU communities focused on shortest and most economical all-weather route south
- MB communities focused on pros and cons of an eastern route versus western route
- Northwestern MB communities on winter road system: primary interest was in an all-weather connection to the south.
- No communities provided any direct feedback on variations within western, central, eastern and northern “corridors”

See Exhibit 11 for the refined route alternatives (NRA, WRA, CRA, ERA).

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NGO and First Nations Consultation

- Nunavut Day: Winnipeg, MB, April 27, 2005
- Hudson Bay Neighbours Regional Round Table (HBNRRT): Rankin Inlet, NU, May 18, 2005 and Gillam, MB, October 5, 2005
- Beverly and Qamanirjuaq Caribou Management Board (BQCMB), Rankin Inlet, NU, May 27, 2005 and Winnipeg, MB, Nov 24, 2005
- NorMan Regional Development Corporation (NMRDC): Flin Flon, MB, September 9, 2005; Winnipeg, MB, November 24, 2005; and Snow Lake, MB, February 24, 2006
- Keewatin Tribal Council: The Pas, MB, February 14, 2006
- Kivalliq Chamber of Commerce: Rankin Inlet, NU, March 28, 2006

Feedback from Government/ Non-government Agencies

MB Conservation feedback on alternatives:

- Modifications to avoid specific features in protected areas and protected areas in general
- Indicated preference for eastern alternative but avoiding Bradshaw Lake ASI

Manitoba Keewatinook Ininew Okimowin

- Support for an all-weather road through the northwest region of Manitoba to Nunavut (a western route alternative) to service the Barren Land, Northlands and Sayisi Dene First Nations

Beverly and Qamanirjuaq Caribou Management Board

- Concerned about road development on barren ground caribou
- Select a route with the least impact on caribou and to re-investigate a rail option to Nunavut
- Investigate road impacts on caribou in other parts of Canada

Natural Environment

- Physiography of Study Area
  - Canadian Shield, bedrock at surface
  - Kazan Region of Shield, except Churchill corridor
  - Periglacial landforms, raised beaches, moraines and eskers
  - Land adjacent to Hudson Bay a post glacial seabed
  - Sedimentary clay over shield in Hudson region
  - Elevations vary from sea level along Hudson Bay to 500 m in the Selwyn Lake Upland

- Climate eco-zones/ eco-regions/growing season

• S. Arctic: Maguse River Upland	100 days
• Hudson Plains: Coastal Hudson Bay Lowland	100 days
• Taiga Shield: Kazan River Upland	104 days
Selwyn Lake Upland	132 days
• Boreal Shield: Churchill River Upland	151 days
Hayes River Upland	149 days

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Natural Environment

- Mean Annual Temperature of Study Area
  - → -11C in north; -4C in southeast
- Mean Annual Precipitation
  - → 200 mm in north; 600 mm in southeast
- Coast climate moderated by open waters of Hudson Bay late summer/early fall; damp foggy weather
- Continuous permafrost in north; discontinuous permafrost in south
- Surficial geology in study area includes:
  - → Massive rocks forming uplands and lowlands
  - → Hummocky bedrock outcrops overlain with tills
  - → Prominent eskers
  - → Significant wetlands and fens: 25-50% of the land area in some regions
  - → Many rivers, streams; large, medium and small lakes

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Natural Environment

- **Flora and Fauna**
  - Dwarf birch, willow and alder on warm, dry sites; willow, sphagnum moss, and sedge on poorly drained sites are dominant in the tundra
  - Black spruce tamarack and jack pine are the predominant species in the boreal forest
  - Habitats host the following species: reptile (1), amphibians (2), fish (27), birds (126) and mammals (35)
  - No endangered species, Ross's Gull is threatened (nests near Churchill), and yellow rail is a special concern
  - Caribou is the biggest harvested resource among the mammals
  - The most important fish resources are: arctic char, lake trout, white fish, arctic grayling, northern pike, while sucker, burbot and walleye

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Natural Environment Findings

Potential Incremental Benefits/Risks on Resources and Environment

	All-Weather Road Phase			
Aspect / Route	West	Central	East	North
Resources Use				
Forest	0	+1	0	0
Tourism Dev.	+1	+1	+1	+1
Ecotourism Dev.	-1	-1	-1	-1
Mineral Expl.	+1	+1	+1	+1
Com. Fishing	+1	+1	+1	+1
Trapping	+1	+1	+1	+1
Hunting	+1	+1	+1	+1
Habitat Protection	-2	-2	-2	-2
Wildlife Populations	-1	-1	-1	-1
Watershed values	-1	-1	-1	-1
Fish Populations	-1	-1	-1	-1
Heritage Values	-1	-1	-1	-1
Protected Areas	-1	-1	-1	-1
Total	-3	-2	-3	-3

Note: 0 – no risk of change; +1/-1 – modest risk for change; 2/-2 significant risk for change

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National and Regional Economy & Interests

- **Proposed new road needs to address specific transportation issues and challenges in NU-MB communities**
  - Remote communities with no inter-community all-weather road infrastructure
  - Low population density and small markets
  - High construction and maintenance costs
  - Long distances between communities
  - Extreme climate and difficult terrain
  - Traditional land use, lifestyles and values

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National/Regional Economy and Interests

- **How do alternative routes address strategic needs?**
  - Regional Economy/Resource Use
  - Sovereignty and Security
  - Regional Network (population served)
  - National Highway Policy
  - Port of Churchill
  - Inter-jurisdictional Trade
  - Partnering Opportunities
  - Work Staging
  - Reliability

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Multiple Account Evaluation

- MAE preliminary results based on workshop with Project Working Group on Oct 11-12, 2006

Evaluation Account	Evaluation Criteria	Western Alignment (NRA/WRA)	Central Alignment (NRA/CRA)	Eastern Alignment (NRA/ERA)
Financial Cost	• Life-cycle costs over 25 years of road construction (including structures), maintenance, rehabilitation and salvage values	○ Longest construction length and rugged terrain for new road west of Common Point A (i.e. WRA); highest cost	◎ Shorter construction length, rugged terrain for new road south of Common Point A (i.e. CRA); higher cost than ERA	● Shortest construction length, gentle terrain south of Common Point A (i.e. ERA); lowest cost
Transportation Savings	• Savings in freight and passenger transport costs to affected communities • Travel benefits to the road users	○ WRA serves 3 communities that now have only winter road land access, but is longest route from Rankin Inlet to Winnipeg	● Shortest distance between Rankin Inlet and Winnipeg but rugged terrain will reduce travel speed	◎ Less communities served than WRA but shorter distance from Rankin Inlet to Winnipeg
Social/ Community	• External effects of the new road on the communities', culture and social values including livelihoods, standard of living, education, use of drugs and/or alcohol	○ Mixed reaction to all-weather road from 3 MB communities that now have only winter road land access	◎ Least number of communities connected by new road	● Significant support from affected communities
Natural Environment	• Nature, degree and mitigation of the impacts to the natural environment (e.g. habitat protection, wildlife populations, watershed/fish values and protected areas)	◎ In same corridor as winter road in MB, but crosses 2 ASIs; concern with impacts on wildlife habitat, especially caribou	○ Impacts on park, park reserves and 2 ASIs	◎ Subject to acceptable mitigation through Bradshaw Lake ASI, modest environmental impact due to shortest length of new road construction
Economy/ National Interest	• Strategic interests served by the new road (e.g. national connectivity; benefits to resource use and inter-jurisdictional trade, Port of Churchill, and sovereignty/security issues)	○ Indirect connection (1070 km) between Churchill and NHS at Thompson; indirect connection (1530 km) between Rankin Inlet and Thompson	◎ Direct connection (560 km) between Churchill and NHS at Thompson but terrain is rugged; direct connection (1020 km) between Rankin Inlet and Thompson	● Direct connection (590 km) between Churchill and NHS at Thompson, gentle terrain; fairly direct connection (1230 km) between Rankin Inlet and Thompson; direct access to north from Nelson River hydro stations; completes reliable multi-modal surface access (road and rail) to Churchill at least cost of all options; shortest length (290 km) of construction from Churchill to Manitoba's all-weather road system
Overall		○	◎	●

Legend: ● = More Favourable; ◎ = Favourable; ○ = Less Favourable
ASI = Area of Special Interest; NHS = National Highway System

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Preferred Route

- **Rationale for preferring the Eastern Route:**
  - Most cost-effective in light of its length, the terrain, construction and maintenance costs and staging of the connection to Gillam (therefore allowing earlier opening and operation of the road section)
  - Strong support from affected communities
  - Least environmental impact of the three options because of its shorter length (subject to solution through Bradshaw Lake ASI)

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Conclusion

Did we answer the following questions?

- Is it feasible to link Rankin Inlet, NU and Churchill, MB by an all-weather road to the National Highway System in MB?
- What is the likely scope of the social and economic benefits and impacts of an all-weather road on northern communities?
- What are the potential natural environment impacts associated with an all-weather road?
- What is the range of construction and maintenance costs for such a road?
- Can an all-weather road be staged initially as a winter road?
- Where is the best route for an all-weather road, taking into account engineering, the natural and social environment, the regional economy and national interests?
- What is the business case for a new road?

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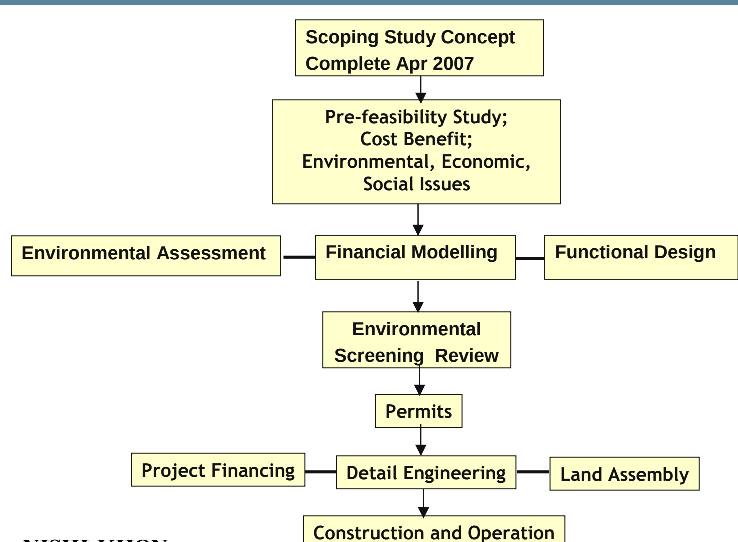
Future Development Phases



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Next Steps/Discussion

- Complete Project Advisory Council meetings in Thompson and Rankin Inlet
- Undertake 2nd Round of Community Consultations meetings: Thompson, Rankin Inlet, Whale Cove, Arviat and Churchill
- Publish Newsletter #2 and Update Project Website
- Finalize preferred route option and business case
- Draft Milestone Report 'B'
- Draft Final Report
- Meetings with Project Working Group and Steering Committee in Winnipeg

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End of Presentation

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Appendix 5. Multiple Account Evaluation Workshop

MULTIPLE ACCOUNT EVALUATION

WORKSHOP

FOR THE

NUNAVUT – MANITOBA
ROUTE SELECTION STUDY

October 11 – 12 2006
Winnipeg, MB

SNC·LAVALIN

MISHI-AHGN

VMI
VALUE MANAGEMENT INC

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INTRODUCTION

Value Management Inc. (VMI) was commissioned by Nishi-Khon/SNC Lavalin Ltd., to facilitate a Multiple Account Evaluation (MAE) workshop to identify the optimum corridor and preferred route of the proposed Nunavut-Manitoba all weather road. The workshop was carried out in conjunction with the Project Working Group and the Nishi-Khon/SNC Lavalin Consultant Team.

A two-day workshop was held in Winnipeg on Wednesday and Thursday, October 11th and 12th, 2006. On Day 1, the workshop commenced with introductions, an update by the consultant team of the status of the project and an explanation of the workshop objectives. This was followed by an outline of the Multiple Account Evaluation (MAE) process, detailed overviews of the common route from Rankin inlet to Churchill and the three alternative routes proposed for the western (WRA), central (CRA) and eastern (ERA) corridors to connect to Thompson, together with their respective construction, environmental and cost issues. The workshop group was also updated on the results of the community consultation process.

On the second day, the workshop group was tasked with carrying out an evaluation of the three alternative routes through an MAE exercise.

TERMS OF REFERENCE

Project Overview

The governments of Nunavut and Manitoba, together with the Kivalliq Inuit Association (KIA), are carrying out a two-year multidisciplinary study to determine the best location for a surface transportation route linking the community of Rankin Inlet in Nunavut to the existing all-weather surface transportation network in Manitoba. The purpose of this study is to select a route for a potential all-weather road and to evaluate the financial/economic opportunities and impacts of construction and operating a roadway network, servicing known and potential social stakeholders in the region. The first phase of the all-weather road may be a winter road.

Objectives of the MAE Workshop

The objectives of the workshop were to:

- Update the Project Working Group on the current status of the study.
- Provide an overview of the Rankin to Churchill route and the alternative routes identified by the study to connect to the Manitoba all-weather road system.
- Carry out an MAE of the alternative routes to objectively identify the optimum route.

ROUTE ALTERNATIVES

From an engineering perspective, the optimum route for building and operating an overland transportation network interconnecting Manitoba and Nunavut is primarily dictated by landscape topography, surficial geology and availability of appropriate road building materials. Areas of peat bog, permafrost and discontinuous permafrost, the number and size of water crossings, and, to a lesser extent, eskers and bedrock conditions, dictate caution in determining routes for all-weather roads. From a protected area point of view, all of the proposed routes traverse areas of special interest (ASIs), and, in one case, a Provincial Park and park reserve, that will ultimately require the approval of Manitoba Conservation.

For a complete understanding of the information underlying the evaluation and selection of the route alternatives, this report should be read in conjunction with the following draft reports prepared by the Nishi-Khon/SNC Lavalin Consultant Team:

- Initial Public Consultation Summary Report (Draft, September 29, 2006)
- Social and Economic Scoping – Findings (Final Draft, September 24, 2006)
- Ecological Values and Related Issues (Interim Report, October 2006)

Rankin to Churchill Alternative (Common Route)

Given the difficult terrain, the common route selected represents the most feasible location for a route from Rankin Inlet to Churchill. As a result, it is common to all three of the route options connecting to the Manitoba all-weather system. Major crossings of the Seal and Churchill Rivers present significant challenges that will require further study to confirm the most favourable crossing points. This route has been optimized to avoid, where feasible, ASIs and Caribou River Provincial Park. The route has been developed from topographical mapping, surficial geology, and 1:60000 and 1:40000 air photos.

The common route passes through a location designated "Common Point A", at which point two (WRA and CRA) of the three alternative routes connecting to Manitoba's all-weather road system commence. This point is located approximately mid-way between the 58th and 59th north parallel. The third alternative route (ERA) connects to the common route on the south side of the Churchill River crossing.

Western Route Alternative (WRA)

At this stage, the WRA has been developed from topographical mapping and surficial geology only. It is the longest of the three proposed routes; however, it will connect three western Manitoba communities - Lynn Lake, Lac Brochet, Brochet and Tadoule Lake. The proposed route generally follows the existing winter road alignment, but deviates from it in order to avoid the extensive use of lake crossings that is common for winter road construction and to take advantage of firm terrain. This route traverses the Goldsand Lake and Sprott Lake ASIs; however, there is existing encroachment by winter roads in these areas.

Central Route Alternative (CRA)

The topography of the CRA is difficult, and dictates a route along a high ridge with unstable ground conditions on either side. Materials availability is not an issue through this corridor due to the rocky terrain; however, the route requires two crossings of the Churchill River. The significant grades along this route will be challenging in terms of construction, and the severity of the finished road grades will likely increase overall travel time. The route traverses the edge of Numaykoos Lake Provincial Park and encroaches directly on the Amisk Park Reserve and two ASIs.

Eastern Route Alternative (ERA)

The ERA has the advantage of the best terrain of the three proposed routes, and is the easiest to construct; having the potential for completion within a single construction season. However, the route traverses the Bradshaw Lake ASI (identified as a high provincial protection designation by Manitoba Conservation). The route through the ASI could follow the toe of a beach ridge (the Grand Beach) ridge running through the ASI, which might reduce the environmental impact. However, if the route through the Bradshaw Lake ASI is not permitted, it may be possible to realign the route along the existing railway to avoid/minimize encroachment. The railway alignment, itself, was not considered optimum in that this route is known to have unstable foundation conditions. South of the Bradshaw Lake ASI, the route continues to traverse the Grand Beach, which provides suitable foundation materials.

EVALUATION METHODOLOGY

MAE Process

The multiple account evaluation process is structured to provide an objective evaluation of the various factors affected by construction and operation of a transportation facility. The evaluation attempts to take into account both quantitative - life-cycle cost and transportation benefits (capital and operating cost, improvements due to reduced travel time/cost), dis-benefits (accidents, fuel consumption), as well as the more subjective, qualitative issues (such as impact on society, community and the environment), and the wider implications to a region's economy and strategic interests. By means of weighting these accounts and sub-accounts (i.e., assigning relative importance of the account to the overall project), and by scoring the perceived impact that each option (alternative route) will have relative to individual accounts, a ranking can be established between the alternatives, identifying the alternative that responds most favourably to the criteria and illustrating the relative differences between them.

For the purpose of this evaluation, the Project Working Group and Consultant Team were tasked with assigning weights to the various evaluation accounts and then scoring the impact of each alternative route against them. It is important to note that, since the Northern Route (NRA) is common to all three of the routes south to the Manitoba all-weather system, the MAE exercise focused somewhat on which of the three alternatives best serves the overall goals of the proposed Nunavut-Manitoba road. However; in the multiple account evaluation, full consideration was given to each of the three alternative routes in northern Manitoba (WRA, CRA and ERA) in combination with the northern alternative route (NRA), the common route, coming south from Nunavut, i.e., the evaluation compared NRA/WRA against NRA/CRA against NRA/ERA.

Weights were assigned for each account out of a total of 100, i.e., percentage importance within both major accounts and sub-accounts. Scoring was achieved by assigning a simple numerical score relative to the present condition - no all-weather connection. The scores ranged from +2 (significantly better than), +1 (better than), 0 (neutral or similar to the present condition), -1 (worse than) and -2 (significantly worse than the present condition).

In order to eliminate, as far as possible, the potential to predetermine the outcome, the workshop group was tasked with assigning weights to the individual accounts first. The weights were then concealed during the scoring process to maintain objectivity.

MAE Evaluation

Prior to commencing the workshop, the Consultant Team assigned a weight of 40% to the Quantitative Account – Capital Cost and Transportation Benefit, based on their previous experience of MAE work on other northern transportation projects. The workshop team concurred with this assessment on the basis that it would be later tested by sensitivity analysis to determine if the outcome is sensitive to the weight.

Table 1 shows the weights assigned by the workshop group to each of the qualitative MAE accounts – Social/Community, Natural Environment, Economy/National Interest and their respective sub-accounts. It was decided that, in order to remain objective, the overall weight assigned to each of the qualitative accounts would be equal at 20%. As before, this would be later tested by analysis to determine if the outcome is sensitive to these weights. Through an interactive session, the workshop group discussed and reached consensus on the weights assigned to each sub-account.

Qualitative Account Weighting

SOCIAL/COMMUNITY	20%	
Tadoule Lake, MB		15%
Lac Brochet, MB		15%
Brochet, MB		6%
Lynn Lake		4%
Thompson, MB		0%
Gillam/Bird, MB		4%
Churchill, MB		11%
Arviat, NU		15%
Whale Cove, NU		10%
Rankin Inlet/Chesterfield/Baker, NU		20%
NATURAL ENVIRONMENT	20%	
Habitat Protection		20%
Wildlife Populations		20%
Watershed Values		15%
Fish Populations		10%
Heritage Values		10%
Protected Areas		20%
Emmissions		5%
ECONOMY/NATIONAL INTEREST	20%	
Regional Economy/Resource Use		20%
Sovereignty and Security		10%
Staging		10%
Regional Network (population served)		20%
Reliability		5%
Churchill		15%
Enhanced Interjurisdictional Trade (National Highway System Connection)		20%

Table 1

Social/Community Account

The weights given to each community under the Social/Community Account were assigned as follows:

- Rankin Inlet has the highest weight (20%) since it is the strategic location for the northern terminus of the proposed road.
- Arviat, Whale, Tadoule Lake, Lac Brochet and Brochet are communities to be connected to the route alternatives and are assigned a weight based on their population and degree of isolation.
- Brochet has the lowest weight (6%) among these communities, since it has both a winter road and water access the Reindeer Lake.
- Churchill is weighted at 11%, since it will be connected in all route alternatives.

- Lynn Lake and Gillam have the lowest weight (4%) among all communities, since they are currently connected to Manitoba's all-weather road system.
- Thompson has a zero weight, since it is considered neutral to all of the route alternatives.

Natural Environment Account

The weights for the sub-accounts under the Natural Environment Account are assigned according to their relative importance to the project study area. Habitat protection, wildlife populations and protected areas are considered the most important (20% each) followed by watershed values (15%), fish populations (10%), heritage values (10%) and, lastly, emissions (5%).

On completion of the weighting exercise, the values were concealed and the workshop group was tasked with reviewing and approving the scores assigned to each of the three route alignments as they related to the accounts and sub-accounts.

In the case of the Social/Community Account, the sub-account scores were derived from the results of the consultation process, as outlined in the Consultant Team's report entitled *Social and Economic Scoping - Findings (Final Draft, September 24, 2006)* with particular reference to *Section 2.2 Summary of Self-Assessment Findings Northern Communities Directly Affected*. After some discussion, it was agreed that these represented an objective view of the communities directly affected by the route alternatives and should be left as-is.

Similarly, the scores for the Natural Environment Sub-Accounts were initially derived from the findings outlined in the Consultant Team's report entitled *Ecological Values and Related Issues (Interim Report, October 2006)*. After some discussion of these scores, the workshop team elected to add a sub-account for Emissions and to revise some of the scoring.

The Economy/National Interest Account reflects the overall benefit to Nunavut, Manitoba and Canada that will occur when Nunavut is connected to Canada's national highway network. Reducing the isolation of northern communities and integrating those communities through partnership opportunities, both public and private, will increase the potential for expansion of resource exploration, tourism development, fisheries, etc. and access to world markets (both import and export). In addition, a land connection to Nunavut will increase the social and economic security of the territory.

Given the importance of the Economy/National Interest Account to this project, the workshop group spent considerable time discussing both the sub-accounts and the scoring. The group reached consensus on the sub-accounts, as follows:

- Regional Economy/Resource Use – Each of the alternative routes will have some impact on the development of resources ranging from mining, forestry and fishery to hydro developments. Opportunities for mining and tourism in the west, forestry opportunities associated with the central route and hydro and mining opportunities to the east, were all considered in this category. It was felt that this was an issue of some significance, and was assigned a weighting of 20%.
- Sovereignty and Security – The key issue for this account related to how quickly strategic resources could be moved to Nunavut and to Churchill, which the group felt has

significant potential for further development as a nationally strategic port. The study group felt that total travel distance and travel time from Winnipeg and Thompson to Nunavut and Churchill best represented the difference between the three routes in terms of response time to a potential threat to national sovereignty or security. It was acknowledged by the group that the distance from Rankin Inlet and Churchill to Thompson is shortest by the central route; however, the curvilinear alignment and difficult grades would reduce overall travel time. Eastern route is a longer route (slightly), but will be a faster travel time from Churchill. The group assigned a weighting of 10% to this account.

- Staging – This account was included to reflect the potential viability of each alternative for staging its development over time, as funding becomes available. The group felt that the only alignment that lent itself to a staged construction was the WRA, which provides opportunity to build in segments that connect the communities along the route and where the existing winter road would provide a connection for the interim period. There are no staging opportunities for either the CRA or the ERA. The group assigned a weighting of 10% to this account.
- Regional Network – This account was included to reflect the population served by each of the alternative routes. Each of the communities to be connected by the WRA and ERA were considered in this account. It was acknowledged by the group that the CRA did not serve any additional communities. The group felt that this was an important criterion and assigned a weighting of 20%.
- Reliability – This account addresses reliability of the route in terms of potential closure due to structural failure, weather and extraordinary circumstances. It was felt by the group that reliability is primarily a function of length and terrain; i.e., potential for slides, motor vehicle accidents, snow and mud slides and flooding. In view of the low risk attached to this account the group assigned a weighting of 5%.
- Churchill – In view of the importance of connecting Churchill with the Manitoba all-weather road system, the group felt that is was important to address this as a separate sub-account within the economy and national interest. The implications of each alternative to Churchill were discussed in terms of overall distance of the connection and resulting travel time, and whether commercial traffic would be likely to use the road connection, as opposed to the railway. The workshop group assigned a weighting of 15% to this account.
- Enhanced Inter-jurisdictional Trade – Each of the alternative routes provides a connection to the national highway system; however, various factors, such as overall distance and operating speed, affect the viability of the route as a trade connection. In view of the importance of an all-weather route between Thompson and Rankin Inlet, via Churchill, by connecting Nunavut and Northern Manitoba to the national highway system, the workshop group felt that the benefits in terms of both inter-jurisdictional and national trade and resource development were equally as significant as regional economy development and resource use, and assigned a weighting of 20%. In effect, this results in a weighting of 40% overall for both regional and national economic development, reflecting the significance that the workshop group placed on both the connection between Rankin Inlet and the Manitoba all-weather system, as well as the efficiency of the individual route alternatives between the common route and the all-weather system in Manitoba.

Table 2 sets out the final sub-accounts and scores agreed upon by the workshop group:

Qualitative Account Scores

	Qualitative Accounts		
	NRA/WRA	NRA/CRA	NRA/ERA
SOCIAL/COMMUNITY			
Tadoule Lake, MB	0	0	0
Lac Brochet, MB	0	0	0
Brochet, MB	1	0	0
Lynn Lake	2	0	0
Thompson, MB	1	1	1
Gillam/Bird, MB	0	0	2
Churchill, MB	2	2	2
Arviat, NU	1	2	2
Whale Cove, NU	0	0	0
Rankin Inlet/Chesterfield/Baker, NU	1	2	2
NATURAL ENVIRONMENT			
Habitat Protection	-2	-2	-2
Wildlife Populations	-1	-1	-1
Watershed Values	-2	-1	-1
Fish Populations	-1	-1	-1
Heritage Values	-1	-1	-1
Protected Areas	0	-2	-1
Emmissions	-2	-1	-2
ECONOMY/NATIONAL INTEREST			
Regional Economy/Resource Use	1.0	0.8	0.8
Sovereignty and Security	1	2	1
Staging	1	0	2
Regional Network (population served)	2	0	2
Reliability	1	1	2
Churchill	0	1	2
Enhanced Interjurisdictional Trade (National Highway System Connection)	0	1	2

Table 2

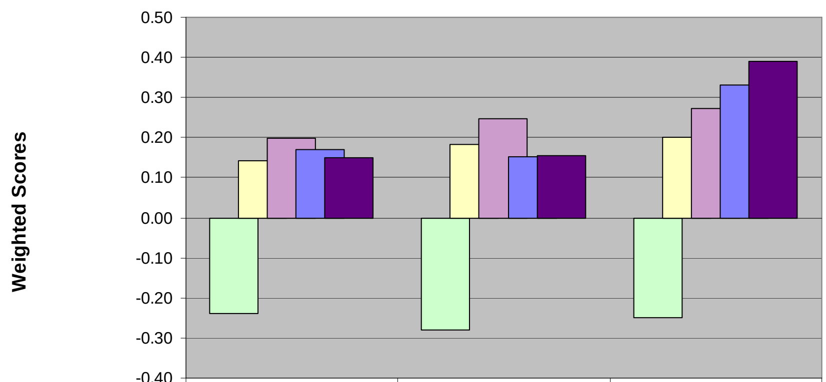
RESULTS OF THE EVALUATION

Recommended Route

On completion of the weighting and scoring process, the weighted scores for each of the three alternative routes were revealed, showing that the Eastern Route was a clear winner, having a value of 0.39 versus 0.16 and 0.15 for the Central and Western Routes respectively. The score of 0.39 indicates that, based on the criteria evaluated, the Eastern Route is approximately twice as beneficial as the other two routes (the difference between the Central and Western Routes is insignificant).

Figure 1 shows the relative rankings for each of the route alternatives:

MAE Evaluation Results



	West	Central	East
Environmental	-0.24	-0.28	-0.25
Social	0.14	0.18	0.20
Benefit Cost	0.20	0.25	0.27
Economy/National Interest	0.17	0.15	0.33
OVERALL RANKING	0.15	0.16	0.39

Figure 1

Note: The weighted scores shown in Figure 1 are preliminary and are based on discussion during the MAE Workshop on October 11-12, 2006. Final scores will be documented in Milestone Report B by NKSL.

The environmental account for all three routes shows as a similar negative impact - all routes impinge on Areas of Special Interest. The Benefit Cost Account for the Eastern Route is better than the other two routes due to its shorter construction length and better topography - reducing the capital and operating costs, even though overall transportation benefits were not as great as the other alternatives. Similarly, the Economy/National Interest Account is significantly better for the Eastern Route due largely to it outscoring the other alternatives in terms of ease of staging, reliability, service to the Port of Churchill and opportunity to enhance interjurisdictional trade.

The Social Account for the Western Route is somewhat less beneficial than the Central Route, largely due to the social issues that are perceived by the various communities to arise as a result of an all-weather road. The Social Account for the Eastern Route is somewhat better than the other two routes, again, largely due to it receiving more enthusiastic support from communities directly affected.

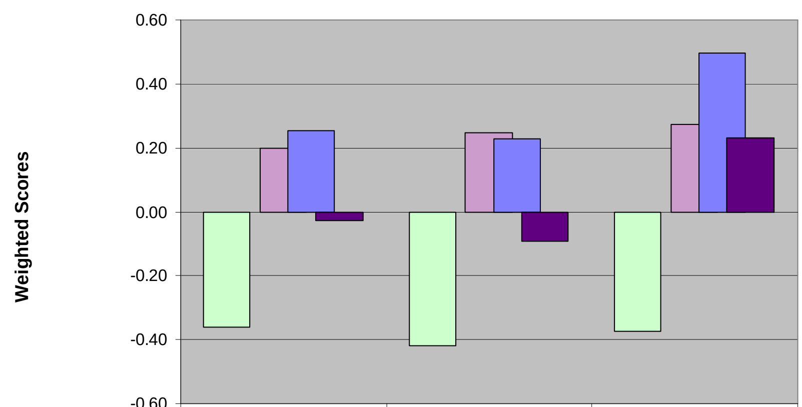
Sensitivity Analyses

Weighting of the accounts and sub-accounts is intended to reflect the relative importance of each criteria, but is the most subjective of the evaluation processes. In order to test whether the outcome of the MAE is sensitive to selection of the weighting, sensitivity analyses are typically carried out by modifying weights to determine if the outcome changes as a result.

Sensitivity analyses were undertaken by zeroing out the weights for each of the three major qualitative accounts and reassigning that weight equally between the remaining two to ascertain any shift in the outcome.

Figure 2 shows the effect of assigning zero weight to the social/community account. While the relative differences change somewhat, the eastern route remains significantly the better option.

Sensitivity Analysis – Zero Weight Social

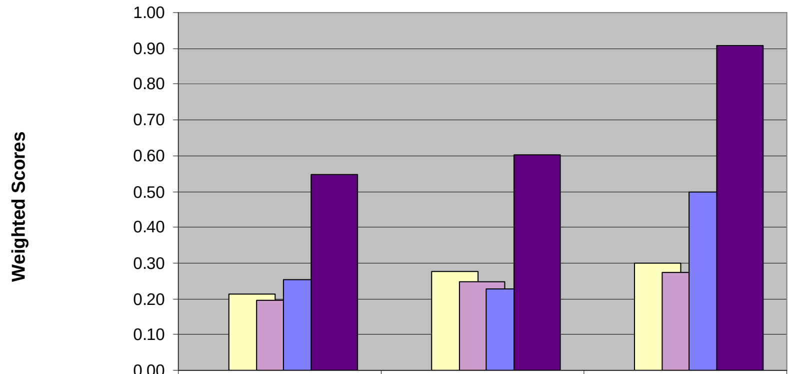


	West	Central	East
Environmental	-0.36	-0.42	-0.38
Social	0.00	0.00	0.00
Benefit Cost	0.20	0.25	0.27
Economy/National Interest	0.26	0.23	0.50
OVERALL RANKING	-0.03	-0.09	0.23

Figure 2

Figure 3 shows the effect of assigning zero weight to the environmental account. Again, while the relative differences change, with the advantage of the eastern route reducing somewhat, it still remains significantly the better option.

Sensitivity Analysis – Zero Weight Environmental

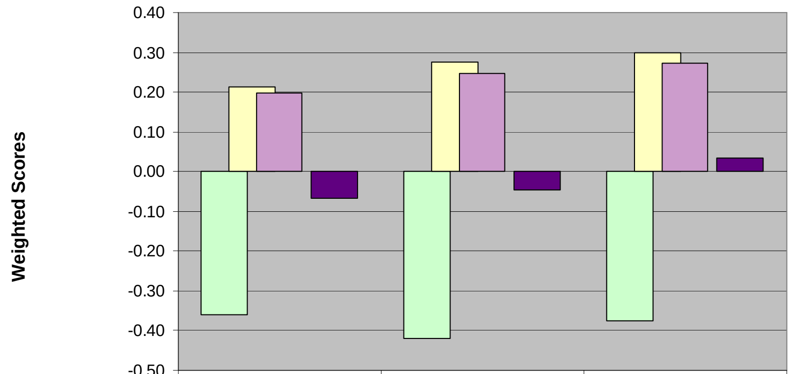


	West	Central	East
Environmental	0.00	0.00	0.00
Social	0.21	0.28	0.30
Benefit Cost	0.20	0.25	0.27
Economy/National Interest	0.26	0.23	0.50
OVERALL RANKING	0.55	0.60	0.91

Figure 3

Figure 4 shows the effect of assigning zero weight to the economy/national interest account. The relative differences change, with the advantage of the eastern route reducing significantly; however, it still remains, on balance, the better option.

Sensitivity Analysis – Zero Weight Economy

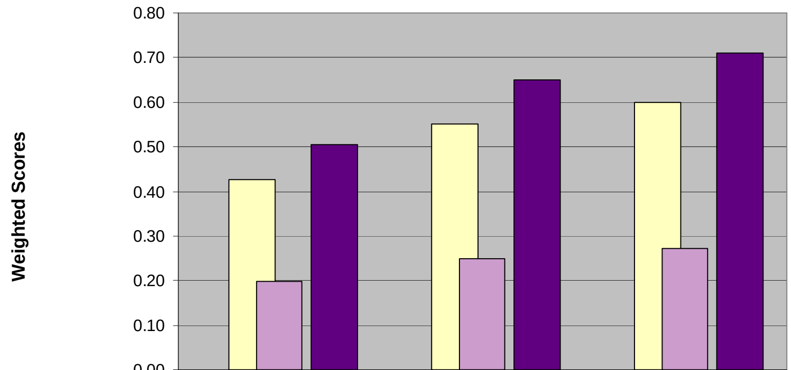


	West	Central	East
Environmental	-0.36	-0.42	-0.38
Social	0.21	0.28	0.30
Benefit Cost	0.20	0.25	0.27
Economy/National Interest	0.00	0.00	0.00
OVERALL RANKING	-0.07	-0.04	0.03

Figure 4

In order to test the sensitivity of the results to the social/community account by itself, both the environment and economy national interest accounts were assigned zero weights. Figure 5 shows that the eastern route remains superior from a social and community aspect alone, although the relative differences between the three routes are significantly reduced.

Sensitivity Analysis – Zero Weight Environment & Economy

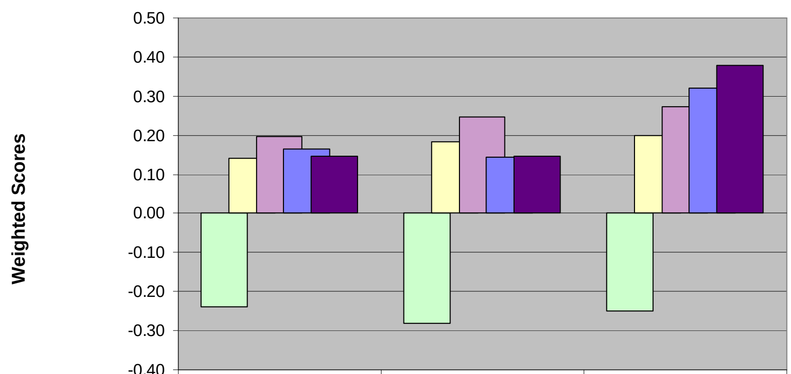


	West	Central	East
Environmental	0.00	0.00	0.00
Social	0.43	0.55	0.60
Benefit Cost	0.20	0.25	0.27
Economy/National Interest	0.00	0.00	0.00
OVERALL RANKING	0.50	0.65	0.71

Figure 5

The workshop group noted that the eastern route would derive considerable benefit from the potential development of hydro power generation, and were concerned that the weighting and the scoring for resource development sub-account might skew the results unfairly in favour of the eastern route. Figure 6 shows the effect of assigning a zero score to hydro development within the resource development sub-account. The eastern route remains the best option by a factor of approximately 2 over the central and western routes, thus it is not sensitive to implications of hydro development in the area served by the eastern route.

Sensitivity Analysis – Zero Weight Hydro Development



	West	Central	East
Environmental	-0.24	-0.28	-0.25
Social	0.14	0.18	0.20
Benefit Cost	0.20	0.25	0.27
Economy/National Interest	0.17	0.14	0.32
OVERALL RANKING	0.15	0.15	0.38

Figure 6

RECOMMENDATIONS

On completion of the multiple account evaluation and sensitivity analyses, the eastern route and northern route combination (ERA/NRA) has emerged as a clearly preferred route to connect from the Rankin Inlet, via Whale Cove, Arviat and Churchill to the Manitoba all-weather system. Accordingly, the workshop group recommends advancing this preferred route to the next stage of consultation and planning development.

APPENDIX A

WORKSHOP ORGANIZATION

MEETING AGENDA

Subject:	**Nunavut-Manitoba Route Selection Study – MAE Meeting** NKSL Project No. 016259
Date/Time:	October 11, 2006 9:00 am – 5:00 pm October 12, 2006 8:00 am– 1:00 pm
Place:	**Greenwood Inn & Suites** Cedar Room, 1715 Wellington Avenue Winnipeg, MB R3H 0G1
Location:	On north side of Wellington Avenue between Route 90 southbound, King Edward Street, and Route 90 northbound, Century Street. Wellington Avenue is the main east-west route to the airport.
Telephone:	204-775-9889 or Toll Free Number: 1-888-233-6730
Fax:	204-775-4576
Email:	winnipeg@greenwoodinn.ca

Invitees: Project Working Group and Staff

Amar Chadha (AC)	Director, Transportation Systems Planning & Development, Manitoba Transportation and Government Services (MTGS)	achadha@gov.mb.ca
Dave Duncan (DBD)	Transportation Planning, MTGS	dbduncan@gov.mb.ca
Jake Kosior (JK)	Transportation Economics, MTGS	
Doug McMahon (DMc)	Director of Regional Operations, MTGS	domcmahon@gov.mb.ca
Ben Rogers (BR)	A/Executive Director Hwy Engineering, MTGS	
Alan Johnson (AJ)	Manager, Transportation Planning Government of Nunavut (GN)	ajohnson@gov.nu.ca
Luis Manzo (LM)	Director of Lands, Kivalliq Inuit Association (KIA)	lmanzo@kivalliqinuit.ca
Lorraine Sourisseau (LS)	Regional Manager, Coordination Initiatives, Transport Canada (TC)	sourisl@tc.gc.ca

Subject: Nunavut-Manitoba Route Selection Study – MAE Meeting
Date: October 11-12, 2006

Nishi-Khon/SNC-Lavalin Consultant Team

Tim Stevens (TS)	Project Manager	Tim.Stevens@snclavalin.com
Mike Paterson (MP)	Geotechnical Engineer/ Project Liaison	Mike.Patterson@snclavalin.com
Phoebe Cheung (PC)	Transportation Engineer	Phoebe.Cheung@snclavalin.com
Chandi Ganguly (CG)	Traffic Engineer	Chandi.Ganguly@snclavalin.com
Chris Baker (CB)	Value Analysis	vmicb@shaw.ca
Debbie Macdonald (DM)	Value Analysis	vmidm@shaw.ca
Peter Lyall (PL)	Transportation Economics	plyall@telus.net
Jack Mollard (JM)	Route Engineering	mollard@jdmollard.com
George Mollard (GM)	Route Engineering	mollard@jdmollard.com
Troy Zimmer (TZ)	Geographer	zimmer@jdmollard.com
Don Kuryk (DK)	Cost Estimating	donaldk@mts.net
Dave Witty (DW)	Socio-Economic And Community Planning	mwitty@mts.net
Ben Hubert (BH)	Environmental Planning/Stakeholder Consultation	benhubert@shaw.ca
John Hickes (JMH)	Stakeholder Consultation (Kivalliq)	nanuq@qiniq.com
Dan Highway (DH)	Stakeholder Consultation (Manitoba)	danhighway@mts.net

Purpose of Meeting:

- Review project progress to date with Project working Group and Consultant Team
- Conduct Multiple Account Evaluation (MAE) on three alternative all-weather routes (Western, Central and Eastern)
- Selection of a prepared all-weather route
- Discussion/agreement on next steps

Subject: Nunavut-Manitoba Route Selection Study – MAE Meeting
Date: October 11-12, 2006

Program:

Wednesday, October 11, 2006 9:00 am – 5:00 pm

1.0 Overview of meeting purpose and processes (CB)

2.0 Study objectives and status; road development criteria (TS)

3.0 The MAE framework overview (PL)

4.0 Route engineering analysis; aerial review of "Common Route" from Rankin Inlet to Churchill (JDM, GM & TZ)

5.0 Route engineering analysis: aerial review of three route alternatives: Western (WRA), Central (CRA) and Eastern (ERA), (JDM, GM & TZ)

6.0 Construction Issues (MP and DK)

7.0 Cost estimates and transportation benefits (TS, DK and PL)

8.0 Social and Community analysis: (BH, DH, JMH & DW)

- Community consultations (PC)
- Non-government organization (MP)

9.0 Resource and natural environment analysis (BH)

10.0 National and regional economy and interests (PC & PL)

11.0 Discussion (All led by CB)

**Lunch will be served 12:00 – 12:30*

Thursday, October 12, 20068:00 am – 1:00 pm

1.0 Introduction to MAE Framework (CB)

2.0 Weighting of accounts and scoring of qualitative accounts for alternative routes (All led by PL)

3.0 Discussion/sensitivity of results (All led by PL)

4.0 Next steps (TS)

Agenda prepared by: T. Stevens, P.Eng.

VALUE ENGINEERING REVIEW

DAY 1 - PROJECT BRIEFING

DATE: Wednesday, October 11, 2006

NAME	REPRESENTING	PHONE	EMAIL
Consultant Team			
Tim Stevens	Nishi-Khon/SNC Lavalin Ltd	604-605-4961	tim.stevens@snclavalin.com
Phoebe Cheung	Nishi-Khon/SNC Lavalin Ltd	604-662-3555	phoebe.cheung@snclavalin.com
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George Mollard	J.D. Mollard & Assoc.	302-352-8811	mollard@dmollard.com
Troy Zimmer	J.D. Mollard & Assoc.	302-352-8811	aimer@dmollard.com
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John M. Hickes	Nanuk Ent.	204-867-6451 x2650	nanuklodge@giniq.com
Project Working Group/Government Representatives			
Alan Johnson	Government of Nunavut	867-360-4606	ajohnson@gov.nu.ca
Amer Chadho	Manitoba Infrastructure & Transportation (MIT)	204-945-2269	achadho@gov.mb.ca
Ben Rogers	MIT	204-945-3722	brogers@gov.mb.ca
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Dave Duncan	MIT	204-945-3646	dbduncan@gov.mb.ca
Keith Lewis	MIT	204-677-6555	klewis@gov.mb.ca
Lorraine Sourisseau	Transport Canada	204-983-5929	sourisl@tc.gc.ca
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Chris Baker	Value Management Inc.	250-655-4358	vmicb@shaw.ca
Debbie Macdonald	Value Management Inc.	250-655-4358	vmidm@shaw.ca

VALUE ENGINEERING REVIEW

CREATIVE SESSION and EVALUATION

DATE: Thursday, October 12th, 2006

NAME	REPRESENTING	PHONE	EMAIL
Consultant Team			
Tim Stevens	Nishi-Khon/SNC Lavalin Ltd	604-605-4961	tim.stevens@snclavalin.com
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Troy Zimmer	J.D. Mollard & Assoc.	302-352-8811	aimer@dmollard.com
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Amer Chadho	Manitoba Infrastructure & Transportation (MIT)	204-945-2269	achadho@gov.mb.ca
Ben Rogers	MIT	204-945-3722	brogers@gov.mb.ca
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Facilitation Team			
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Debbie Macdonald	Value Management Inc.	250-655-4358	vmidm@shaw.ca

Appendix 6. Business Case

BUILDING LASTING INFRASTRUCTURE

Business Case for:

NUNAVUT – MANITOBA ALL WEATHER ROAD

September 28, 2007

Submitted to:

Mr. Amar Chadha,
Director of Transportation Systems
Planning and Development
for Manitoba Infrastructure and Transportation

NISHI-KHON
SNC • LAVALIN

Nishi-Khon/SNC-Lavalin Limited

SNC·LAVALIN

September 28, 2007

BY EMAIL

Manitoba Infrastructure & Transportation
Transportation Systems Planning & Development
15th Floor, 215 Garry Street
Winnipeg, Manitoba

Attention: Amar Chadha, P.Eng., Director

Dear Mr. Chadha:

Re: Proposal for Business Case
Nunavut - Manitoba All-Weather Road

Nishi-Khon SNC-Lavalin (NKSL) is pleased to submit this proposal for the Business Case, Nunavut-Manitoba All-Weather Road (AWR), as requested by your email of September 5, 2007, along with the Study Terms of Reference.

NKSL has extensive experience in transportation planning, feasibility studies, as well as engineering, procurement and construction projects in Nunavut, Northwest Territories (NWT) and across all provinces in Canada. We have just completed the two-year, multi-disciplinary Nunavut-Manitoba Route Selection Study upon which the development of this Business Case will be based. For this Business Case assignment, we intend to nominate the same core team members that worked on and successfully delivered the Route Selection Study. This will ensure that the knowledge, experience and working relationships developed in the past two years will be effectively retained and transferred to the development of the Business Case.

The Business Case assignment will be led by Ms. Phoebe Cheung, Project Manager, and Mr. Tim Stevens, Technical Advisor. The economic impact analysis will be conducted by Professor Eric Howe of the University of Saskatchewan. They will be supported by Mr. Peter Lyall, Transportation Economist, Mr. Andy Tam, Transportation Engineer; and Mr. John Hickes, Project Liaison for Nunavut and Churchill communities. We have developed a methodology and work plan that will fulfill the requirements of the Project Working Group for this Business Case.

We understand the significance of this assignment in furthering the development of the Nunavut-Manitoba AWR to the Territory of Nuvavut, Province of Manitoba, and to Canada as a whole. Our goal in this assignment is to provide decision makers and stakeholders with a clear understanding of the value, risks and priority of the AWR development such that project funding and implementation decisions can be made.

We look forward to discussing with you and the Project Working Group the content and execution of this proposal in more detail. To achieve substantial completion of the Business Case by mid December, we will require your authorization to start the week of October 8. To this end, we propose to have a teleconference with yourself and, if necessary, other members of the Project Working Group, in the next two weeks. I will call you to set up this call in the next few days. In the mean time, please feel free to contact me at (604) 605-4962 for any further information or clarifications.

Yours truly,
Nishi-Khon/SNC-Lavalin Ltd.

ARWachmann.

____
Tony Wachmann, P. Eng.
Vice President, Operations
Mining & Metallurgy Vancouver

Enclosure

cc. John Hodgson, Executive Director, Kivalliq Inuit Association

Melodie Sammurtok, Project Manager, Kivalliq Inuit Association

Luis Manzo, Director of Lands, Kivalliq Inuit Association

Alan Johnson, Manager, Transportation Planning, Nunavut Department of Economic Development & Transportation

Lorraine Sourisseau, Regional Manager, Coordination Initiatives, Transport Canada

Ron Pritchard, Manitoba Infrastructure and Transportation

Mike Chin, P.Eng., Vice President, Engineering, Roads and Infrastructure, SNC-Lavalin Inc.

TABLE OF CONTENTS

1.0 INTRODUCTION

Nishi-Khon/SNC-Lavalin (NKSL) is a northern multidisciplinary engineering company. The company provides a full range of feasibility study, planning, engineering and environmental services to governments and private sector Clients throughout the northern region of Canada. NKSL is 51-per-cent owned by the Dogrib Nation Group of Companies and 49-per-cent owned by SNC-Lavalin Inc., Canada's leading engineering-construction company. Since 1994, NKSL has successfully invested in hydro power generation, forestry, heavy equipment supply, aviation, construction catering and a number of industrial and community resource development activities.

In 2005, NKSL was retained by the Kivalliq Inuit Association, as well as the Governments of Canada, Nunavut and Manitoba to conduct a two-year multi-disciplinary Route Selection Study to determine the best location for an all-weather road (AWR) linking the communities of Rankin Inlet and Churchill to the existing all-weather surface transportation network in northern Manitoba. This study is now completed with the recommendation of a preferred route extending from Manitoba PR 290 at Sundance to Rankin Inlet. Links from the main stem of the preferred route provide connections with Churchill in Manitoba; and Arviat and Whale Cove in Nunavut. As the immediate next step of the Route Selection Study, NKSL was asked to submit a proposal for a Business Case for the Nunavut Manitoba All-Weather Road.

2.0 PROJECT TEAM AND ORGANIZATION

2.1 Project Team

NKSL brings to the project a qualified and knowledgeable team of professionals with extensive project experience in Nunavut, Manitoba, across Canada and overseas. We will commit to the Business Case the core team members that worked on and successfully delivered the Route Selection Study over the past two years. This will ensure that the knowledge, experience and working relationships developed in the Route Selection Study can be effectively retained and transferred to the development of the Business Case. As shown in Figure 2-1, the Business Case will be led by Ms. Phoebe Cheung and Mr. Tim Stevens, Project Engineer and Project Manager of the Nunavut-Manitoba Route Selection Study. In this Business Case study, Phoebe will be the Project Manager and Tim will be the Technical Advisor. In addition, we will engage Professor Eric Howe of the University of Saskatchewan in the economic modelling and economic impact analysis of the Nunavut-Manitoba AWR. They will be supported by Mr. Peter Lyall, Transportation Economist; Mr. Andy Tam, Transportation Engineer; and Mr. John Hickes, Project Liaison for Nunavut and Churchill communities. The qualifications and experience of the project team members are summarized below.

Tony Wachmann, P.Eng. **Project Sponsor**

Tony has over 30 years of experience in civil engineering for mining, mineral processing, municipal, chemical and industrial facilities and is acutely aware of the need for practical engineering solutions to meet budgets and environmental constraints. Tony's work experience includes more than 70 projects involving pre-feasibility and feasibility studies, trade-off analysis, technical and financial audits, project evaluations, as well as detailed design and construction management. Tony played an instrumental role in the Nunavut-Manitoba Route Selection Study and the Bathurst Inlet Port and Road Project, serving as Project Sponsor on behalf of NKSL in both projects. Tony is currently the Director of NKSL and Vice President of Operations for the Mining and Metallurgy Group of SNC-Lavalin Engineers and Constructors Inc.

As Project Sponsor for this study, Tony will have corporate responsibility to oversee NKSL's delivery on its obligations. Tony's time will not be charged to the Client.

Phoebe Cheung, P.Eng. — Project Manager

Phoebe is a Project Manager and Transportation Engineer specializing in transportation planning, economics and project delivery. Her professional career began in 1995 at the British Columbia Ministry of Transportation, where she worked on various highway planning, design and construction projects. As part of her graduate studies, Phoebe conducted considerable research in urban transportation planning, transport demand management, road pricing and public-private partnership (P3) as a procurement mode in Canada. In addition to her recent experience in the Nunavut-Manitoba Route Selection Study, she was the Project Manager in the Squamish Route Selection Study in BC. The project presented significant challenges in transportation planning, traffic engineering, highway and structural design, and involved extensive stakeholder and public consultation with the province, municipality, Squamish First Nations, regulatory agencies, community groups and developers in the area. Currently, Phoebe is serving as Project Engineer for the Bathurst Inlet Port and Road Project, providing project management and engineering support for the environmental permitting of the project under the Nunavut Impact Review Board.

As Project Manager, Phoebe will be responsible for the delivery of this study within the agreed-upon scope, schedule and budget. She will lead the consultant team in the execution of the study and be the liaison for the Client in all study issues and requirements.

Tim Stevens, P.Eng. — Technical Advisor

Timothy Stevens was the Project Manager in the two-year Nunavut-Manitoba Route Selection Study and has the most intimate knowledge about the Nunavut-Manitoba AWR. Tim is an accomplished engineer at a senior management level with over 40 years of experience in the planning, design and management of highway and roadway projects in Canada and overseas. From 1977 to 1989, he was Senior Planning Engineer with Manitoba Highways and Transportation. Subsequently, until March 1996, he served as Director of Highway Planning in the BC Ministry of Transportation. Tim has a wealth of knowledge in transportation systems planning, needs studies, corridor and route studies, functional planning, preliminary, functional and detailed design, as well as natural and socio-community impact assessments. He has been providing engineering guidance, review, and advice on nearly all SNC-Lavalin highway projects in Western Canada over the past eleven years.

As Technical Advisor, Tim will be responsible for the technical engineering aspects of the study, providing input, continuity and direction from his experience in the Route Selection Study, as well as reviewing and signing off on all study reports.

Eric Howe, Ph.D. **Economist**

Eric received his B.A. (1973, cum laude) from Wittenberg University and Ph.D. (1982) from University of Maryland. He is currently the Professor of Economics at the University of Saskatchewan, specializing in Aboriginal social policy research, individual charitable giving, economic forecasting, economic modelling, study of the economy of Saskatchewan, and microeconomic theory. He has been developing his research program in Aboriginal Social Policy Research for the past 25 years and has extensively published in professional journals, including articles in Econometrica, Journal of Regional Science, Canadian Public Policy, Social Choice and Welfare, Journal of Aboriginal Economic Development, Arctic, and American Journal of Agricultural Economics. In addition to teaching and academic research, Eric has worked on numerous consulting assignments with Environment Canada, Transport Canada, the Government of the Northwest Territories, the Government of Saskatchewan, the Federation of Saskatchewan Indian Nations, the General Council of the Métis Settlements of Alberta, Kitikmeot Corporation, among others. He has been involved in the economic impact analysis of the Bathurst Inlet Port and Road Project for the past eight years, responsible for the economic modelling of the project in Nunavut, NWT and across all other Canadian provinces.

For the Business Case study, Eric will be responsible for the economic modelling and economic impact analysis of the NU-MB AWR, building on his recent experience from the Bathurst Inlet Port and Road Project. Eric will also participate in the stakeholder and industry interviews in order to define the low and high development scenarios of the study region.

Peter Lyall, P.Eng. **Transportation Economist**

Peter is the President of Apex Engineering Limited in Vancouver. He has 31 years of experience in transportation planning and has been specializing in Benefit Cost Analysis and Multiple Account Evaluation for the past 20 years. His experience includes over 150 project evaluations in major highway corridors, Federal/Provincial cost shared projects, National Highway Plan user benefits, numerous Provincial projects and northern transportation projects in the James Bay region. He has been instrumental in developing and applying the Multiple Account Evaluation techniques for the BC Ministry of Transportation. Peter was responsible for the Benefit/Cost Analysis and the Multiple Account Evaluation of the Nunavut-Manitoba Route Selection Study.

For the Business Case study, Peter will be responsible for the detailed benefit cost analysis of the NU-MB AWR, based on the impacts generated from the economic models.

Andy Tam, P.Eng. **Transportation Engineer**

Andy has 13 years of professional experience in transportation planning and engineering for both private and public sectors in Canada, Hong Kong and China. He has a wide spectrum of transport planning and traffic engineering experience, including traffic management, traffic impact assessment, road operation and safety analysis, conceptual and functional design, feasibility study, rail and transit planning, parking study, pedestrian simulation and multi-modal traffic demand modeling. Andy is familiar with the use of various GIS and traffic simulation computer programs, including ArcView, ArcInfo, CUBE, PEDROUTE, SATURN, SimTraffic, SYNCHRO and TRIPS. Prior to his return to Canada in 2006, Andy conducted numerous transport planning and urban design studies in Hong Kong, and held a part-time teaching position for a undergraduate transport policy course at the City University of Hong Kong.

Andy will be responsible for the transportation analysis of the Business Case study, analyzing the effects of the AWR on the transportation industry. He will also assist with the literature review and gap analysis as part of the Business Case.

John Makayak Hickes **Nunavut Liaison**

John was born near Pistol Bay, on the western Hudson Bay coast, between the present communities of Whale Cove and Rankin Inlet. Over his long career, he has gained experience in a number of fields, focusing on the social and economic development of aboriginal groups and individuals, including but not limited to: community economic development, economic development of small businesses, business management and administration, alcohol and drug counselling, tourism and hospitality industries, including tourism, hospitality, and cross-cultural training, sustainable development, the mining industry, transportation industry, and human resource development. John's professional career has focused on aboriginal business issues and training, and he has worked to ensure that Inuit organizations, businesses, and individuals are actively engaged in all aspects of economic development. John is known to aboriginal groups and individuals across Canada, and particularly in the North, for his business acumen and community-mindedness. John was the Project Liaison for the Nunavut and Churchill communities and played an indispensable role in the community consultation of the Nunavut-Manitoba Route Selection Study.

For the Business Case study, John will serve as the liaison for the Nunavut and Churchill communities and ensure that the appropriate stakeholders and industry agencies are engaged in the interviews and consultation process.

2.2 Client Organization

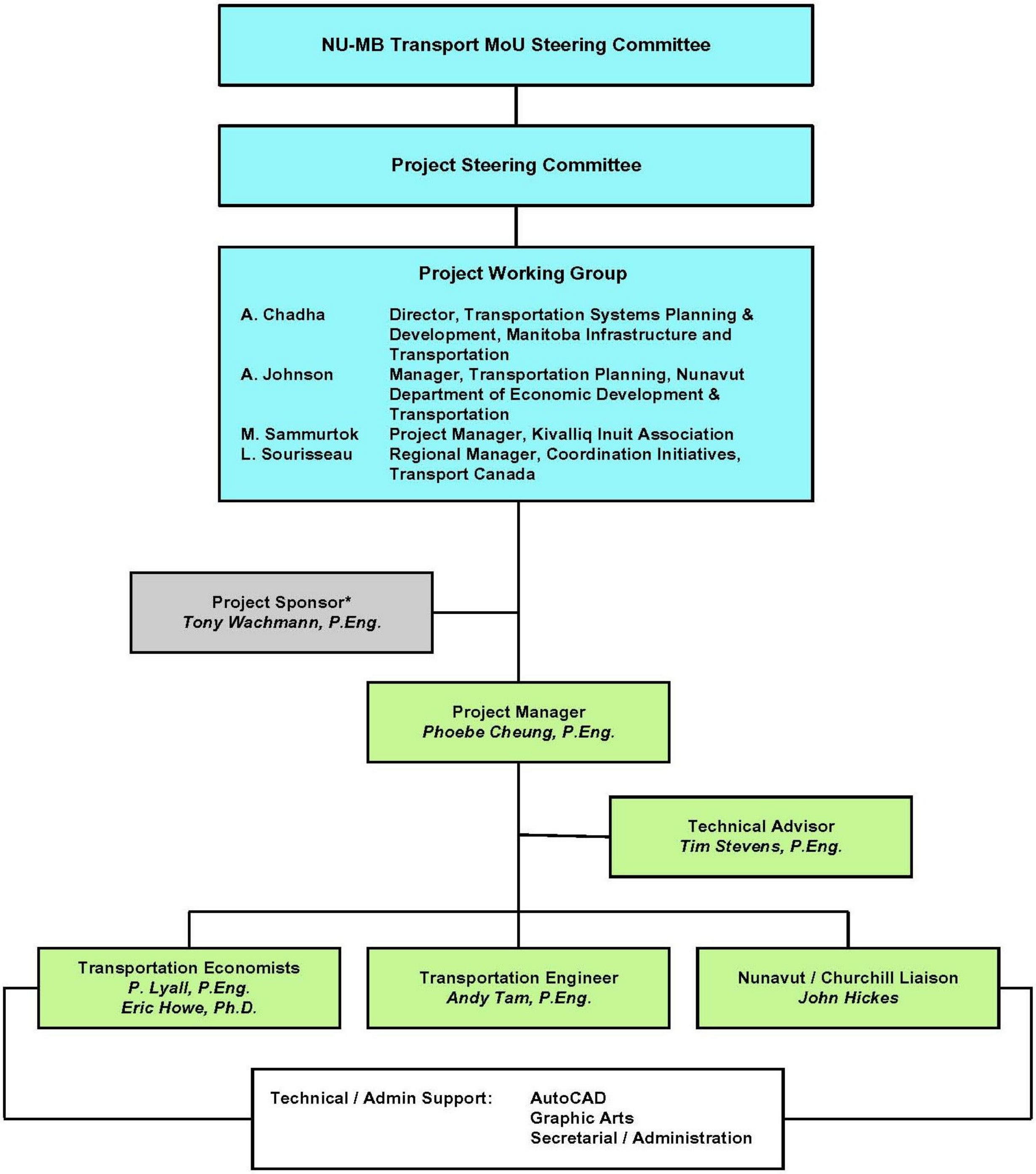
The consultant team will report through the Project Manager to the Project Working Group, which we understand will be chaired by Amar Chadha, P.Eng, the Technical Contact for the study. The Project Working Group in turn will, we understand, report to a Project Steering Committee consisting of the Assistant Deputy Minister, Transportation, Nunavut Department of Economic Development and Transportation; the President of the Kivalliq Inuit Association; the Assistant Deputy Minister, Transportation Policy & Regulation, Manitoba Infrastructure & Transportation; and the Agreements Coordinator, Manitoba Aboriginal and Northern Affairs. The Steering Committee reports to the Nunavut-Manitoba Memorandum of Understanding (MoU) Steering Committee, consisting of the Deputy Ministers responsible for transportation in the two governments.

During the 2-year Route Selection Study undertaken for the Nunavut-Manitoba road, the consultant team met twice with the Project Advisory Council (PAC), which consisted of representatives of municipal governments, First Nations, Manitoba Metis, the RCMP, businesses and non-government organizations with interests in the study area. The team also attended some regular meetings of organizations such as the Beverly and Qamanirjuaq Caribou

Management Board, NorMan Regional Development Corporation, Thompson Unlimited, the Keewatin Tribal Council and Chambers of Commerce.

We do not feel it necessary to meet face-to-face with the PAC as a body during preparation of the Business Case for the Nunavut-Manitoba AWR Project. In order to maintain a transparent planning process for the project, it may be appropriate to inform all of the PAC members about the intent of the Business Case study and to provide them with a generic listing of the government agencies and commercial interests we intend to interview; and welcome their opinions on the need to proceed with the project. This will be confirmed with the Project Working Group in the start-up of the Business Case study.

Figure 2-1: Study Organization Chart



* Non-reimbursable position

3.0 PROJECT UNDERSTANDING AND METHODOLOGY

3.1 Study Objectives

As outlined in the Study Terms of Reference, the objective of the study is a high level business case providing a first order indication of socio-economic benefits and costs attributable to the construction and operation of the Nunavut-Manitoba All-Weather Road (AWR); and the determination of resulting gains to respective beneficiaries. The Business Case is to provide decision makers and stakeholders with a clear understanding of the value, risks and priority of the development of the Nunavut-Manitoba AWR. To meet these objectives, the following questions will need to be answered in this assignment:

- What is the base case scenario in terms of long term economic effects in the study area with no AWR development?
- What are the low and high development scenarios for economic activities in the study area as a result of the AWR development?
- What are the socio-economic benefits and costs attributable to the construction and operation of AWR (i.e. incremental differences between the base case and the low and high development scenarios)?[1]
- What other values will be provided by the AWR under the low and high development scenarios that cannot be quantified in the socio-economic analysis (e.g. strengthening Canada's sovereignty and national interest in the Arctic)?
- Who are the beneficiaries of this AWR and what are the resulting gains in their respective jurisdiction?
- What are the risks of not proceeding with the AWR development?

3.2 Study Approach and Methodology

As discussed in Section 2, NKSL will use a "compact core team" approach to deliver a technically competent and cost effective solution for the Business Case assignment. The core team members will leverage our background and knowledge of the Nunavut-Manitoba AWR; our working relationships with members of the Project Working Group, stakeholders and industry contacts in Nunavut and northern Manitoba; as well as our expertise in aboriginal socio-economic research and economic modelling in northern Canada.

The proposed study methodology is illustrated in Figure 3-1. The methodology employs a logical, research-based and problem-solving approach with three study phases:

[1] Environmental costs and benefits are important concerns for the development of the AWR. An overview environmental assessment has been provided for each of the route alternatives for the Nunavut-Manitoba road in the Route Selection Study. Further environmental analysis is not included in the scope of this Business Case.

Phase 1: Data Collection

- Task A: Literature Review
    - Review economic profiles (e.g. commercial, industrial, service industries, Gross Domestic Products (GDP), median income, and other "quality of life" measures) of communities within the study area (e.g. Rankin Inlet, Whale Cove, Arviat and Churchill), as well as other regions with AWR, but away from urban centres (e.g. Yokon and Northwest Territories).
    - The AWR served regions will serve as reference regions to the communities within the Nunuvut-Manitoba study area to compare the "gaps" that can potentially be bridged by the AWR development (see Gap Analysis in Task E).
    - Review regional sourcing for labour, equipment and supplies for the Nunavut-Manitoba AWR.
- Task B: Stakeholder and Industry Interviews
    - Conduct interviews with selected stakeholder and industry participants in the Nunavut-Manitoba study area to establish a range of development scenarios associated with the AWR;
    - Questionaires will be prepared and face-to-face interviews will be conducted to the extent possible; otherwise, telephone and/or email interviews will be conducted by the Consultant Team such that extensive travel will not be required.
    - Governments, stakeholders and industry representatives to be interviewed will, upon confirmation with the Project Working Group, likely include:
        - Cumberland Resources (Meadowbank Baker Lake Gold Project, Meliadine East and West Projects)
        - Starfield Resources (Ferguson Lake Project)
        - Kaminak Gold Corporation (Baker Lake Uranium Project)
        - Shear, Stornoway and BHP Billiton (Churchill Diamond Project)
        - Nunavut Planning Commission
        - Mines Branch, Government of Manitoba
        - Mining Association of Manitoba
        - Nunavut Tourism
        - Travel Manitoba
        - Qulliq Energy Corporation
        - Manitoba Hydro
        - Churchill Gateway Development Corp (Omnitrax and Port of Churchill)

Phase 2: Modelling and Analysis

- Task C: Economic Modelling
    - Based on the literature review and stakeholder/industry interviews, establish the base case, low development and high development scenarios associated with the AWR development.
    - To model the economic impacts of the AWR in Nunavut, the NUNAVUTMOD model will be used (see Appendix A). Economic benefits will be forecast under both the low and high development scenarios (as compared to the base case with no AWR) and expressed in terms of GDP, investment, employment, personal income, population and other variables relevant to the AWR Business Case.
    - The Statistics Canada Input/Output Model will be used to measure the economic impacts in Manitoba and other provinces/territories in Canada. Four runs of the Input/Output Model will be generated to obtain industry multipliers for the impact of increases in personal expenditures, gross fixed capital formation, government current expenditures and international exports (see Appendix A for more details on the modelling methodology and sample outputs).
- Task D: Benefit Cost Analysis
    - Based on the outputs of the Economic models as discussed in Task C above, annual cash flows of project benefits and costs will be generated in a spreadsheet format for a 30-year study horizon (assuming 20 years of AWR construction[2] and 10 years of post-construction development to take effect).
    - For an accurate cash-flow model of the project benefits and costs over the 30-year study horizon, we assume that the AWR will be constructed in 3 stages: Stage 1 connecting Rankin Inlet to Whale Cove and Arviat from Year 1 to 5; Stage 2 connecting Churchill to Arviat from Year 6 to 15; and Stage 3 connecting Sundance/PR 290 to Churchill River from Year 16 to 20. This is the expressed preferred phasing of the AWR by the Project Working Group and Project Steering Committee. We will re-confirm this phasing scheme with the Project Working Group prior to starting this assignment.
    - Benefit/Cost Analysis will be conducted using 5% and 10% discount rates for each of the low and high development scenarios (all compared to the Base Case scenario with no AWR development). Analysis will be conducted to determine the Internal Rates of Return, the Net Present Value (NPV) and the Benefit to Cost (B/C) Ratios for all analysis scenarios.
    - Project benefits will be broken down and distributed, to the extent possible, to the relevant stakeholders and governments (e.g. residents, industries, Governments of Canada, Nunavut and Manitoba). Road usage by type of traffic (freight, passenger, mining and/or industry-related, etc) on the AWR will be used as a proxy for the distribution of project benefits to the respective stakeholders and governments.

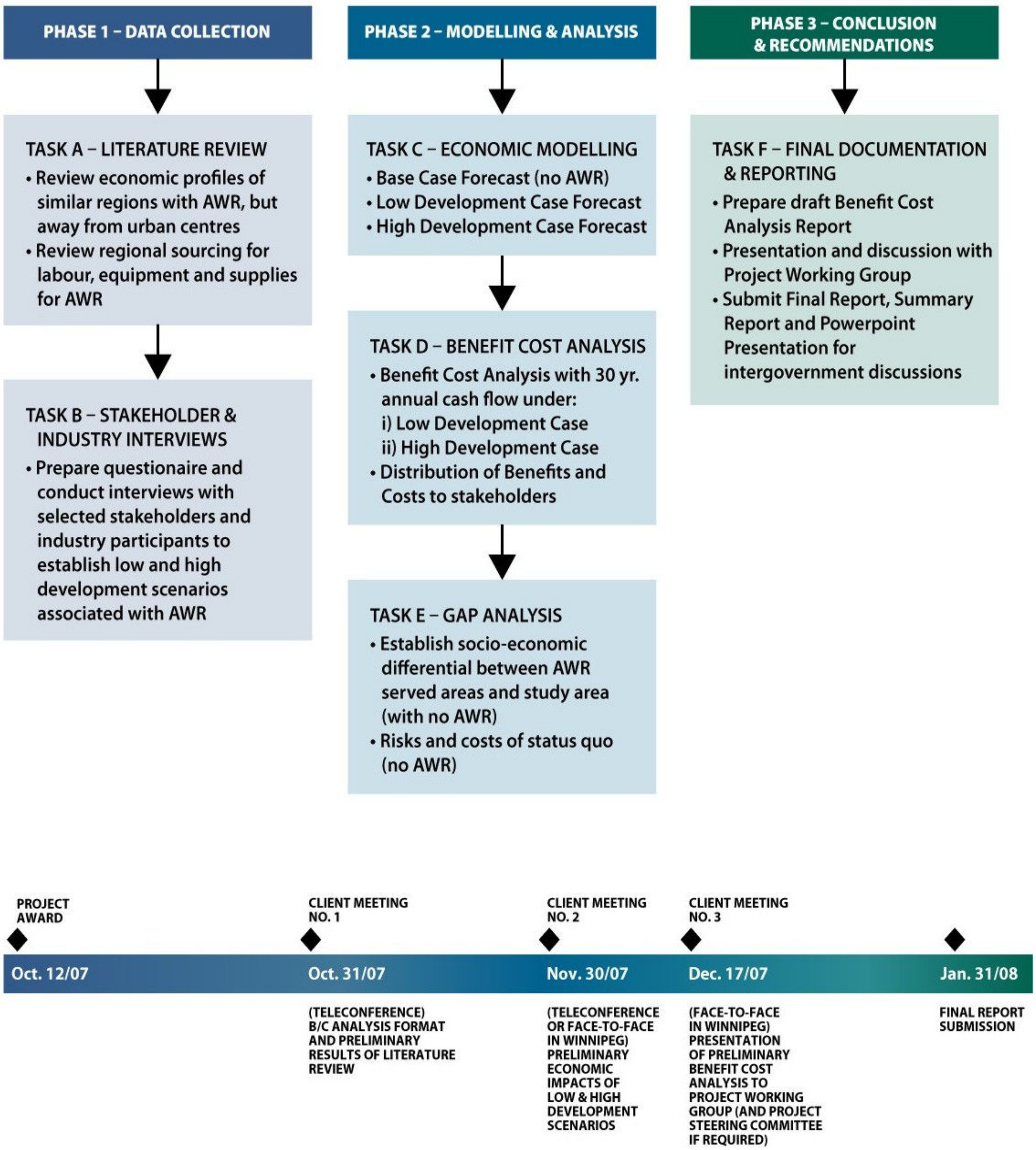
[2] It is noted that this 20–year construction period will not start until at least five years from the present time for the necessary engineering, environmental assessment, property negotiation, permitting and project funding processes.

- Task E: Gap Analysis
  - Based on the literature review in Task A, establish socio-economic differentials, or gaps, that currently exist between AWR served communities and the Nunavut-Manitoba study area.
  - Provide qualitative and quantitative, to the extent possible, analysis of how these gaps can be bridged with the development of the AWR.
  - Conduct a risk analysis of the monetary value of costs over time of a continuing gap should the AWR development not take place (i.e. the socio-economic risks of not proceeding with the AWR development).

<u>Phase 3: Conclusion and Recommendations</u>

- Task F: Documentation and Final Reporting
  - A Draft Benefit Cost Report will be prepared at the end of Phase 2 to summarize the analysis and findings to date, including the economic modelling and impact analysis, the Benefit/Cost Analysis and the Gap Analysis.
  - The Draft Benefit Cost Report will be presented to the Project Working Group and, if necessary, to the Project Steering Committee and Deputy Ministers responsible for transportation in Nunavut and Manitoba in the format of face to face meetings in Winnipeg. The purpose of these meetings will be to present and confirm the findings arising from the study to date, and to discuss any further factors and issues having significant effects on the Business Case.
  - A Final Report will be prepared incorporating all study findings and discussions with the Project Working Group, Project Steering Committee and Deputy Ministers, including the distribution of benefits and costs, and an assessment of data confidence and risks. A Summary Report and a Power Point Presentation will also be submitted at the end of the study for use as an informational tool in inter-governmental discussions and presentations.

Figure 3-1: Study Flowchart and Milestones



4.0 SCHEDULE AND FEE

4.1 Schedule and Deliverables

The project schedule will be based on the study methodology discussed in Section 3.2 above, and to meet the milestones and deliverables as specified in the Study Terms of Reference. In addition, the Technical Contact Person, Mr. Amar Chadha of Manitoba Infrastructure and Transportation, has indicated a desired completion of the first draft of the Benefit Cost Analysis by mid-December 2007. To meet this timeline, the project schedule is targeted as follows:

- Project Award: October 12, 2007
- Phase 1 Data Collection: October 15 – 31, 2007
    - *Client Meeting No. 1 (Teleconference) – confirm format of benefit cost analysis spreadsheets and preliminary results of literature review*
- Phase 2: Modelling and Analysis: November 1 to 30, 2007
    - *Client Meeting No. 2 (Teleconference or face-to-face in Winnipeg) – present regional development effects for the low and high development scenarios*
- Phase 3: Conclusion and Recommendations: December 1, 2007 to January 31, 2008
    - *Draft Benefit Cost Report submitted to Project Working Group by December 14, 2007*
    - *Presentation to Project Working Group and, if necessary, Project Steering Committee and Deputy Ministers, in Winnipeg: week of December 17, 2007*[3]
    - *Final Report Submission: January 31, 2007*

4.2 Fee Proposal

Our fee estimate to complete the tasks specified in this proposal is summarized below (excluding GST). A detailed breakdown of this fee estimate is provided in Figure 4-1.

SNC-Lavalin Personnel Fee (including sub-consultants):	$86,840
Disbursements:	
Four runs of Statistics Canada I/O Model	$4,000
Allowance for travel, vehicle and meal expenses, at cost	$6,000
Allowance for office expenses, at $7.50 per manhour (incl. communications, photocopying, maps, films, etc)	$5,235
Total Fee (excl. GST):	**$102,075**

[3] Note that in our fee estimate, we have allowed for two trips to Winnipeg for Client meetings and potential stakeholder/industry interviews. Any additional travel beyond these two trips will require additional costs, which have not been budgeted for in our Fee Proposal.

The above fee estimate is to be interpreted as cost reimbursable, based on the scope of work specified in the Study Terms of Reference. NKSL will commit to completing the work described for the fee provided above. Any scope increases initiated by the Client organizations or stakeholder groups will require the authorization of the Technical Contact Person before proceeding. Any additional work beyond the scope described herein authorized by the Technical Contact Person and/or members of the Project Working Group will be charged on a "fee for service" basis, using the hourly rates as tabulated in Figure 4-1.

4.3 Contractual Considerations

While in agreement with the overall terms and requirements outlined in the Study Terms of Reference, this Proposal and our obligation to enter into an Agreement are subject to agreement on mutually acceptable contract terms and conditions, including but not limited to limitation of liability, aggregate exposure and reasonable limitations on the use of our report(s), to be finalized during contract preparation and finalization.

Please refer to Appendix B for the standard notice that we include in our reports involving work similar to that required for this Business Case for Nunavut-Manitoba All-Weather Road.

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Figure 4-1: Fee Proposal

			Project Manager		Technical Advisor		Transportation Engineer		Transportation Economist		Economist		Nunavut Liaison		CAD Drafter		Document Control/Admin			
			P. Cheung		T. Stevens		A. Tam		P. Lyall		E. Howe		J. Hickes							
		Hourly Rate	$120		$130		$110		$120		$160		$90		$65		$45		TOTAL	
Phase	**Task**	**Task Description**	HRS	COST	HRS	COST	HRS	COST	HRS	COST	HRS	COST	HRS	COST	HRS	COST	HRS	COST	**HRS**	**COST**
1	**Data Collection**																			
	A	Literature Review	20	2,400			20	2,200											40	4,600
	B	Stakeholder and Industry Interviews	40	4,800	20	2,600					40	6,400	24	2,160			12	540	136	16,500
		Milestone: Client Meeting 1 (Teleconference)	8	960	4	520	4	440	4	480	4	640							24	3,040
		Phase 1 Sub-Total	68	8,160	24	3,120	24	2,640	4	480	44	7,040	24	2,160			12	540	200	24,140
2	**Modelling and Analysis**																			
	C	Economic Modelling	12	1,440	4	520					154	24,640							170	26,600
	D	Benefit Cost Analysis	12	1,440	8	1,040	16	1,760	40	4,800									76	9,040
	E	Gap Analysis	16	1,920	8	1,040	16	1,760	8	960									48	5,680
		Milestone: Client Meeting 2 (Teleconference or Face-to-face in Winnipeg)	12	1,440	8	1,040			4	480	8	1,280					8	360	40	4,600
		Phase 2 Sub-Total	52	6,240	28	3,640	32	3,520	52	6,240	162	25,920					8	360	334	45,920
3	**Conclusions and Recommendations**																			
	F-1	Prepare Draft Final Report	24	2,880	8	1,040	8	880	8	960					16	1,040	8	360	72	7,160
		Milestone: Client Meeting 3 (Face-to-face in Winnipeg)	16	1,920	16	2,080			8	960			8	720			8	360	56	6,040
	F-2	Prepare Final Report, Summary Report and Powerpoint Presentation	16	1,920	8	1,040									4	260	8	360	36	3,580
		Phase 3 Sub-Total	56	6,720	32	4,160	8	880	16	1,920			8	720	20	1,300	16	1,080	164	16,780
		TOTAL FOR PERSONNEL	**176**	**21,120**	**84**	**10,920**	**64**	**7,040**	**72**	**8,640**	**206**	**32,960**	**32**	**2,880**	**20**	**1,300**	**36**	**1,980**	**698**	**86,840**

Personnel Sub-total	**$**	**86,840**
Four runs of Statistics Canada's I/O Model	**$**	**4,000**
Allowance for travel, vehicle and meal expenses, at cost	**$**	**6,000**
Allowance for office expenses, at $7.50/personnel hour	**$**	**5,235**
Total Fee Proposal (Excl. GST)	**$**	**102,075**

APPENDIX A:

Proposal by Professor Eric Howe

APPENDIX B

STANDARD NOTICE

This document contains the expression of the professional opinion of Nishi-Khon SNC-Lavalin Ltd. (“NKSL”) as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the agreement dated * (the “Agreement”) between NKSL and * (the “Client”), and the methodology, procedures and techniques used, NKSL’s assumptions, and the circumstances and constrains under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

NKSL has, in preparing the cost estimates, followed methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care, and is thus of the opinion that there is a high probability that actual costs will fall within the specified error margin. However, no warranty should be implied as to the accuracy of estimates. Unless expressly stated otherwise, assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.) upon which NKSL’s opinion as set out herein is based has not been verified by NKSL; NKSL makes no representation as to its accuracy and disclaims all liability with respect thereto.

NKSL disclaims any liability to the Client and to third parties in respect of the publication, reference, quoting, or distribution of this report or any of its contents to and reliance thereon by any third party.

APPENDIX C

BUSINESS CASE TERMS OF REFERENCE

SEPTEMBER 5, 2007

TERMS OF REFERENCE

Business Case
Nunavut – Manitoba All Weather Road

1. Introduction

Throughout 1999 and 2000, a “Nunavut-Manitoba Transportation Assessment” was undertaken jointly by the Governments of Canada, Nunavut and Manitoba. This study established that a road connection between Manitoba and Nunavut is a critical requirement to providing communities in the Kivalliq Region of Nunavut with access to Manitoba and the rest of North America.

Nishi-Kohn/SNC-Lavalin (NKSL) has completed a study that determined the best location for a road route linking the community of Rankin Inlet to the Manitoba highway network. The preferred route (see attached map) extends from Manitoba PR 290 at Sundance to Rankin Inlet. Links from the main stem of the preferred route provide connections with Churchill in Manitoba; and Arviat and Whale Cove in Nunavut.

When completed the preferred route determined in the NKSL study (the Study) will provide the single overland fixed link between Nunavut and the rest of Canada. The preferred route has a main stem length of 1 090 km that would be constructed to an all weather 2-Lane pioneer arterial gravel road standard. The study concluded that all sections of the all weather road (AWR) could reasonably be completed in 20 years (excluding the option examined to stage development for the 240 km section from the Churchill River to the tree line as a winter road first then to an AWR).

The Business Case for a Nunavut-Manitoba All Weather Road is to take place under the auspices of the Nunavut-Manitoba Transportation MOU (signed in December 2001) between the two jurisdictions and of which a key objective is collaboration on the road initiative.

2. Business Case Objectives

The objective is a high level business case providing a first order indication of socio-economic benefits and costs attributable to the construction and operation of the Nunavut-Manitoba all weather road; and the determination of resulting gains to respective beneficiaries.

The business case will provide decision makers and stakeholders with a clear understanding of the value, risks and priority of AWR development; provide demonstrable evidence of value in AWR development, to determine if AWR development offers sufficient value and merit for implementation; and, to enable decision makers and stakeholders to objectively measure subsequent achievement progress.

3. Study Approach

A base case and two all weather road scenarios will be developed:

a) The **base case** will forecast the long term economic effects of no all weather road development,

b) A **low development scenario** will be developed that forecasts modest incremental economic activity with all weather road development, and

c) A **high development scenario** will be developed assuming robust incremental economic activity.

The difference in economic activity between the base case and the high and low development scenarios will represent the range of potential benefits and costs attributable to AWR development. Incremental economic effects considered for both the low and high development scenarios will include:

- The construction and maintenance of the AWR, detailed to indicate potential regional sourcing for labour, equipment and supplies.
- Transportation cost savings on freight and passenger travel.
- Effects on the transportation industry (trucking, air and marine) including new, expanded and displaced activities, including regional employment effects.
- Spin off effects regarding the potential development of mineral resources, fisheries, tourism, commercial activities (service industries, wholesale and retail trade) and arts and crafts.
- Public sector effects relative to the delivery of services.
- The development of regional energy resources to serve both regional and extra regional markets.
- Passenger mobility effects, including cost savings and enhanced social interaction and access to commercial and public services as benefits.

Benefits and costs will be identified and quantified in monetary terms to the extent possible. In the case of effects not lending themselves to monetary quantification the Consultant will assign subjective values to indicate the importance of these effects relative to quantified benefits and costs (e.g. the socio-economic value of increased passenger travel might be measured as the 'willingness/ability to pay" for trip costs from disposable income).

The value of the Nunavut – Manitoba All Weather Road will also be considered and noted as an instrument for supporting and strengthening Canada's national strategic interests and sovereignty in the far north.

4. Study Methodology

For the purpose of framing the low and high development scenarios it will be assumed the Nunavut-Manitoba all weather road is constructed over 20 years. The NUNAVUT- MANITOBA ROUTE SELECTION STUDY (*Route Selection Study*) prepared by Nishi-Khon - Lavalin for the Kivalliq Inuit Association will be the primary reference for identifying potential economic and social developments (mining, fisheries, energy, tourism, arts and crafts, public services, resupply logistics, passenger travel, wholesale and retail trade). The Consultant will supplement the potential developments identified in the *Route Selection Study* by reviewing economic activity profiles (e.g. commercial, industrial, and service industries) of regions similar to the study area which are served by all weather roads, but are a considerable distance from a major urban supply/processing centre.

Regional developments that potentially could be triggered by the availability of the AWR (and its right of way for energy transmission) will be in terms of hypothetical developments considering the resource base, infrastructure and demographics of the region. The "region" will be considered as a 500 km band centered on the preferred AWR route alignment.

The benefit cost timeframe for the business case will be 30 years. Similar study work has demonstrated that regional development effects of transportation investment become most pronounced following construction. The AWR construction is assumed to be undertaken over 20 years. A 10 year post construction period is regarded as necessary to reasonably depict potential regional development effects of the AWR.

The business case will include an analysis of regional benefits and costs of the low and high development scenarios, a gap analysis, the potential distribution of benefits and costs to specific stakeholders, and an assessment of confidence and risk associated with data developed for the benefit cost analysis.

- Benefit Cost Analysis of Low and High Development Scenarios
  Annual cash flows (30 year time frame) of benefits and costs associated with the full range of regional development effects from AWR development will be spread sheet detailed by year and by distribution to stakeholders (residents, industries, and governments of Canada, Manitoba and Nunavut). The analysis will be undertaken using both 5% and 10% discount rates, and will provide Internal Rates of Return, Net Present Values and Benefit Cost Ratios.

- Gap Analysis
  The rationale for AWR construction is to provide lower cost and more reliable transportation; and to provide a stimulus for incremental economic activity in the region. A gap analysis is an important feature of the business case. It will provide an indication of the socio-economic differential which now exists between AWR served areas and the study region; and the extent to which the provision of the AWR can potentially narrow this gap. The baseline reference for the gap analysis should be reflective of the quality of life in areas currently AWR served. A key indicator is median income. Per capita Manitoba median income (gross and after tax) can be adopted as an indicator of quality of life, for use as the baseline for the gap analysis. The socio-economic differential between AWR served areas and the study area will represent the gap to be closed by AWR development. Expected risks are the monetary value of costs over time of a continuing differential should AWR development not take place (i.e., opportunity cost of not proceeding).

- Distribution of Benefits and Costs
  The benefits and costs associated with the regional development effects attributable to AWR development will be linked to specific stakeholders. Stakeholders identified in the distribution of benefits and costs will be regional residents, industries, public services, and the governments of Canada, Manitoba and Nunavut in respect to incremental tax revenues.

- Assessment of Data Confidence and Risk
  Sensitivity testing of significant benefit and cost data inputs will be undertaken to test the impact of possible variances on the study results.

5. Progress Review

Progress in developing the business case will be presented at a minimum of three milestone points of the study (e.g. when the benefit cost analysis spreadsheets have drafted, when regional development effects for the low and high scenarios have been determined, when the benefit cost analysis is completed in preliminary form).

6. Project Management

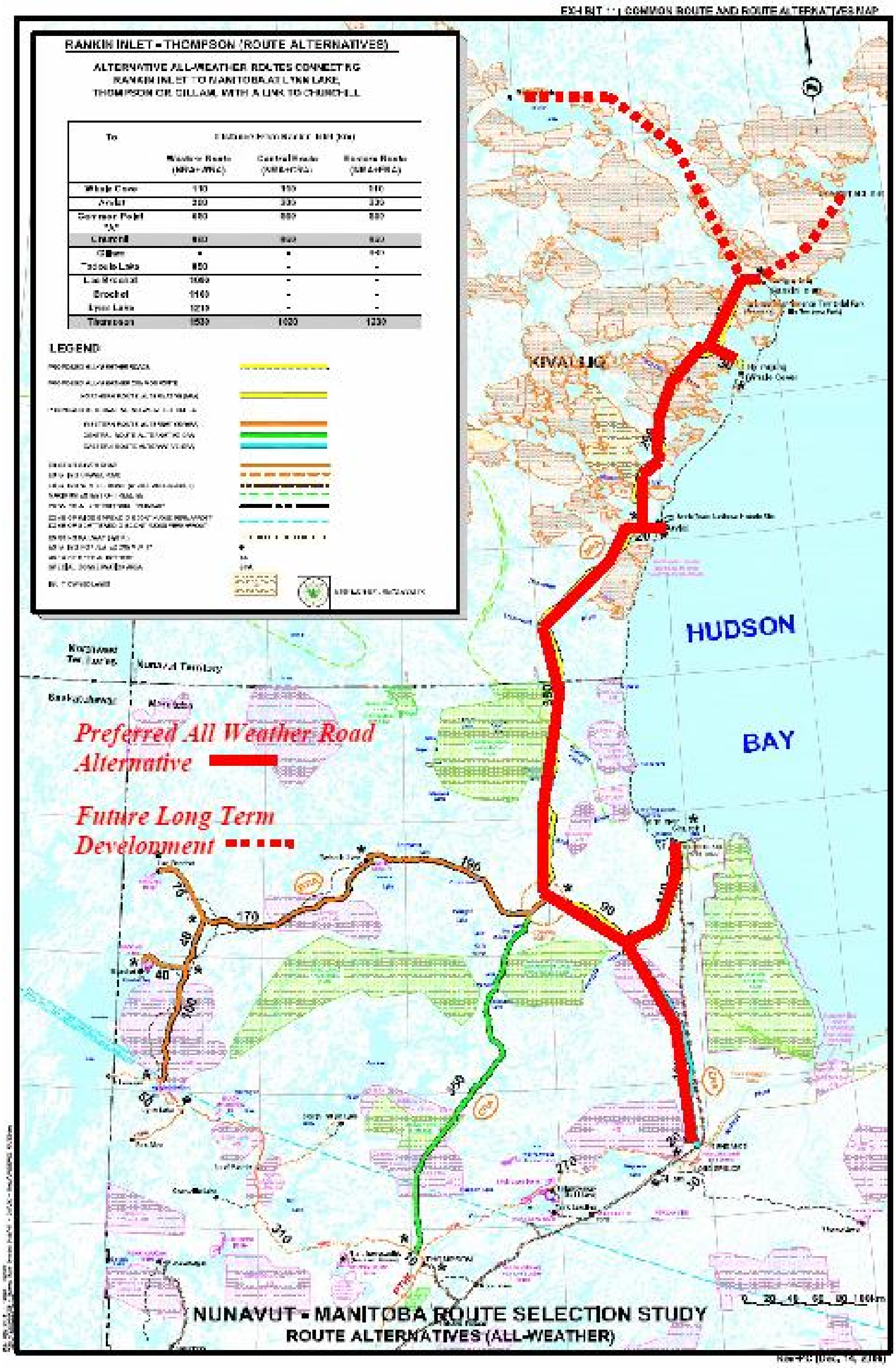
Mr. Amar Chadha, Director of Transportation Systems Planning and Development for Manitoba Infrastructure and Transportation, is the Technical Contact Person for the Business Case project; and will be responsible for the day to day work required in support of the study.

7. Anticipated Deliverables

The consultant will provide twenty-four copies each of a final comprehensive report and a summary report, one photo ready copy of each and an electronic copy of each all in Microsoft Word format.

The summary report shall include the final conclusions of the study outlining the process undertaken to arrive at these conclusions, present the key findings/ issues arising from the study, and provide a discussion with respect to future consideration of factors and effects having significant influences on the business case.

The consultant shall provide a Power Point Presentation for use as an informational tool in intergovernmental discussions. The Power Point content will be a concise summary of salient aspects of the Business Case as accepted in the final report.



RANKIN INLET – THOMPSON (ROUTE ALTERNATIVES)
ALTERNATIVE ALL-WEATHER ROUTES CONNECTING RANKIN INLET TO MANITOBA AT LYNN LAKE, THOMPSON OR GILLAM, WITH A LINK TO CHURCHILL
LEGEND
KIVALLIQ
HUDSON
BAY
Preferred All Weather Road Alternative
Future Long Term Development
NUNAVUT – MANITOBA ROUTE SELECTION STUDY
ROUTE ALTERNATIVES (ALL-WEATHER)

Appendix 7. Scoping Study – Hydroelectric Power from Manitoba to the Kivalliq Region in Nunavut

Kivalliq Inuit
Association

Kivalliq Inuit Association

Kivalliq Region, NU

Report

Scoping Study – Hydroelectric Power from Manitoba to the Kivalliq Region in Nunavut

BBA Document No. / Rev. 3560001-000000-47-AET-0001 / RAA

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PRELIMINARY

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REVISION HISTORY

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RAA	Preliminary	2015-09-04

EXECUTIVE SUMMARY

Through previous initiatives, methods to supply power to the Kivalliq region from Manitoba have been investigated, as well the benefits of building a road from Churchill to Rankin Inlet, Chesterfield Inlet and Baker Lake. Some of these initiatives were put on hold due to a lack of financing.

In 2014, the Hudson Bay Regional Roundtable (HBRRT) resolved to further investigate the construction of a power transmission system from Manitoba to supply power to the Kivalliq region, as well as the construction of a winter road, as the best solutions to support economic development in Kivalliq, to reduce greenhouse gas emissions from diesel generation and oil heating, and to improve quality of life in the communities.

HBRRT delegates established the Energy Options Working Group (EOWG) with a mandate to look at energy development of the Hudson Bay region, and, particularly, to examine the merits of a high-voltage transmission line to supply electrical power to the Kivalliq region of Nunavut from Manitoba's power grid.

The EOWG retained the services of BBA, an engineering firm, to undertake a technical, economic and environmental assessment of the transmission line project. To this effect, BBA has joined up with technical experts from Econotec Inc. for the economic viability and impact analysis, and from Canada North Environmental Services (CanNorth) for the environmental aspects of the study.

The current document, prepared by BBA's team, provides an Investment Justification with the aim of helping the EOWG to get funding for a feasibility study, which would be the next step in getting the power line project under way.

Project Concept

The concept of the power transmission project consists of interconnecting the Kivalliq region with the Manitoba Hydro power grid. Two scenarios are considered in the elaboration of a high level implementation strategy. The overall approach will be refined in the feasibility study.

1. Coastal Scenario

The Coastal Scenario would involve the interconnection of the coastal communities of Arviat, Whale Cove, Rankin Inlet and Chesterfield Inlet to the Manitoba grid, as well as supplying power to existing and future mining operations located along the power line. It would consist of the following:

- construction of a 230 kV power line from Churchill in Manitoba up to Rankin Inlet;
- construction of three main power substations:

- one to the west of Churchill to raise the voltage from the existing 138 kV to 230 kV, a voltage more suitable for the expected Kivalliq loads and distances involved;
- one close to Arviat required for compensation but also used to step voltage down to 34 kV, a voltage more readily usable to bring power to the Arviat community;
- one close to Rankin Inlet, also for compensation and generating 34 kV for surrounding communities and for the Meliadine project.

- construction of 34 kV lines to route the power from the main substations to the communities of Arviat, Rankin Inlet, Whale Cove and Chesterfield Inlet;
- construction of a smaller substation in each hamlet to step down the 34 kV power to a voltage level that allows for interconnection to the existing distribution system within each community.

2. Coastal and Inland Scenario

The Coastal and Inland scenario would add the interconnection of the Baker Lake hamlet to the transmission system to the Coastal scenario and the provision of electrical power to mining operations located in the Baker Lake area. It would include the following additional investments:

- construction of a 230 kV power line from the Ranking Inlet main substation to the Baker Lake area;
- construction of a main substation close to Baker Lake, used for compensation and stepping voltage down to 69 kV; a higher voltage than 34 kV since potential clients, such as the Kiggavik mining project, are further away;
- construction of a 69 kV line to Baker Lake;
- construction of a local substation to feed the Baker Lake community.

Power demand analysis and forecasts

Power demand forecasts were prepared for the 5 communities and for the mining sector. The forecasts were developed in line with the Coastal and Coastal-Inland scenarios.

Energy demand forecasts for the communities were based on a detailed analysis of past consumption of electrical power and heating oil in the residential and commercial sectors. The major factors supporting the growth of electrical power demand in the communities were identified as population growth and the conversion of space heating from oil to electricity.

Conversion from oil to electricity would induce a near seven-fold increase of the average annual electrical energy consumption of residential customers from 6,000 kWh to 40,000 kWh per customer, a figure validated with residential consumption data for Northern Manitoba communities with similar climatic conditions. The future power consumption for the commercial sector was estimated conservatively by assuming that it would maintain its share of the total energy used for space heating, which would mean a three-fold increase of the power consumption for the commercial sector.

It is expected that 10 years after the power line has come into service, when conversion to electric heating will have been completed in the 5 Kivalliq communities, energy consumption will have grown from 38 GWh to 185 GWh and total peak load will have increased from 8 MW to 47 MW.

For the mining sector, forecasts of power demand were based on energy and power demand data supplied by the mining companies. Agnico Eagle's Meliadine gold mine project would need about 250 GWh of energy annually and 30 MW of power until the end of operations planned for 2034, while AREVA Resources' Kiggavik uranium mine project, located in the Baker Lake area, would require about 165 GWh of energy and 21 MW of power during its 12 years of operation. It should be noted that while the start-up of the Agnico Eagle project in 2019 seems highly probable, the timing of AREVA's Kiggavik project remains conditional upon a rise in the price of uranium.

The power demand of these two mining projects represents 60% of total demand, with 40% for the 5 Kivalliq communities combined. The scoping study examined the mining sector to find new loads (potential new projects) to offset the power demand decrease following the end of operations of the Meliadine and Kiggavik mines. To that effect, the scoping study consulted the annual overviews of the Canada-Nunavut Geoscience Office and discussed the mineral potential of the Kivalliq region with its Chief Geologist. It was concluded that in the short to medium term, it would be overly optimistic to include additional demands by the mining industry in power demand forecasts. However, given the well identified potential and the amount and positive results of the exploration work performed for gold deposits in coastal areas (Whale Cove) and for uranium in the Baker Lake area, it would be overly pessimistic to assume that there would be no mining activity in the Kivalliq Region after 2034. Furthermore, mining operations at Meliadine and Kiggavik could be extended beyond the planned schedules, which is usually decided near the end of the mine operation. It is on that basis that the demand forecasts used in the viability analysis of the transmission project included additional power demand by the mining sector, from 2034 until the end of the 40 year minimum life of the infrastructure, of 20 MW in the Coastal scenario and of 40 MW in the Coastal & Inland scenario.

Project implementation strategy and investment costs

Environmental Assessment and Permitting

Construction of a Nunavut-Manitoba interprovincial transmission line has potential for important environmental benefits once the project becomes fully operational. The greatest benefits of an electrical transmission line supplying the Kivalliq region include the reduction of greenhouse gas emissions from diesel generators, and a reduced potential for fuel spills (small scale residential spills or large-scale spills during transport). A reduction in generator usage may also result in increased air quality for northern communities, eliminating emission of dust, fumes, or other noxious elements resulting from combustion.

A reduction in the risk of fuel spills is another major advantage of an electrical transmission line. Petrol products from small spills that inevitably occur on occasion while fueling generators may eventually work their way into soils or wetlands. Large spills, while infrequent, can cause significant impact to wildlife, soils, wetlands and waterbodies. Effects of spills are often not well understood, but may persist for generations, and may have regional, national, and international significance. Installation of a transmission line would eliminate much of this risk by reducing the use and transport of diesel throughout a relatively pristine and sensitive ecosystem.

The installation of a new power transmission line running from Churchill, Manitoba to Kivalliq, Nunavut, will require extensive environmental consideration, planning and permitting processes.

Environmental permitting processes for a project of this magnitude are extensive and require significant planning. The most rigorous permitting or permission process will likely include an Environmental Impact Assessment on a federal or provincial/territorial level. The approach forward and the level of regulation required will need to be refined within the feasibility study.

All environmental requirements, including best-practices, adherence to federal, provincial and territorial regulations, permitting processes, monitoring, reporting, and community involvement represent components in a broad environmental strategy, which may be outlined in a comprehensive Environmental Management Plan, the features of which will depend on project details.

Sensitive features that may be impacted by Project construction and maintenance include wildlife and vegetation resources, soils and terrain, wetlands and watercourses, heritage resources, and the human environment. Cumulative effects in association with present or future projects throughout the transmission line planned corridor are an additional possibility and may be reduced or mitigated through careful Project planning. Through avoidance of sensitive timing windows, effects to wildlife, soils, wetlands, and vegetation may be avoided or reduced, including incidental taking of migratory bird nests, disruption of critical wildlife reproductive processes, addition of silt to waterbodies, erosion and rutting, and the melting of permafrost. Environmental surveys will be required to determine the presence of sensitive elements such as sensitive wildlife species or species at risk, rare plants, or sensitive geological features. If such elements are found, mitigation measures such as avoidance, monitoring, or additional restoration practices may be necessary. Similarly, heritage surveys will be required to determine whether or not heritage resources are present along the transmission line corridor; the presence of artifacts or heritage sites may result in additional mitigation requirements. Any impact or perceived impact to the human environment and traditional values of local residents must be weighed against the increased quality of living provided by affordable and reliable electricity and reduced greenhouse emissions.

Economic viability

The methodology used for the analysis of the economic viability of the Manitoba-Nunavut transmission line project basically consisted of estimating the value of the benefits to be created by the infrastructure in terms of fossil fuel savings net of the purchases of electricity from the Manitoba Hydro grid and of associated operating costs. Calculations were made for the two scenarios, Coastal and Coastal and Inland, on the basis of the power demand forecasts, including the assumption that new mining operations will partly replace power demand from the Meliadine and Kiggavik mines after their closure. The major assumptions made in the calculations were:

- project life duration set at 40 years and start-up in 2024/25;
- 4% discount rate and 4% interest rate;
- price of oil assumed to drop by 20% in 2014/15 and to stand at $0.90/litre in 2024/25 for bulk shipments delivered in Rankin Inlet; after 2024/25, oil prices are to rise by 0.8% per year in accordance with US Energy Information Agency forecasts;
- price of electricity purchases from Manitoba Hydro set at $0.08/kWh as the middle point of the potential purchase price range indicated by Manitoba Hydro;
- estimates of oil savings for power generation and space heating are based on power production parameters of QEC production equipment in each community; a $0.05/kWh was added to diesel oil savings to account for savings on other operating costs directly associated with diesel generation.

The key results of the viability analysis are the following:

Volume and value of fossil fuel savings

- once conversion to electric heating is completed, fossil fuel savings for space heating would be in the order of 20 million litres annually, while diesel oil savings for power generation in QEC installations would be in the order of 15 million litres;
- the bulk of fossil fuel savings would take place in the mining sector with savings of about 60 million litres of diesel fuel per year in the Coastal scenario and around 100 million litres in the Coastal and Inland scenario;
- for the 5 communities, the gross value of heating oil savings is estimated at $21M per year and that of diesel fuel for power generation in QEC installations at $18M, for a total amount of about $40M;
- the mining sector could see estimated gross diesel fuel savings of up to $60M annually for the Coastal scenario and of $100M for the Coastal and Inland scenario,
- if there are no long term mining sector clients, the net present value (NPV) of the project is negative in both scenarios for the base case $0.90/litre oil price (the NPV of the project is the

NPV of oil savings, that is gross savings minus other cost elements such as electricity purchases, operating costs and amortization charges);

- although oil prices are currently (September 2015) very depressed, it is not unthinkable that in 2024/25, they could have recovered to what they were just a few years ago, around $1.13/litre, so that oil savings could be much larger;
- even with an oil price 25% higher than in the base case, the two scenarios yield mostly negative NPVs, if there are no long term mining clients;
- the key factor for assuring the viability of the transmission system is for new mining operations to be started after (or before) the closure of Meliadine and Kiggavik; only then do NPVs become positive and significant in relation to the investment.

Economic viability indicators

In the base case without long term mining sector clients, the analysis yields negative economic viability results for both the Coastal and the Coastal and Inland scenarios;

- the results are slightly improved but remain negative with a purchase price of $0.07/kWh for electricity instead of $0.08/kWh;
- a 25% rise of the price of oil to $1.13/litre with respect to the base case of $0.90/litre would lead to small but positive IRRs, although the NPV at 4% discount would still be negative;

It is only under the assumption that other mining projects of a similar magnitude are undertaken and remain in activity after the announced closure years of Meliadine and Kiggavik that positive IRRs and NPVs are obtained;

- the base case with long term mining clients yields an IRR of 3.8% for the Coastal scenario and of 6.0% for the Coastal and Inland scenario;
- a purchase price of $0.07/kWh for electricity instead of $0.08/kWh improves IRRs by about 1%, while a price of $0.09/kWh reduces IRRs by about 1%;
- a 25% increase in the price of oil up to $1.13/litre in 2024/25 and beyond would yield attractive IRRs for both scenarios, but especially for the Coastal and Inland scenario with a 10.2% IRR;

Unit cost estimations

The cost of the energy to be delivered by the transmission system was calculated after including the amortization of project capital investment costs. For this, an amortization period of 40 years and an interest rate of 4% were used, resulting in annual debt repayments of $33.9M for the Coastal Scenario and of $47.4M for the Coastal and Inland scenario. Unit cost calculations indicated the following:

- in the Coastal and Inland scenario, the unit cost hovers around $0.20 per kilowatt-hour purchased, when the Meliadine and Kiggavik mines are in activity, but climbs to $0.36/kWh after the mines close down;
- should long term mining sector clients effectively materialize, the unit cost would remain around $0.20/kWh.

Summary and conclusions of the economic viability analysis

The major conclusions to be drawn from the economic analysis of the project are the following;

1. The Coastal and Inland scenario appears more viable than the Coastal scenario

The Coastal and Inland scenario appears more viable because it allows the investment costs to be spread over a larger power demand by the mining sector; however, uncertainty about future mining projects in the Baker Lake area is greater than for the Coastal scenario where the Meliadine gold mine is close to getting the final go ahead signal.

2. The viability of the project is sensitive to oil prices

The project is highly sensitive to the price of oil and shows attractive returns, if at the time of start-up oil prices return to their mid-2014 level

3. On the basis of fossil fuel savings, the project is economically viable if there are long term mining clients;

The fact that the economic viability indicators obtained from the analysis are negative in the case where there is no long term mining clients is not surprising, because a large investment would serve a relatively limited load. What is important is that the indicators are positive in the case where there is long term demand from the mining sector, which can be considered as a bet on the future, but one that may cost dearly if it is not made.

4. Even if there are no long term mining clients, on the basis of unit cost estimations, the project is the best alternative for supplying electricity to the 5 Kivalliq communities

The unit cost estimations indicate that the transmission line is the best alternative for providing energy to the 5 Kivalliq communities even if there are no mining projects after Meliadine in the Coastal scenario and after Meliadine and Kiggavik in the Coasta and Inland scenario. Indeed, although the debt amortization assumptions made include a subsidy element, the estimate of a $0.36/kWh unit cost to be supported by the communities only must be compared to the generation costs of QEC. These costs currently are $0.30/kWh for fuel only and are equal or higher than those of the transmission line, when adding other generation operating and maintenance charges and some system expansion and equipment amortization charges that could be avoided with the transmission line.

5. The transmission line option eliminates the risks of oil price increases and of missing out on mining sector development

The transmission system option is one that allows for minimizing several types of risks. The most important risk is that of a rise in oil prices that would make power generation and space heating recurrently costlier and lead to larger subsidy payments by the federal government. This risk also weighs on mining sector projects. The oil price risk has to be compared to the limited risk of price increases of the power to be delivered by Manitoba Hydro. Although mining sector development is not necessarily dependent on grid supplied power, not building the line creates the risk of missing out on future mining projects that could be attracted by the availability and affordability of electricity; additionally it creates the risk of missing out on supplying clean energy to proposed and future projects. The transmission line also reduces the risks of diesel generation equipment breakdown, since QEC power stations would only be used as back-up during line outages.

6. The project will have large economic, social and environmental impacts

The transmission line project may improve the economics of mining in the Kivalliq region, however the development the two advanced stage projects of Meliadine and Kiggavik has not been tied to the construction of the line and economic impact in terms of job creation and local purchases would take place anyway.

The direct economic benefits of increased power availability for the population of the Kivalliq hamlets to be interconnected would largely depend on the tariff policy to be implemented by QEC and the Government of Nunavut and the extent to which the population of Kivalliq is offered reduced electricity rates. The quality of life in Kivalliq hamlets and whole region would be improved with the use of a clean energy source entailing the elimination of fuel odours, fuel spills and combustion fumes; the quality of air would be improved markedly

The elimination of large volumes of green house gases from oil heating and diesel generation in the communities and in the mining sector would have an economic value of several million dollars annually if a carbon tax is applied.

The Government of Canada would be a major beneficiary of the project through potentially reduced fuel subsidy payments, that could be reallocated to more profitable uses in the social sectors (health, education, housing).

The way forward

1. The scoping study provides a valid justification and basis to carry on with the development of the project

This scoping study is a first step in the development of the project. It has resulted in the definition of a project concept, in a preliminary assessment of its economic viability and in the identification of the regulatory processes and environmental assessment requirements that must be satisfied before undertaking the final design and construction phases. These results form a valid justification and basis to continue with the development of the project.

2. The next steps will consist of a feasibility study and of the preliminary environmental studies but a Project Brief is a required as a agreed basis to proceed and for requesting financial assistance.

The next steps will consist in conducting a feasibility study and the preliminary environmental studies allowing to start the community engagement process and to initiate discussions with the Federal Government and other interested parties about the viability and the financing of the project.

In order to proceed to the next steps, it would be required to prepare in the immediate future a Project Brief or concept paper that would summarize the agreed upon elements of the Scoping Study, the objectives targeted by the project, the activities to be undertaken, the roles and responsibilities of stakeholders, a timeline and preliminary critical path and a budget estimate for the studies to be conducted over the next three to four years up to the design Licensing and Design Phase.

Assuming that stakeholders adhere to the project concept and to the process proposed and that they express their will to initiate technical studies and the regulatory approval process, the EOWG and the HBRRT will have to present a formal request for assistance to the Federal Government, It is to be decided if the request is to be presented directly by the Government of Nunavut or by Qulliq Energy Corporation, as the future owners of the infrastructure, or by the EOWG and the HBRRT on their behalf. A clarification of the roles of stakeholders may be necessary.

3. Financial assistance and facilitation assistance is available from the federal government and can be requested trough CanNor.

Northern Projects Management Office (NPMO) of CanNor is available to assist the project's proponents for the purpose of facilitating the regulatory process. Strategic Investments in Northern Economic Development program (SINED) aims to enhance the Economic Infrastructure Base by supporting the planning and development of multi-user physical infrastructure critical to economic growth.

The project appears to meet the eligibility and funding criteria of those programs.

4. Coordination between stakeholders on electricity pricing and financing issues

The scoping study has left open the issues of how the capital investment would be financed and of what would be QEC's selling price of electricity to industrial clients and to customers in the communities. Manitoba Hydro explained what would be the mechanics of electricity pricing and hinted that the selling price would be in wide range of $60 to $100 per GWh. The issues of electricity pricing and of project financing are tied together. Therefore, it would help the project's advancement if stakeholders could somehow establish criteria for their collaboration and positioning on these issues and potentially investigate the possibility of innovative financing approaches such as Public Private Partnerships or other mechanisms. Some basic understanding on key issues would help to obtain assistance from the Federal Government.

In this respect Recommendation V of the Standing Senate Committee on Energy, the Environment and Natural Resources should be reminded to stakeholders. In summary, the Senate Committee identified a federal loan guarantee as one possible funding avenue, but insisted on the conditions attached to it, in particular concerning the financial merit of the projects proposed and the repayment of the guarantee by rate payers through a proper regulatory regime.

5. Project Timeline

It has been determined on the basis of the usual duration of environmental studies and of the normal course of regulatory processes that the timeline for approvals and construction would delay the start-up of the transmission system up to 2024/25, at least nine from now. This timeline means that the project will potentially miss out on several years of power demand from Meliadine mining operations due start in 2019 and completely on demand from the Amaruq-Meadowbank extension due to close down in 2022.

It would be of great importance and benefit for the project for stakeholders to define a strategy to accelerate the studies and approval process. In particular, environmental studies should commence within the shortest possible delay.

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1. INTRODUCTION

1.1 Project purpose and context

Through previous initiatives, methods to supply power to the Kivalliq region from Manitoba have been investigated, as well as the benefits of building a road from Churchill to Rankin Inlet, Chesterfield Inlet and Baker Lake. Some of these initiatives were put on hold due to a lack of financing.

In 2014, the Hudson Bay Regional Roundtable (HBRRT) concluded that the implementation of a power transmission system from Manitoba, as well as the construction of a winter road, were among the best solutions to support the economic development in Kivalliq, reducing the greenhouse gas emissions from diesel generation and improving the quality of life of the neighbouring communities.

HBRRT delegates unanimously passed a resolution to establish an Energy Options Working Group (EOWG). The EOWG includes representatives from the Nunavut and Manitoba Governments, from Qulliq Energy Corporation and Manitoba Hydro (the electric utility companies of Nunavut and Manitoba), from the Kivalliq Inuit Association (representing the interests of all Inuit living in the Kivalliq Region) and from Kivalliq Municipal Governments, as well as the Town of Churchill and private sector corporations.

The mandate of the EOWG is to look at energy development issues for the broader Hudson Bay Region and, in particular, to examine the merits of a high-voltage transmission line between Manitoba and Nunavut to supply the Kivalliq communities, as well as mine sites or other potential industrial sectors. Such a transmission line could provide many benefits and reduce the dependence on high-cost diesel powered generating stations.

The replacement of fossil fuels by cleaner hydroelectric power could bring considerable social, economic and environmental benefits to the Kivalliq region. Furthermore, it could potentially improve the economic viability of developing mineral resources and of creating employment in the western Hudson Bay region. As three major mining projects in the Kivalliq region will require power in the upcoming years, the amortization of the transmission line project will highly depend on when mining installations are connected to the system and the duration of the mine operations afterward.

The EOWG has retained the services of BBA, an engineering firm, to undertake a technical, economic and environmental assessment of the transmission line project. To conduct this assessment, BBA has put into place a team of technical experts, including Econotec Inc. to undertake the economic viability and impact analysis component of the study. Canada North Environmental Services (CanNorth) has also been retained to cover the environmental aspects of the project.

The current document, prepared by BBA's team, provides an Investment Justification with the aim to help the EOWG get funding for a feasibility study.

1.2 Project summary description

This Investment Justification analysis report presents a scenario that seems to offer the most benefits. Opinions are provided in good faith to inform the reader of the main opportunities and challenges associated with the project. The base case scenario is developed on the basis of previous studies, discussions, available information and the expertise of all parties involved. A more in depth study, i.e. a feasibility study, would be the next step, further reviewing all alternatives deemed relevant and optimizing an overall solution.

The present report proposes a step-by-step implementation strategy, addressing specific challenges, while increasing the economic benefits and the quality of life of the communities.

For the purpose of this report, it is assumed that the construction of a winter road from Churchill to Rankin Inlet, Chesterfield Inlet and Baker Lake will be completed before the construction of the transmission system.

The 230 kV high voltage transmission line would originate from a new substation located near Churchill and bring power to five communities of Nunavut's Kivalliq region, i.e. Arviat, Whale Cove, Rankin Inlet, Chesterfield Inlet and Baker Lake. The high voltage line would also supply power to mining projects, two of which are at a more advanced stage of development (the Meliadine gold mine and the Kiggavik uranium mine). The transmission line would also include fibre optics, bringing high speed communication to both communities and industries.

For the project to be successful, an environmental management strategy to manage environmental aspects of the project through all project phases should be implemented and scheduled along with other project milestones. Table 1 indicates key elements that will be required to be completed during each project phase described in Section 1.3, and anticipated costs for the relevant work to be completed to meet anticipated environmental requirements. The following outlined draft plan will need to be modified depending how the project proceeds, including right of way clearing and construction methods, how responsibilities will be allocated between the proponent, the contractor and the operator.

1.3 Project timeline

The following timeline is considered realistic in order to complete the first two steps of the implementation strategy, i.e. to supply power to Meliadine mine, Arviat and Rankin Inlet with the possibility of also interconnecting Whale Cove and Chesterfield Inlet. The feasibility study will further investigate the optimal timeline for the last three steps of the implementation strategy, as the corresponding transmission system would likely not be in service before 2025. These steps mainly depend on the load growth in the Baker Lake area, as well as network limitations.

2015-2018	2018-2020	2020-2022	2022-2024	2024-2025
1 - Technical Studies and Agreements	2 - Environmental Studies	3 - Licensing and Design	4 - Construction	5 - Start-up

1.3.1 Technical Studies and agreements

This item includes a feasibility study, the two main utility studies (System Impact Study and Facility Study) and the interconnection agreements.

- The feasibility study will address economic, technical, and environmental aspects of the project. Power sale negotiations will also begin at this step.
- The System Impact Study evaluates the technical performance of the new system, while the Facility Study provides cost estimates and prepares the package that will be included in the agreements.

The technical studies and agreements are intended to clearly define the project and the conditions prior the environmental consultation process. This step is expected to last nearly three years, with one year for the feasibility study and two years for the utility studies, including financing and follow-up.

The work necessary to prepare for field studies must be completed, including route selection, imagery acquisition, habitat classification, and refinement of field scoping and access planning. Of prime importance to initiate in Phase 1 are IQ/TEK data acquisition, and planning for community engagement in both Nunavut and Manitoba. It is important that this work begins early and is well scoped to ensure that any beneficial partnerships that would be developed for the project, stakeholders, and Inuit and First Nations are able to proceed in a timely manner, as these relationships are key to project success. Some field work and numerous meetings will be required in this phase.

1.3.2 Environmental Context and Planning

Construction of a Nunavut-Manitoba interprovincial transmission line (the Project) is a major endeavor with huge potential benefit. The construction of the Project will provide residents of isolated communities and industrial mining operations in Nunavut with affordable electricity and decrease the carbon footprint of these same communities by reducing or eliminating the necessity of diesel generators.

At the same time, for a project of this magnitude, there is high potential for new and major impacts to a variety of sensitive impact receptors in this relatively pristine region, on both the local and regional environment scales. Categories of impact receptors include wildlife resources, vegetation, soils, wetlands and waterbodies, heritage resources, and the human environment. Cumulative effects compounding impacts from other projects in the same or nearby area or regions can also be induced. Environmental impact assessment should include a detailed analysis of all potential effects of project construction, operation, and maintenance on these impact receptors to ensure sufficient forethought and planning is applied to implement effective safeguards and mitigation strategies for the project as a whole, in the unique context of the environmental setting of the project. Similar remote, large-scale transmission line projects have mitigated project-related impacts on sensitive resources by including environmental management through all project phases, from route selection to construction access reclamation.

As discussed in Section 3, the Project will be subject to provincial, territorial, and federal legislation, and all permits and approvals from regulatory agencies with interest in the Project should be obtained prior to construction. Permitting considerations should include not only the construction and maintenance phases of the Project itself, but all ancillary infrastructure including roads, switching stations, and work camps, both temporary and permanent.

At this step, field studies will be completed (likely multi-year in some areas), the planned community engagement will be executed, the Environmental Assessment (EA) submissions will be prepared and contributors' sections coordinated, mitigation strategies will be agreed upon between members of the project team, translations will be commissioned to ensure that Inuit and First Nations are able to review the project submissions, and the EA will be submitted for regulatory review. Recruitment of local workforce to assist in environmental field studies and community engagement work will be key to successful implementation in terms of providing project support, geographic relevance, and social and ecological context for both field studies and community engagement work. A large amount of field work and coordination for community engagement will be required.

Table 1: Draft environmental management plan

Date	2015-2018	2018-2020	2020-2022	2022-2024	2024-2025
Project Phase	**1. Technical Studies and Agreements**	**2. Environmental Studies**	**3. Licensing and Design**	**4. Construction**	**5. Start-up**
Environmental Requirements	▪ Route selection ▪ Imagery acquisition ▪ Habitat classification ▪ Field scoping/access planning ▪ IQ/TEK data acquisition ▪ Community engagement - Planning phase	▪ Field studies ▪ (Wildlife, Vegetation, Soils, Terrain and ground-truthing, Wetlands, Heritage, Human environment) ▪ Community engagement ▪ Environmental assessment writing and coordination of other contributors' sections ▪ Mitigation strategies ▪ Commissioning of translations ▪ EA submission	▪ Community engagement - Results phase ▪ Permitting ▪ Environmental sections - tender package ▪ Construction Environmental Management Plan (C-EMP) preparation ▪ Training - local environmental monitors	▪ Environmental management - environmental team lead ▪ Environmental coordination - site presence ▪ Site orientation environmental training ▪ Issues management /Non-compliance documentation ▪ Reclamation assessment	▪ Reclamation follow up ▪ Environmental as-built report preparation
Estimated Cost	$2,000,000	$2,500,000	$750,000	$3,000,000	$400,000

1.3.3 Licensing and design

As discussed in Section 3, the Project will be subject to provincial, territorial, and federal legislation, and all permits and approvals from regulatory agencies with interest in the Project should be obtained prior to construction. Permitting considerations should include not only the construction and maintenance phases of the Project itself, but all ancillary infrastructure including roads, switching stations, and work camps, both temporary and permanent.

Detailed engineering and the procurement of some major equipment is expected to occur in parallel with the licensing process. The specific schedule for these two items will need to be reviewed based on the mandate given to the utilities and/or contractors and/or consultants.

Licensing and design will include provision of information about the project to relevant stakeholders, including First Nations. Permitting will proceed subsequent to obtaining environmental approvals for the Project. To ensure that permit and approval conditions are reflected in contract terms, an environmental section should be included in tender packages released for bid. Additionally, a Construction Environmental Management Plan (C-EMP) should be prepared to enable the construction team to complete work in accordance with permissions and approvals obtained for the project. The C-EMP should contain specific details to avoid or mitigate Project effects on the environment using best practices, identify responsibles per contractual obligations, identify audit and reporting procedures, and provide contingency for new identified issues and for feedback from the public. The C-EMP should be finalized with input by the selected contractor, including plans for environmental protection during right of way preparation, temporary work camps, water use, etc., as may be practically required. To optimize local involvement, local environmental monitors should be hired and trained in the specifics of the project at this time. These individuals will work with the site environmental coordinators on the owner’s project team to provide ongoing environmental monitoring for the duration of construction.

1.3.4 Construction

The construction of the 230 kV transmission line from Churchill to Rankin Inlet (approximately 615 km) would take about three years. Most of the work would be performed during winter in order to limit the environmental impact. The typical construction season is generally from mid-December to the end of March. The design of the transmission line shall offer flexibility regarding the different construction techniques used by the contractors for various landscapes and site conditions. The rest of the construction work will occur during this three-year timeline. It is not assumed to be on the critical path of the project as long as there is no supplementary delay in the procurement of long-delivery items.

During construction, which includes right of way preparation (clearing) and transmission line construction, the planned environmental management comes into play. It is critically important that the Project owner limits liability relating to environmental aspects during construction of the project, and that may result from incomplete or ineffective mitigation. Because the Project owner is legally bound by conditions in permissions and approvals, it is essential that work be completed in accordance with those conditions. An environmental lead serves as primary advisor on environmental matters on behalf of the Project owner and liaises between the owner team, contractors, the site environment staff, and regulators on issues management. Site visits are made on occasion. The site environmental coordinators ensure ongoing successful implementation of the C-EMP by the contractors, provides site orientation environmental training (including preparation of relevant training materials), coordinates responses to environmental issues, and supervises environmental monitor staff. Environmental monitors observe and document correct work practices and serve as a resource to the contractors to mitigate environmental issues that may arise during work. This team manages environmental issues on an ongoing basis throughout construction, documents compliance, and completes reclamation assessments prior to demobilization by the contractors.

1.3.5 Start-up

The major portions of the transmission system are expected to be tested upon their completion. At least three months is expected for the final inspection and start-up of the entire transmission system.

This step also includes reclamation follow-up, to ensure a smooth transition to operational maintenance, which may require significant coordination with the operating agency. Environmental as-built report preparation will be required to document permit and approval compliance and to close out any permits that were obtained to facilitate work

1.4 Regulatory process and permitting

Regulatory processes and permitting can be expected to be components of each project phase. Project approvals must be obtained from relevant regulatory agencies prior to commencing construction, and permits for numerous aspects of project development and maintenance will be necessary throughout the lifetime of the project. For a complete breakdown of major project permitting requirements, refer to section 3.

1.5 Mining projects

The transmission line project is to a large extent tied to the realization of two mining projects being currently developed in the Kivalliq region. These mines would create a significant and stable power demand and thus contribute to the amortization of the high capital expenditure required for the transmission system.

Two projects presently at an advanced stage of development that could become clients of the transmission infrastructure are:

- The Meliadine advanced-stage gold project in Nunavut Territory, northern Canada is Agnico Eagle's second major project in Canada's Low Arctic, following the Meadowbank mine. Meliadine is the company's largest development project based on reserves and resources. The Meliadine project is located 25 km northwest of Rankin Inlet. This project would require approximately 30 MW of power and 250 GWh of energy once it is running at full strength. Meliadine mine would start operations in 2019, five to seven years before the transmission line is completed, thus depriving the project from substantial demand. However, operations are to take place until closure in 2034, so it would potentially be a major client of the transmission line.
- The Kiggavik uranium mine project is a major advanced exploration project of AREVA Resources Canada Inc. The project is located approximately 80 km west of the community of Baker Lake and would require up to 21 MW of power and 155 GWh of energy. The start of the project is, however, contingent on a rise in the price of uranium. AREVA has mentioned that a 2024/start date may be considered, with mining operations extending until 2035 and decommissioning lasting four more years.

The Amaruq is another Agnico Eagle gold mining project consisting of extending the life of the Meadowbank installations in order to process ore extracted from the Amaruq deposit. However, this project would be completed two years or more before the transmission line can reach the Baker Lake area. Therefore, as it stands, this project cannot be seen as a potential client.

This scoping study has examined the mineral potential of the Kivalliq as it is currently assessed by the Nunavut Mineral Exploration, Mining & Geoscience Office. On that basis, it can be assumed that over the long term mining activity will continue to take place in the Kivalliq region after the Meliadine and Kiggavik projects are completed and power demand scenarios have been developed to reflect this eventuality.

2. POWER DEMAND FORECASTS

Detailed electric power demand forecasts were prepared for each community. These forecasts reflect the increase in electricity demand resulting from the replacement of diesel power generation by the grid and of oil heating by electric heating in the communities. The demand projections also include potential demand from mining projects.

2.1 Kivalliq communities

As mentioned previously, the five Kivalliq region communities of Arviat, Baker Lake, Chesterfield Inlet, Rankin Inlet and Whale Cove are considered as possible candidates for being connected to power substations to be built for transforming the high-voltage power of the transmission line to lower voltages appropriated for the distribution of electric power to the communities.

Electrical energy and power demand forecasts have been developed for these five communities in order to estimate the electrical load that can be supplied by the line and the ensuing benefits in terms of the reduced cost per kilowatt-hour against the cost per kWh of generating the same load with diesel power stations using diesel fuel. The power demand forecasts will also include the calculation of the savings to be realized by switching from oil heating to electric across the five communities.

2.1.1 Energy consumption in the Kivalliq communities

The first step in the forecasting process consists of analyzing past consumption. This will be done for both electricity and oil consumption for the dual purposes of generating electricity and forheating houses and commercial buildings in the five communities.

1. Electricity generation

Data provided by Qulliq Energy Corporation enables visualization of electrical power generation and energy consumption in the five Kivalliq communities.

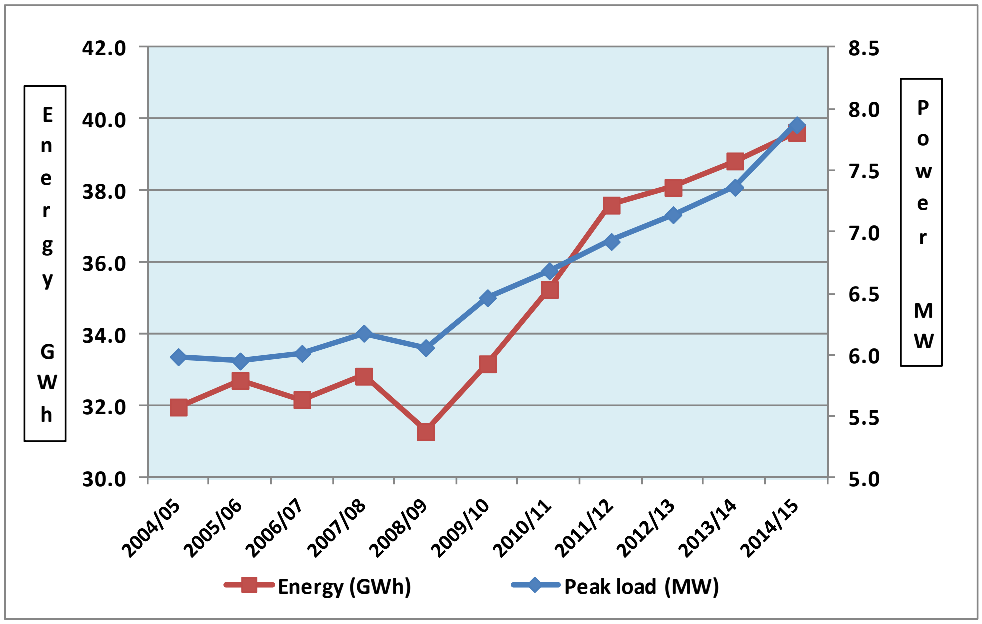


Figure 1: Demand for electricity in the five Kivalliq hamlets 2004/05-2014/15

Figure 1 presented above shows that after stagnating around 32 GWh per year from 2004/05 to 2008/09, overall demand for electric power has picked up afterwards in the five communities, reaching close to 40 GWh in 2014/15. This corresponds to an annual growth rate of 3.9% over the 2004/05-2008/09 average demand.

The total peak load reached by the generation station in the five communities has behaved in a similar way, increasing from an average of 6.0 MW from 2004/05 to 2008/09 to 7.9 MW in 2014/15 for an average annual growth rate of 4.3% over the last six years.

The growth of electricity production in the five Kivalliq hamlets from 2009/10 to 2014/15 has been generally positive with an average annual increase of 3.4% against the 2004/05-2008/09 averages. Energy production includes sales to customers, plus energy used for power station service (utility's operation) and system losses. Arviat is where growth was greatest, at 4%; however, this may be due to a high level of system losses in this is not necessarily caused by an increase in sales to customers (see Table 2).

Energy production in 2014 was twice as much in Rankin Inlet (17.8 GWh) as in Arviat and Baker Lake (8.9 GWh), hamlets, which are of similar size, especially Arviat, with 2,611 inhabitants in 2014 versus 2,820 for Rankin Inlet. This difference reflects the higher concentration of institutions and commercial activity in Rankin Inlet. Electricity consumption is minimal in Chesterfield Inlet and Whale Cove, two small hamlets each with a population of less than 500 inhabitants.

The electrical peak load in the hamlets is relatively small, reaching close to 8 MW in 2014, with 3.1 MW in Rankin Inlet, 2.2 in Baker Lake and 1.7 MW in Arviat. Peak loads in Chesterfield Inlet and Whale Cove averaged 0.4 MW in the last two years.

Table 2: Growth of electricity production of the five Kivalliq hamlets (2004/05-2014/15)

Energy (GWh)	Population (2014)	2004/05-2008/09 Average (GWh)	2013/14 (GWh)	2014/15 (GWh)	Annual growth rate 2004/09-2014/15
Arviat	2,611	6.9	8.1	8.9	4.0%
Baker Lake	2,164	7.3	9.1	8.9	3.3%
Chesterfield Inlet	387	1.8	2.1	2.1	2.3%
Rankin Inlet	2,820	14.5	17.7	17.8	3.3%
Whale Cove	456	1.6	1.8	2.0	3.2%
Five hamlets	8,438	32.2	38.8	39.6	3.4%
Peak load (MW)	**Population (2014)**	**2004/05-2008/09 Average (MW)**	**2013/14 (MW)**	**2014/15 (MW)**	**Annual growth rate 2004/09-2014/15**
Arviat	2,611	1.31	1.49	1.73	4.6%
Baker Lake	2,164	1.41	1.95	2.19	7.1%
Chesterfield Inlet	387	0.36	0.37	0.39	1.2%
Rankin Inlet	2,820	2.61	3.19	3.13	3.0%
Whale Cove	456	0.35	0.36	0.43	3.3%
Five hamlets	8,438	6.04	7.36	7.87	4.3%

Source: Energy Secretariat, Qulliq Energy Corporation

2. Power consumption by class of customer

The consumption of electricity by QEC's customers was analyzed for the purpose of establishing the number of customers and the average consumption by class of customer, as the calculation of power demand forecasts uses these two parameters. The customer groups retained are the following:

1. Commercial Private
2. Commercial Public
3. Housing Private
4. Housing Public.

Figures for the consumption of diesel fuel used in power generation were obtained from the Energy Secretariat and from QEC, which is the sole producer of electric energy in each of the 5 communities.

The data, collected from QEC for each hamlet, is summarized in Table 3. Detailed information by hamlet is presented in Appendix Table 1.

Table 3: Number of QEC customers and energy consumption by customer class

	Number of customers			Energy (GWh)			kWh/customer		
QEC Customer Class	**2012/13**	**2013/14**	**2014/15**	**2012/13**	**2013/14**	**2014/15**	**2012/13**	**2013/14**	**2014/15**
Commercial–Priv.	302	262	274	9.2	9.3	9.8	30,581	35,526	35,732
Commercial-Public	363	381	381	11.8	12.7	12.7	32,565	33,223	33,422
Housing-Private	956	1,025	1,018	6.2	6.5	6.6	6,492	6,316	6,506
Housing-Public	1,213	1,366	1,354	7.5	7.9	7.7	6,144	5,814	5,689
Total Customers	**2,834**	**3,034**	**3,027**	**34.7**	**36.4**	**36.8**	**12,249**	**11,991**	**12,174**

Source: Qulliq Energy Corporation

From Table 3, it can be seen that commercial private and public sector customers add up to approximately 61% of energy demand, while private and public housing make up for 39% of total demand. The share of demand by commercial customers reaches 66% in Rankin Inlet.

The number of public and housing customers climbed to nearly 2,400 customers in 2014 and 2015, a number which more or less matches the 2,090 housing units identified in the 2009-2010 Housing Survey1, augmented by the number of new public and staff housing units that were added to the housing stock since the Housing Survey.

As such, the number of QEC housing sector customers is assumed to correspond to the number of housing units in each of the five Kivalliq hamlets. As for the distribution of housing customers between Public and Private housing, it is was found that the number of public housing customers is more or less equal to the number of Nunavut Housing Corporation Public Housing Units.

Finally, the data provided by QEC shows that there is a significant difference of about 10% between the power consumption of Private and Public housing customers, with an average of around 6,500 kWh per year for the former and 5,900 kWh per year for the latter.

For commercial customers, there is not a wide difference between Commercial Private and Commercial Public customers, but large variations exist between hamlets in the average consumptions of commercial customers; again, Rankin Inlet has the highest averages.

[1] 2009/2010 Nunavut Housing Needs Survey, Nunavut Bureau of Statistics and Statistics Canada, January 2011.

2.1.2 Consumption of diesel oil for power generation

Table 4 aggregates the costs of diesel oil to generate electricity for the 5 Kivalliq communities. Data for each community is presented in Appendix Table 3. Figures presented in Table 4 show that:

- Diesel oil consumption for power generation in the five communities has increased overall by 3% from 2010/11 to 2014/15, in line with the quantity of energy produced;
- The specific consumption ratio (litre/kWh) has not fluctuated much around an average of .270 litres per kilowatt hour.
- The cost of diesel fuel has increased significantly from 2010/11 to 2014/15, by $0.20 per litre in nominal terms; it has reached $0.30 per KWh in 2014/15;
- The five communities spent close to $12M in 2014/2015 for the purchase of diesel fuel.

Table 4: Costs of electricity generation

	FY2010/11	FY2011/12	FY2012/13	FY2013/14	FY2014/15
Diesel fuel used (litres)	9,623,577	9,962,780	10,219,829	10,429,244	10,838,819
Energy produced (kWh)	35,257,656	37,607,846	38,101,624	38,838,673	39,630,704
Litres per kWh	0.273	0.265	0.268	0.269	0.273
Cost of fuel	$8,666,604	$10,105,705	$10,821,200	$10,780,777	$11,951,929
Cost of fuel per litre	$0.90	$1.01	$1.06	$1.03	$1.10
Cost of fuel per kWh	$0.25	$0.27	$0.28	$0.28	$0.30

Source: Qulliq Energy Corporation

2.1.3 Consumption of heating oil

It is required to gather similar information on the consumption of heating oil in order to estimate the potential savings to be made by replacing oil heating with electric heating. It is therefore also necessary to associate the current and future customers of QEC with their current and future consumption of heating oil in the eventuality that they continue to use oil heating. Information about consumption of Heating Oil was requested from the Energy Secretariat and from the Petroleum Products Division. The data received enabled to measure the overall consumption of fuel for space heating, as well as for power generation. The Petroleum Products Division (PPD) however did not provide a breakdown of consumption by consumer class, for which PPD customers could be matched to QEC customers in the four classes retained for the analysis; this apparently results from the fact that the distribution of heating oil is made through private distributors and no strict distinction appears to be made between entities dealing with PPD and the final users of the heating oil.

The data collected from PPD and the Energy Secretariat allowed to quantify the consumption of heating oil by community for which detailed results are presented in Appendix Table 2.

Additional data collected from the National Housing Corporation (NHC) was used to estimate the heating oil consumption of residential customers. The data provided by NHC indicates that the number of public sector housing units is more or less equal to that of the number of QEC's Public Housing customers. The average annual heating oil consumption of NHC public housing units (line 3 in Table 5) was used to estimate the heating oil consumption of the housing sector (line 3). The consumption of the commercial sector (line 5) was estimated by taking the difference between Total Heating Oil Consumption, as reported by PPD (line 1), and the estimated housing sector consumption. The average heating oil consumption of QEC's commercial customers (line 7) was obtained by dividing the Commercial sector consumption (Line 5) by the number of QEC commercial sector clients (line 6).

Table 5: Estimated heating oil use by QEC housing and commercial customers 2013/14

	Arviat	Rankin Inlet	Chesterfield Inlet	Whale Cove	Baker lake
1- Total heating oil consumption (PPD data) – (litres)	3,303,271	5,767,699	899,384	719,583	3,819,490
2- Number of QEC residential customers	584	922	127	119	639
3- Average heating oil consumption per housing unit NHC (litres)	3,649	3,388	3,534	3,969	3,536
4- Estimated heating oil consumption of QEC residential customers (litres)	2,131,133	3,124,152	448,802	472,359	2,259,214
5- Estimated heating oil consumption of Commercial sector (litres)	1,172,138	2,643,547	450,582	247,224	1,560,276
6- Number of QEC commercial sector customers	123	237	56	43	184
7- Estimated average heating oil consumption of QEC's commercial customers (litres)	9,530	11,154	8,046	5,749	8,480

The estimated consumption figures for the average annual consumption heating oil for QEC's Housing and Commercial customers will be used to estimate the savings to be made on the purchase heating oil when the conversion to electric heating takes place.

2.1.4 Total consumption of petroleum products for power generation and space heating

The total consumption of oil for power generation and space heating in the five hamlets is presented in Table 6, showing the following:

- Annually, the five communities use more than 25 million litres of petroleum products for power generation and space heating;

- Annually, the Government of Nunavut spends close to $30M for the purchase of that oil.
- There is a significant difference between the cost of oil for power generation and oil for space heating; this difference has narrowed in the last years; it may be due to distribution costs against bulk purchases.

Table 6: Fuel oil consumption for power generation and space heating in the five communities

	Power Generation (QEC)			Space Heating			Total fuel-oil consumption		
	Million litres	Cost per litre ($/l)	Total cost (M $)	Million litres	Cost per litre ($/l)	Total cost (M $)	Million litres	Cost per litre ($/l)	Total cost (M $)
2008/09	N.A	N.A	N.A	12.5	$1.21	$15.0	N.A.	N.A	N.A
2009/10	N.A	N.A	N.A	12.5	$1.20	$15.0	N.A	N.A	N.A
2010/11	9.6	$0.90	$8.7	12.8	$1.17	$15.0	22.4	$1.05	$23.7
2011/12	10.0	$1.01	$10.1	15.3	$1.14	$17.5	25.2	$1.09	$27.6
2012/13	10.2	$1.06	$10.8	14.4	$1.12	$16.1	24.6	$1.09	$26.9
2013/14	10.4	$1.03	$10.8	14.5	N.A	N.A	25.3	N.A	N.A
2014/15	10.8	$1.10	$12.0	N.A	N.A	N.A	N.A	N.A	N.A

Source: Qulliq Energy Corporation, Petroleum Products Division, Energy Secretariat.

2.1.5 Power demand forecasts for QEC housing and commercial customers

The forecasting of power demand was based on the following:

- Calculation of population growth rates per five year intervals in the five communities over the 2014 to 2035 period. Population projections produced by the Nunavut Bureau of Statistics were used. (See Table 7).These projections are based on revised Nunavut population estimates for the 2014 base year.
- Estimation of the future number of QEC customers belonging to the housing sector, public and private, based on population growth rates in each community.
- Estimation of future consumption by housing sector customers in the event that the availability of cheaper hydroelectric power makes the conversion of heating of housing units from oil to electric economical.

Table 7: Population projected annual average growth rate per 5-year period 2014/2035

Hamlet	2014-2019	2019-2024	2024-2029	2029-2034
Arviat	2.38%	2.20%	1.85%	1.74%
Baker Lake	1.52%	1.38%	1.31%	1.19%
Chesterfield Inlet	1.29%	1.18%	1.24%	1.26%
Rankin Inlet	1.56%	1.45%	1.46%	1.30%
Whale Cove	1.35%	1.37%	1.54%	1.26%

Source: Nunavut Community Population Projections 2014 to 2035, Nunavut Bureau of Statistics, August 2010.

Table 9 presents the assumptions made regarding the effects the conversion to electric heating would have on electrical energy use by QEC housing and commercial sector clients. Based on energy consumption figures for residential customers in northern Manitoba communities using electric heating, many of which have average consumption above or close to 40,000 kWh (see Table 8), it was considered that projecting an annual consumption of 40,000 kWh for residential customers was a reasonable and well founded assumption (see Table 9). This assumption is further supported by the fact that some communities listed in Table 8 have milder climates than the 5 Kivalliq communities.

Table 8: Average electricity use of Northern Manitoba residential customers using electric heating, 2014

City	Mean Temperature Differential with Rankin Inlet	Customer Count	Electricity Use kWh	Average kWh/ Customer
Thompson	+2.9	350	14,601,929	41,720
The Pas		122	5,043,489	41,340
Flin Flon	+1.0	464	18,728,317	40,363
Norway House	+0.7	858	33,770,980	39,360
Cross Lake	+0.4	320	12,182,375	38,070
St Theresa Point		19	703,364	37,019
Nelson House		79	2,901,798	36,732
Opaskwayak		41	1,498,021	36,537
Split Lake		565	20,613,976	36,485
Garden Hill		1,175	42,301,587	36,001
Oxford House		216	7,656,044	35,445
Snow Lake		312	11,011,150	35,292
Pukatawagan		173	6,083,010	35,162
Churchill	+6.5	194	6,266,977	32,304

Source: Manitoba Hydro.

Conversion of residential QEC customers to electric heating represents a 6-7 fold increase in electricity use.

As for commercial customers who have varied profiles and space heating needs, the supposition was made that the average current electricity use of commercial clients in each community would triple after conversion to electric heating. This assumption is supported by the fact that, after conversion, the electric energy consumption of the commercial sector would represent a very similar proportion of total electric energy consumption for space heating as the proportion of heating oil consumption accounted for by the commercial sector. Furthermore, in Arviat and Rankin Inlet, district heating provided by QEC to major public buildings, like schools and government offices, would not be available any longer because of the shift from the grid to electricity. The heating oil savings from district heating are estimated by QEC at more than 1 million litres per year, which would correspond to around 4 million kWh adding up to the estimated electric energy consumption.

Table 9: Average energy consumption of QEC customers before and after converting to electric heating

	Before conversion (kWh)		After conversion (kWh)	
	Residential	Commercial	Residential	Commercial
Arviat	5,872	36,075	40,000	108,200
Baker Lake	6,041	26,624	40,000	79,900
Chesterfield Inlet	5,800	21,800	40,000	68,800
Rankin Inlet	6,200	44,400	40,000	133,8100
Whale Cove	6,200	22,900	40,000	65,500

Discussions with key informants established that almost all residential and commercial space heating systems are hot water systems using oil furnaces, while domestic hot water is also produced with oil burning devices. It was also mentioned that the conversion from oil to electricity would be fairly simple and not costly. However, the conversion of a large number of customers from oil to electricity would likely be extender over several years. Therefore, it was further assumed that average consumption increases with conversion to electric heating over an eight-year period, with 60% of customers switching to electricity in the first 3 years (20%, 25%, 15%) after the power line comes into service in 2024/25, plus 10% in each of the following 3 years and 5% in each of the last two years.

Detailed results of projections of energy and power demand by QEC residential and commercial customers are presented in Appendix Table 4.

2.2 Mining sector potential power demand

2.2.1 Advanced stage mining projects

The transmission line project is, in a way, tied to mining projects being developed in the Kivalliq region and to the significant and stable electricity demand they will create, thus helping to amortize the high capital expenditure needed to build the infrastructure required to feed the mining installations and the Kivalliq communities.

The Meliadine gold mine and the Kiggavik are the two projects that are presently at an advanced stage of development and that could become clients of the transmission infrastructure, depending on the competitiveness of power supplied by the line and on timing. The energy and power demand potentially generated by these projects is presented in Table 9.

Table 10: Mining sector potential power demand

Project	Agnico Eagle Meliadine		AREVA Resources Kiggavik		Agnico Eagle Meadowbank-Amaruq	
Year	Energy GWh	Peak load MW	Energy GWh	Peak load MW	Energy GWh	Peak load MW
2019	215	25	0	0	33	16
2020	215	25	0	0	136	16
2021	214	24	0	0	136	16
2022	252	29	0	0	100	16
2023	251	29	0	0	0	0
2024	244	28	156	21	0	0
2025	238	27	156	21	0	0
2026	238	27	156	21	0	0
2027	251	29	156	21	0	0
2028	251	29	156	21	0	0
2029	251	29	156	21	0	0
2030	251	29	156	21	0	0
2031	251	29	156	21	0	0
2032	251	29	156	21	0	0
2033	201	23	156	21	0	0
2034	0	0	156	21	0	0
2035	0	0	156	21	0	0
2036	0	0	52	7	0	0
2037	0	0	52	7	0	0
2038	0	0	52	7	0	0
2039	0	0	52	7	0	0

Source: Agnico Eagle and AREVA Resources.

2.2.2 Long-term future power demand of the mining sector

The interconnection with Manitoba is also seen as a way to offer power rates and power availability incentives that would help to develop the mineral potential of the Kivalliq region by improving the logistics and economics of exploiting mineral deposits already identified and by encouraging further exploration of the territory. This also is true for developing the mineral potential of Northern Manitoba from Churchill to the Nunavut border.

Canada-Nunavut Geoscience Office, a division of Resources Canada, based in Iqaluit, is a major source of information for assessing the mineral potential of the Kivalliq region. It studies and monitors the development of the mineral potential of Nunavut. The Geoscience Office also publishes an annual exploration and mineral potential update for the Kivalliq region. The BBA team examined the Kivalliq Region Exploration Overview-2014 and discussed the mineral potential of the region with the Chief Geologist of the Geoscience Office. The websites of mining companies were also used as information sources.

The Kivalliq Region Exploration Overview-2014 identifies 24 mineral properties, out of which one was in production, Agnico-Eagle's Meadowbank gold mine, three were advanced stage projects (Meliadine, Kiggavik and Amaruq), 12 were considered active with some exploration work taking place in 2014, while 9 were inactive. The report describes the geological characteristics of each deposit and the exploration work carried out with a historical perspective. The properties are classified by substance and their location is pinned onto a Kivalliq region map.

In order for mining properties to be considered as potential clients of the transmission system, the properties must have obtained strong exploration results and be located at a reasonable distance from the power line corridor and from the proposed substations. The mineral potential of the Kivalliq region is diversified, but exploration work carried out has yet to confirm the economic potential of most properties identified in base metals, diamonds, iron, rare earths.

In the gold sector, exploration work carried out by Northquest for the Pistol Bay project near Whale Cove is encouraging and could lead to future exploitation of the property's deposits. Similarly, however, the major potential of the Kivalliq region seems to reside in the uranium deposits of the Thelon Basin in the Baker Lake area, which has been compared to the Athabasca Basin, which is the world's leading source of high grade uranium, Uranium properties owned by Cameco Corporation and by Quilliq Energy Corporation were said to be of exceptional quality.

Given that electrical energy demand by these two mining projects would still represent 60% of total demand, against only 40% for the 5 Kivalliq communities when conversion to electric heating is completed, the scoping study examined if the mining sector could generate power demand through new projects after the expected closure of the Meliadine and Kiggavik mines.

Based on the documentary review and the discussions held, it was concluded that in the short to medium term, it would be overly optimistic to include additional demand by the mining industry in power demand forecasts. However, given the well identified potential and the amount and positive results of exploration work performed for gold deposits in coastal areas (Whale Cove) and for uranium in the Baker Lake area, it would be overly pessimistic to assume that there will be no mining activity in the Kivalliq Region after 2034. Furthermore, mining operations at Meliadine and Kiggavik could be extended after the announced closure dates.

It is on the basis of the analysis and considerations presented above that the demand forecasts used in the viability analysis of the transmission project included, from 2034 until the end of the 40 year minimum life of the infrastructure, additional power demand by the mining sector, of 20 MW for the Coastal scenario and of 40 MW for the Coastal and Inland scenario. This additional power demand would translate into additional energy demand of 175 GWh for the Coastal Scenario and of 350 GWh for the Coastal and Inland scenario.

The overall energy demand forecasted for the mining sector is presented in Figure 2.

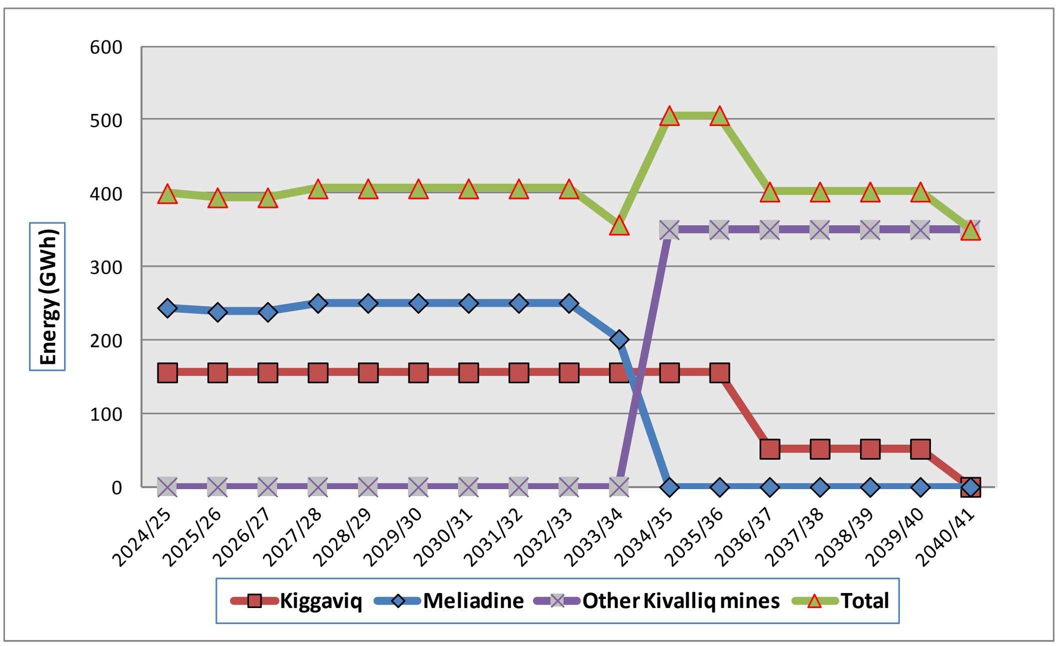


Figure 2: Forecast of electrical energy demand by the mining sector in the Kivalliq region

2.3 Power demand scenarios

2.3.1 Coastal Scenario

The power demand forecasts resulting from the analysis presented above and combining demand from the communities and from the mining sector in the Coastal scenario are illustrated in

Figure 3 for energy demand and in Figure 4 for the estimated peak load.

Figure 3 shows the profile of energy demand, with consumption by communities rising rapidly in the first years while conversion to electric heating takes place, but levelling off afterwards when the conversion is completed and population growth slows down as forecasted by demographic projections. Total energy demand would reach 430 GWh after 9 years, but would decline to 185 GWh annually after the closure of Meliadine, when it will depend solely on coastal communities. Should other mines come into operation in coastal areas, energy demand could remain above 350 GWh according to the assumptions made of a new 20 MW load in 2034/35 right after Meliadine has closed down.

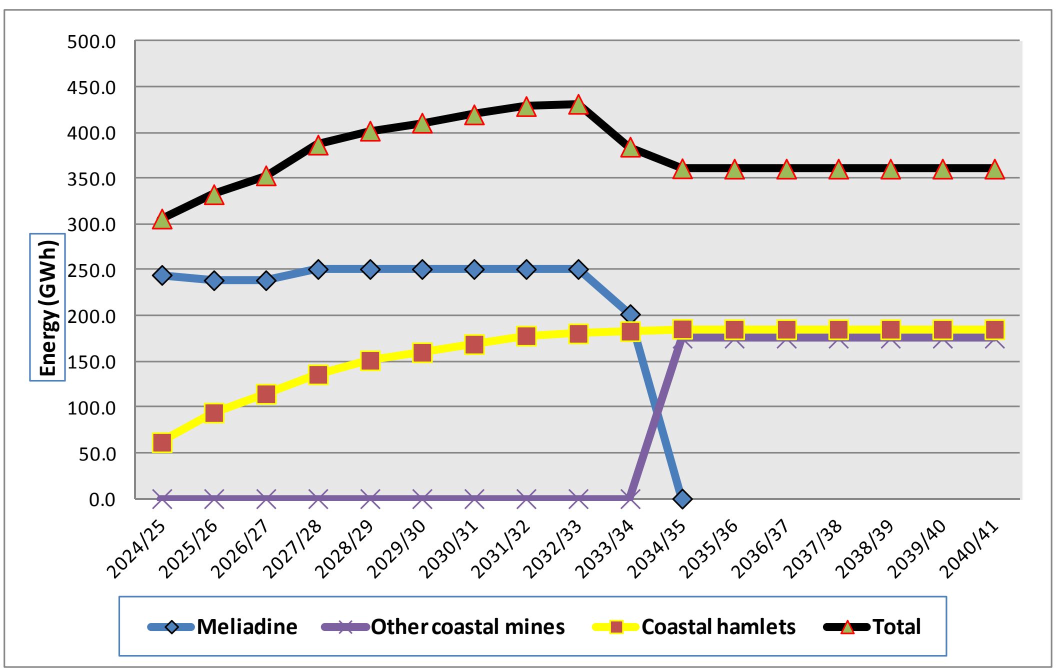


Figure 3: Coastal Scenario: Energy demand forecast

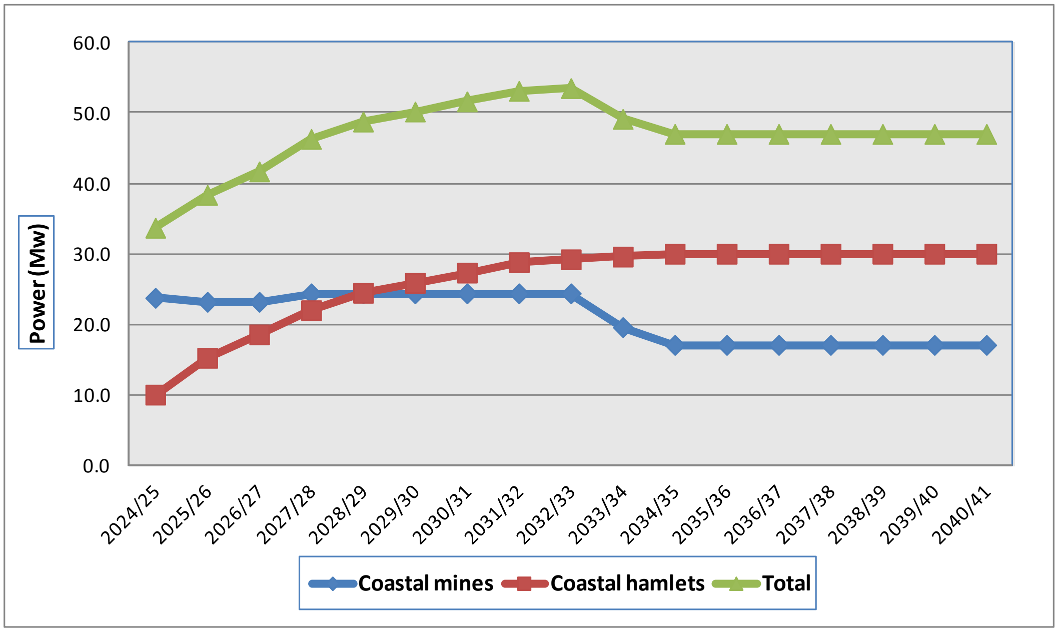


Figure 4: Coastal Scenario: Power demand forecast

As for the peak load represented in Figure 4, it would climb to 54 MW in Year 9 when Meliadine is still at full strength, at a time when conversion to electric heating would have pushed the cumulative peak-load of communities to about 30 MW. It should be noted that a diversity factor of 85% has been applied to the peak loads of each community and of the Meliadine mine in order to account for peak loads occurring at different times.

2.3.2 Coastal and inland scenario

The cumulative energy and power demand forecasts for the Coastal and Inland scenario are presented in Figure 5 and Figure 6 respectively. This scenario is obtained by adding the prospective demand of the Baker Lake hamlet and of the Kiggavik mine project. It also adds 20 MW of power demand for additional mining projects that may take place in the Baker Lake area, for a total prospective demand of 40 MW for future mining projects to start operations when Meliadine and Kiggavik will have closed down.

In this scenario, total energy demand would rise up to 650-750 GWh per year, with about 250 GWh originating from the communities.

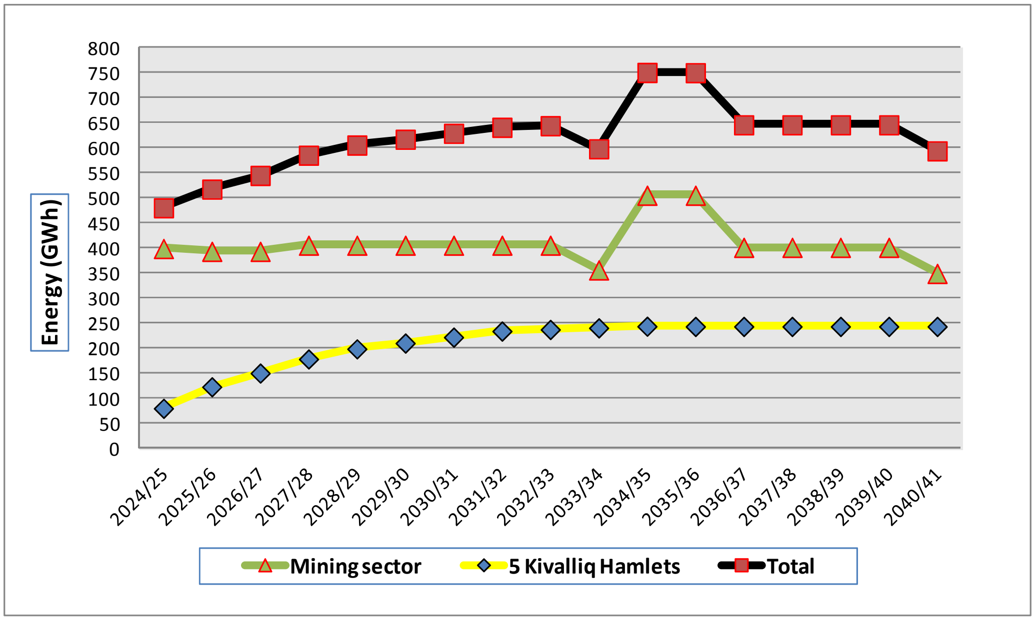


Figure 5: Coastal and Inland Scenario: Energy demand forecast

The peak load forecasted for this scenario would rise up to 80 MW after applying a diversity factor of 85%.

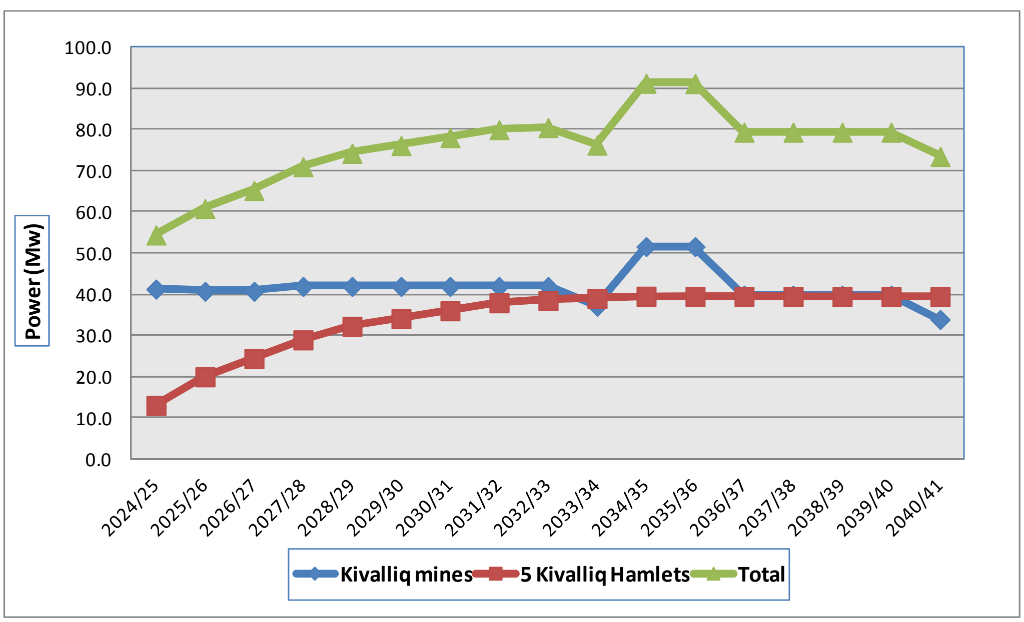


Figure 6: Coastal and Inland Scenario: Power demand forecast

Detailed demand projections by community and potential mining projects are also presented in Appendix Table 4.

3. SUMMARY OR REGULATORY, PERMITTING, AND ASSESSMENT REQUIREMENTS

Permits and approvals will be required under provincial, territorial, and federal legislation for aspects of construction, maintenance, and ancillary infrastructure (Table 11). Additionally, project activities must abide by provincial, territorial, and federal acts and regulations that do not require permits, but which are applicable to entities operating within Canada. The following presents a list of acts and regulations under which permits must be obtained, followed by a list of additional applicable acts and their relevant subsections, with explanation of relevance. Project commitments and mitigation strategies described in regulatory submissions should comply at minimum with the list below. Non-compliance may result in denial or withdrawal of necessary project approvals or the levying of fines by the administrating regulators.

A description of ecosystem components that are predicted to be potential impact receptors follows; these need to be evaluated during the EA process, and are summarized in Table 12. Project interactions with these ecosystem components are anticipated to act as significant project constraints, including influencing schedule, construction methods, and indeed project feasibility. Effort will be required to manage project interactions with these environmental aspects. Rationale for the importance of each ecosystem component, and a description of the anticipated interaction and/or any uncertainties, is provided for understanding.

3.1 Provincial and territorial requirements

3.1.1 Manitoba provincial permitting requirements

The Environment Act (GM 1988d); Environmental Approvals Branch; Manitoba CWS

- A licence must be obtained by submitting an Environmental Impact Statement (EIS), following an Environmental Assessment with both field and desktop components.
- Note that an additional permit will be required to conduct the Environmental Assessment research.

The Crown Lands Act (GM 1988e); Crown Lands and Property Agency and the Lands Branch; Government of Manitoba

- A general crown land lease or permit must be obtained from the Crown Lands and Property Agency by submitting an application along with topographic maps identifying the Project location.
- Regional work permits must additionally be obtained from the Lands Branch.

Table 11: Environmental authorization requirements for the Manitoba-Nunavut transmission line project

Applicable Legislation or Regulations	Regulatory Agency	Required Authorization
Provincial: Manitoba		
The Environment Act	Environmental Approvals; Manitoba CWS	Licence
The Crown Lands Act	Crown Lands and Property Agency	General Permit
	Lands Branch; Manitoba CWS (regional offices)	Work Permits
The Forest Act	Forestry Branch; Manitoba CWS	Timber Permits
Heritage Resources Act; Heritage Manitoba Act	Historic Resources Branch, Government of Manitoba	Heritage Permit
The Wildlife Act	Government of Manitoba	-
The Noxious Weeds Act	Government of Manitoba	-
Territorial: Nunavut		
The Environmental Protection Act	Nunavut Department of Environment	Licence
Commissioner's Land Act	Government of Nunavut	Land Use or Access Permits for Commissioner's or Municipal lands.
Cities, Towns, and Villages Act	Government of Nunavut	
Historical Resources Act, Nunavut Land Claims Agreement Act	Inuit Heritage Trust and Nunavut Impact Review Board	Heritage Permit
The Wildlife Act	Nunavut Department of Environment	-
Federal		
National Energy Board Act	National Energy Board	Environmental Impact Statement1
Canadian Environmental Assessment Act	Canadian Environmental Assessment Agency	Environmental Impact Statement1
The Fisheries Act	Department of Fisheries and Oceans Canada	Fisheries Act Authorization1
The Nunavut Land Claims Agreement	Designated Inuit Organization	Inuit Impact and Benefit Agreement
The Nunavut Land Claims Agreement	Nunavut Impact Review Board	Project Approval
The Nunavut Land Claims Agreement	Kivalliq Inuit Association	Land Use or Access Permits for Crown or Inuit-owned lands.

Applicable Legislation or Regulations	Regulatory Agency	Required Authorization
Territorial Lands Act and Land Use Regulations	Aboriginal Affairs and Northern Development Canada	
The Migratory Bird Convention Act	Environment Canada	-
The Species at Risk Act	Environment Canada	-
The Navigation Protection Act	Transport Canada	Navigable Waters Permit1
The Environmental Protection Act	Environment Canada	-

The Forest Act (GM 1988f); Forestry Branch; Manitoba CWS

- Timber permits must be obtained in order to clear vegetation on the right-of-way (ROW). Commercial Timber Permits will be required should timber be marketed; should timber be bulldozed or used as a road base, a timber damage appraisal must be completed.
- Note that neither scenario is likely for the preparation of the transmission line right of way.

The Heritage Resources Act; and The Manitoba Heritage Act; Manitoba Tourism, Culture, Sport, and Consumer Protection; Historic Resources Branch

- A Heritage permit will be required pre-construction. This can be acquired by performing a Heritage Resources Impact Assessment of the Project area.
- Note that a separate permit is required to conduct archaeological research.

3.1.2 Nunavut territorial permitting requirements and federal requirements relevant to licencing

Territorial permitting processes for Nunavut must occur pursuant to the outcome of project review by the Nunavut Impact Review Board (NIRB).

The Environmental Protection Act (GNWT 1988b); Nunavut Department of Environment

- A licence and project approval must be obtained prior to construction activities.

Commissioner's Land Act (GNWT 1988c); Government of Nunavut; and Cities, Towns and Villages Act (GNWT 1988d); Government of Nunavut

- Land use or access permits must be acquired for construction activities on Commissioner's or municipal lands. Additional Federal land use permits and permissions will apply.

Historical Resources Act and Nunavut Land Claims Agreement Act (GNWT 1988a; GC 1993a) Inuit Heritage Trust and Nunavut Impact Review Board

- A Heritage permit will be required pre-construction. This can be acquired by performing a HRIA of the Project area.
- Note that a separate permit is required to conduct archaeological research.

3.1.3 Provincial and territorial environmental acts and regulations

There are additional provincial and territorial acts that will not dictate the procurement of a specific environmental permit, but may affect project activities. All phases of the project must abide by the following provincial and territorial acts:

The Wildlife Act (GM 1988a); Manitoba

- Sections 45 to 50.

The Wildlife Act (GN 2003); Nunavut

- Sections 62 to 75.

The Noxious Weed Act (GM 1988b); Manitoba

- Sections 3 and 7.

3.2 Federal Permitting Requirements

3.2.1 Federal Regulation

Regulation of this Project on a federal level will be necessary, as all projects occurring within Nunavut require approval through the federal Nunavut Planning Commission (NPC) and NIRB. The initial regulatory step includes submission of a project proposal to the NPC to ensure compliance with the Nunavut Land Use Plan, which is undergoing the finalization process in 2015. The most current public document is the Draft Nunavut Land Use Plan (NPC 2014). Under the DNLUP, the proposed project transmission line corridor is shown to potentially transect land under three designations: Mixed Use Areas, Special Management Areas, and Protected Areas (Figure 7). Mixed Use designation under the DNLUP indicates no specifications in land use, although project activities may be subject to conditions ensuring sustainable environmental and cultural values. Project activities are expected to conform to DNLUP specifications in Mixed Use Areas, on the condition of adherence to environmental best-practices.

Special Management Areas designated under the DNLUP that may be transected by the planned transmission line corridor include core caribou calving/post-calving grounds with high mineral potential, lands with high mineral potential, a key migratory bird habitat site (McConnell River outside the Migratory Bird Sanctuary), polar bear denning areas, and community watershed sources. Land use in these areas must conform to specifications that will be determined during NIRB Project screening. Specifications are likely to include consideration of cumulative impact, set-backs and timing restrictions for sensitive wildlife species, and habitat and/or watershed mitigation requirements (NPC 2014: table 1; lines 3, 48, 49, 106, and 167).

The proposed transmission line corridor is expected to transect two types of DNLUP-designated Protected Areas: Denesuline Land Withdrawals and core caribou calving/post calving areas. Land use is more tightly regulated in Protected Area-designated lands; while transmission lines and winter roads are not specified as prohibited developments, many other major development categories are prohibited (NPC 2014: Table 1; lines 47 and 97). The DNLUP contains provision for a planned all-weather road corridor consistent with the proposed transmission line route, but transecting the relevant Protected Areas (Figure 7). The path forward should include confirmation from the NPC that transmission line and winter road construction in the planned road corridor conforms to the DNLUP. Should the project be considered not to conform to the DNLUP, the proponent may apply for a plan amendment or ministerial exemption, but such processes will likely result in significant delays and may not result in project approval.

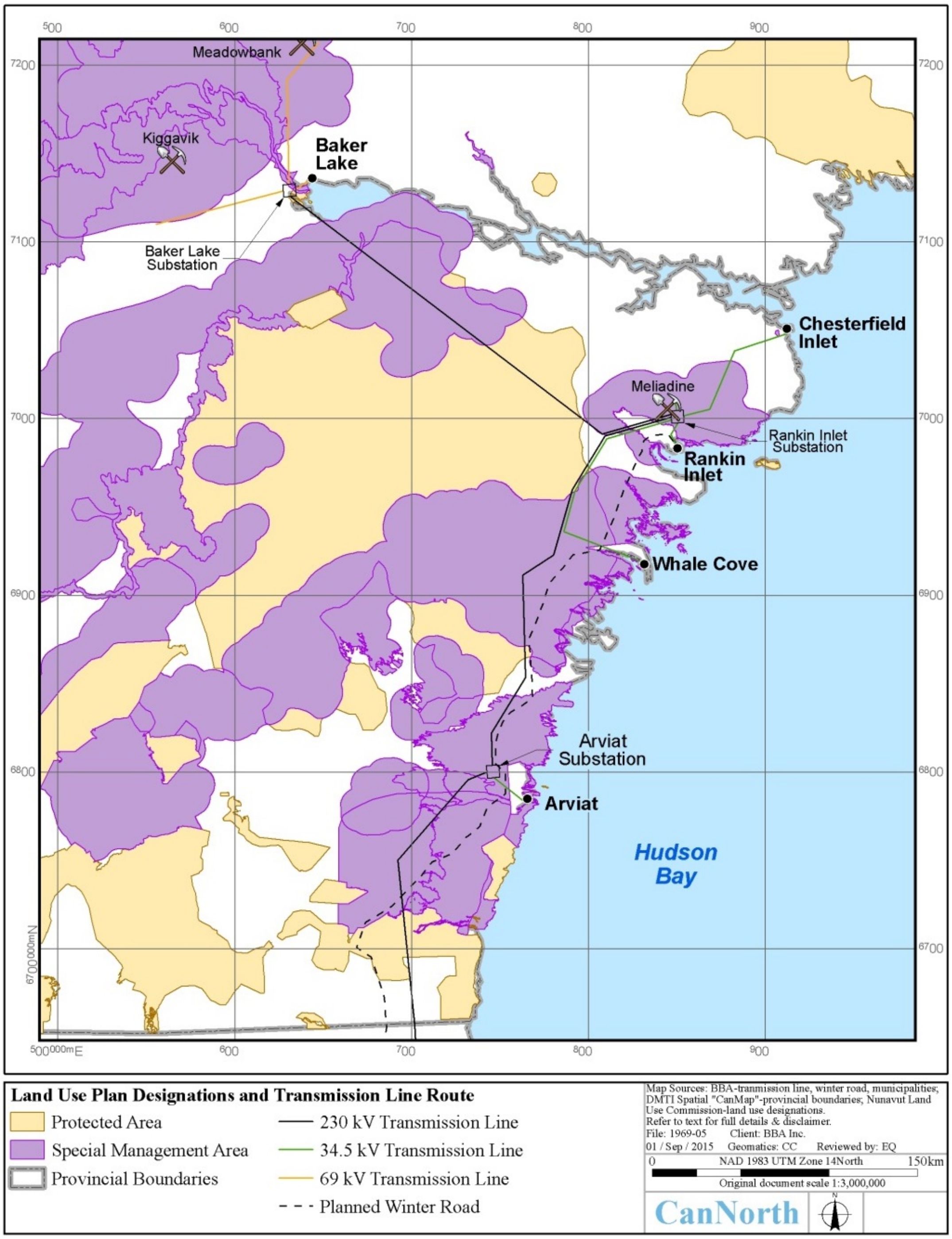


Figure 7: Draft Nunavut Land Use Plan (2014) land designations for the Nunavut-Manitoba transmission line project

Environmental assessment

An Environmental Assessment (EA) will be necessary to fulfill project environmental approval processes, and is likely to be regulated under one or more federal agencies; however the correct approach cannot be determined with certainty until project details are finalized and a proposal is submitted and reviewed. Three main possibilities for EA regulation exist:

- Regulation under the Government of Manitoba and the NIRB only.
- Regulation under the National Energy Board (NEB) (in addition to Government of Manitoba and NIRB).
- Regulation under the Canadian Environmental Assessment Agency (in addition to Government of Manitoba and NIRB).

The EA for this project may be regulated by more than one agency in a cooperative agreement fulfilling the requirements of all parties; in order to determine the correct course of action, the proponent is encouraged to seek legal counsel. Listed below are the Federal Acts and Regulations under which project approval and/or EA regulation may be required:

National Energy Board Act (GC 1985b); National Energy Board

- The project may require regulation under the NEB. Through NEB project regulation, environmental impact is assessed; however the project may also trigger a larger-scale EA under the Canadian Environmental Assessment Act (below). The NEB has provision to fulfill all CEAA (2012) requirements. Regulation of this project under the NEB is considered the least likely outcome for environmental assessment of this project.

Canadian Environmental Assessment Act (GC 2012); Canadian Environmental Assessment Agency

- An EA and Environmental Impact Statement (EIS) may be required under CEAA 2012. This project does not meet specific criteria for a Federal EA due to the specified line voltage of 240 kV or less, however, there are special provisions under which sensitive habitat may trigger EA legislation. Legal counsel is advisable. Should an EA be required under the Canadian Environmental Assessment Act, a cooperative approach under the administration of both federal and provincial/territorial governments may fulfill all legal requirements, while preventing duplication.

The Fisheries Act (GC 1985c); Department of Fisheries and Oceans Canada (DFO)

- Should construction or maintenance processes be suspected to risk serious harm to fish, including the death of fish or permanent destruction or alteration of fish habitat, project details must be submitted to DFO for review. It should be noted that a Memorandum of

Understanding exists between the NEB and DFO; NEB handles all DFO submission requirements for the projects under its regulation.

Nunavut Planning and Project Assessment Act (GC 1993b); Nunavut Planning Commission

- A project proposal must be submitted to the NPC for approval prior to submission to the NIRB. Project details will be reviewed for conformity to the Draft Nunavut Land Use Plan (NCP 2014).

Nunavut Land Claims Agreement Act (GC 1993a); Nunavut Impact Review Board; Nunavut Department of Environment

- A project proposal must be submitted to the NIRB for approval. An Environmental Screening will be required; a cooperative approach will be used if an EA is also triggered under CEAA 2012. All other permitting processes in the Territory of Nunavut may occur pursuant to approval by the NIRB.
- Land use permits must be acquired for project activities on Inuit-owned lands. Should the project be classified as a Major Development Project (capital costs exceeding $35 million and/or 200 person hours of employment over a 5-year period), an Inuit Impact and Benefit Agreement must be finalized prior to project commencement under Article 26. Submission to the responsible Designated Inuit Organization includes a comprehensive outline of possible project benefits and detriments to all Inuit stakeholders. Should there be failure to reach an agreement, the Proponent may submit an application for review to the Nunavut Surface Rights Tribunal.

Nunavut Waters Regulations (GC 2013); Nunavut Land Claims Agreement (1993a); Nunavut Waters and Nunavut Surface Rights Tribunal Act (GC 2002b). Nunavut Water Board.

- Water licences are required if the project requires the use of water.

Territorial Lands Act (GC 1985a); Aboriginal Affairs and Northern Developments;

- Land Use or Access Permits must be obtained prior to construction activities on crown lands.

3.2.2 Additional Federal Environmental Acts and Regulations

There are additional federal acts that will not dictate the procurement of a specific environmental permit, but may affect project activities. All phases of the project must abide by the following federal acts:

The Migratory Birds Convention Act (GC 1994); Environment Canada

- Section 2; Articles I to V.

The Species at Risk Act (GC 2002a); Environment Canada

- Sections 32 to 36.

The Navigation Protection Act (GC 1985d); Transport Canada

- Sections 3 to 14.

The Environmental Protection Act (GC 1999)

- Sections 4 to 9.

3.3 Additional requirements and considerations

Additional permits and permissions may be applicable depending on project details and ancillary infrastructure. Some possibilities to consider include:

- employees and contractors must be fully trained in the proper handling of hazardous substances and waste dangerous goods, and in emergency spill response. Contractors must adhere to relevant provincial or territorial legislation;
- additional provincial or territorial permits will be required for associated infrastructure such as temporary work camps and winter roads;
- permits for some aspects of work camps (e.g., sewage disposal) must be obtained from provincial or territorial governments;
- temporary Water-use Permits must be obtained from provincial/territorial governments for surface water used during construction;
- fuel storage permits should be acquired through provincial or territorial governments;
- additional permits and permissions may be applicable should wetlands be affected by construction activities;
- wetland and/or habitat compensation may be required in case of unavoidable impacts; and,
- additional permits and permissions may be required if the route is altered such that it crosses a provincial or territorial park or other sensitive or protected area.

The necessity for such requirements and permitting may be addressed and/or refined during project planning through the development of the C-EMP and dependant on regulatory review comments.

3.4 Major environmental aspects

3.4.1 Wildlife resources

Rare and sensitive wildlife species

The proposed transmission line, associated infrastructure, and the processes of construction and maintenance have the potential to affect wildlife and/or wildlife habitat (Table 12). Applicable legislation and regulations designed to minimize impact to wildlife include the Manitoba and Nunavut provincial/territorial Wildlife Acts, activity restriction guidelines for sensitive species and species at risk, federal protection of species listed under Schedule 1 of the Species at Risk Act (SARA), and the Migratory Bird Convention Act (MBCA) (Government of Manitoba (GM) 1988a; Government of Canada (GC) 1994; GC 2002a; Government of Nunavut (GN) 2003; Environment Canada (EC) 2009). Detailed surveys of wildlife and delineation of wildlife habitat will likely be required for the transmission line right of way, and may be undertaken under provincial, territorial, and/or federal legislation. Conservation measures and best practices (including seasonal timing of work) may vary depending on the species, density, and sensitivity of wildlife species encountered in the Project area during these pre-construction environmental surveys.

Avian Species

The transmission line route will transect the breeding or staging habitat of migratory bird species. Migratory birds and their nests, eggs, and offspring are protected under the MBCA in Canada and the majority of bird species receive federal protection under this act (GC 1994). Species excluded from the MBCA (e.g., blackbirds or raptors such as rusty blackbirds (Euphagus carolinus) and peregrine falcons (Falco peregrinus) may be protected under other acts or regulations including activity restriction guidelines, the provincial or territorial Wildlife Acts, and SARA (GM 1988a; GN 2003; EC 2009; SARPR 2011a).

In order to avoid impact to migratory birds, the following best practice guidelines are recommended:

- strategic timing of brush-clearing, earth-levelling or other processes that may cause disturbances to breeding birds, or their nests and offspring;
- identification and preservation of key breeding or staging habitat for sensitive species occurring on or adjacent to the ROW through a combination of desktop and field surveys; and,
- employment of environmental monitors for construction work occurring within the core breeding season in order to detect the presence of sensitive bird species and prevent incidental take of migratory bird nests, if work might affect birds or their nests.

Table 12: Ecosystem components potentially affected by transmission line activities

Potential Receptor	Pathway
Wildlife and Wildlife Habitat	
Birds	Disturbance to birds protected under the MBCA during construction and operation.
	Disturbance of sensitive, rare, or at risk bird species during construction.
	Habitat loss resulting from impacts to vegetation and wetlands during construction.
	Mortality during operation by accidental line strikes or electrocution.
Amphibians	Mortality of hibernating amphibians during construction.
	Loss of habitat used for breeding, living, or hibernating.
Other Wildlife	Disturbance to wildlife, including sensitive, rare, and at risk wildlife species during construction and operation.
	Habitat loss or fragmentation.
Soils and Vegetation	
Rare Plants	Loss of rare plants resulting from vegetation clearing, structure placement, and off-road access during construction and operation.
Tundra or Forest	Loss or degradation of plant communities, including those that provide wildlife habitat, during construction and operation.
	Introduction of weed species during construction and operation.
	Increased potential for fires during construction and operation.
Soil Stability and Quality	Loss of vegetative cover of sandy soils, resulting in soil erosion and reduced soil quality during construction and operation.
	Habitat degradation or erosion due to melting of permafrost.
	Soil contamination due to spills during construction and operation.
Aquatic Habitat	
Wetlands, Waterbodies and Water Courses	Direct impacts to wetlands, including wetland margins and watercourses during construction.
	Alteration of wetlands due to placement of structures on man-made islands.
	Wetland contamination due to spills during construction and operation.
	Introduction of weed species during construction and operation.
Fish and Aquatic Resources	Fish and fish habitat loss, alteration, or disruption of fish or fish habitat during construction.
Water Quality	Potential introduction of deleterious substance during construction and operation.
	Potential release of sediments during construction or operation.

Timing of major construction activities outside the nesting period for migratory birds is a key factor in avoiding impact to the breeding potential for most bird species. Guidelines outlining this timeframe by provincial or territorial region are supplied by Environment Canada; throughout most of the Project area, the core breeding season lasts between mid-May and mid-August (EC 2015). Should vegetation clearing or other high-disturbance activities be necessary within this period, nest searches performed by qualified environmental monitors will likely be required. Due to the difficulty and time-consuming nature of locating nests and the large scale of this project, this approach is not recommended with the exception of small areas (less than one hectare) that may require clearing or groundwork from time to time.

Key migratory bird habitats or sensitive bird assemblages may also occur in the vicinity of the transmission line route. Such occurrences may include breeding colonies, major staging areas necessary for stop-over during migration, or the nest sites of sensitive species (e.g. raptors or species protected under SARA). Should such occurrences be detected during assessment, construction, or operation, special measures may be required to minimize impact. Examples include avoiding the destruction of large stick nests used by eagles, osprey, herons, or other species that may re-use nest sites between years, avoidance of high-disturbance work adjacent to major migration stop-over points during spring and fall migration periods, set-back restrictions limiting work close to the nests of sensitive bird species, and bird deterrence installations on lines adjacent to staging or migration areas (APLIC 2006; EC 2009; EC 2013; NPC 2014).

It is likely that post-construction colonization of transmission line structures will occur by raptor species (e.g., osprey [Pandion haliaetus]) that capitalize on the presence of prominent outlooks and secure nest locations provided by the built structures. Presence of raptor nests on structures can cause death to birds who might accidentally contact conductors, outages due to flashover events, and high cost of maintenance to occasionally remove bird nests, which must be done by permission of the regulatory authority. Design should accommodate potential colonization by the inclusion of nest platforms and/or nest deterrents on the structures at areas of high habitat potential, as may be determined during assessment work.

Mammalian species

Rare and/or sensitive mammalian species may occur in the vicinity of the transmission line route. In some cases, the presence or distribution of mammalian species may be relatively poorly documented due to the remote location of the project area. A combination of desktop and field surveys will provide information on mammal habitat and populations along the transmission line route and will document the presence or absence of sensitive species. For many sensitive mammalian species with potential to occur within the Project area, such as wolverines, population densities are typically low (COSEWIC 2014) and the presence of a sensitive element such as an active den may be dealt with on a case-by-case basis. Other species may require significant pre-planning; caribou (Rangifer tarandus), for example, are a sensitive mammalian species that are known to occur within the general vicinity of the transmission line route. Two subspecies may be encountered throughout the project area. Woodland caribou (Rangifer tarandus caribou) may be present at the southern extreme of the transmission line route where there is forest cover, and are listed as Threatened on SARA Schedule 1 (COSEWIC 2002; SARPR 2011b). Barren ground caribou (Rangifer tarandus groenlandicus) are likely to be present throughout the project area. Those barren-ground caribou present within the project area are unlikely to belong to a population protected under SARA (COSEWIC 2004); however the caribou herds have high traditional value to aboriginal people and are monitored through government and aboriginal stakeholders.

Transmission lines or other linear developments have been previously documented to impact caribou behaviour or survival under some circumstances through creating barriers to caribou movement, increasing ease of access to predators and human hunters, altering habitat, and increasing human activity (Reimers et al. 2000; COSEWIC 2002; BQCMB 2015). Due to the length of the transmission line, construction may affect the habitat of more than one caribou population, therefore consultation with the Beverly and Qamanirjuaq Caribou Management Board, Aboriginal and Inuit communities, Environment Canada, and the governments of Manitoba and Nunavut is recommended to ensure that impact to caribou populations is minimized. Inuit Qaujimajatuqangit (IQ) and Traditional Ecological Knowledge (TEK) will likely constitute an important factor in determining approach and mitigation for caribou in the Project area.

Polar bears are listed as Special Concern on SARA Schedule 1 and also occur within the transmission line corridor. Polar bear conservation represents a unique mitigation challenge, as one of their most sensitive timing periods (denning and birth of young) occurs during the otherwise optimal construction periods over the winter months (Richardson et al. 2005; Durner et al. 2006). Maternal dens are most likely to occur along the steep slopes of lakes and riparian areas (Richardson et al. 2005; Durner et al. 2006); suitable habitat may require assessment prior to construction to prevent destruction of active polar bear dens or disturbance resulting in abandonment of young.

Amphibian Species

Amphibian diversity throughout the Project area is expected to be low, with only one species, northern leopard frog (Lithobates pipiens), protected under SARA (COSEWIC 2000). Federal activity restriction guidelines apply to any wetlands used by northern leopard frogs for breeding or hibernation (EC 2009). While impact to amphibian breeding habitat is expected to be low, should such habitat be altered or destroyed, mitigation measures may be necessary. In general, any impact to wetlands should be avoided in order to preserve amphibian habitat. Should breeding wetlands for northern leopard frogs be altered or destroyed by construction or maintenance activities, amphibian relocations, wetland compensation, or other mitigation measures may be required. Such measures would be determined on an as-needed basis and are unlikely due to typical placement of structures in upland locations.

Wildlife Sanctuaries and Areas of Ecological Significance

There are several sensitive or protected areas adjacent to the proposed route (Figure 7) including two provincial parks, one national park, a migratory bird sanctuary, three Important Bird Areas (IBAs), and the core caribou calving grounds for the Qamanirjuaq herd (BQCMB 2000; IBA 2015A). Of these, the McConnell River IBA and the Qamanirjuaq calving grounds are likely to be transected by the Project route. The McConnell River IBA contains a migratory bird sanctuary that is protected under federal law. The remaining IBA also contains key migratory bird habitat, particularly for breeding waterbirds and migratory landbirds and is designated as a Special Management Area under the Draft Nunavut Land Use Plan (IBA 2015b; NPC 2014). This wetland is also listed as a Ramsar site, indicating that it is recognized as a wetland of international significance. These areas may require special planning to maintain mandated protections and additional communication and approval from relevant stakeholders is recommended.

3.4.2 Vegetation and soil resources

Vegetation

The construction, maintenance, and operation of the Project may result in impact to vegetation, with potential effects including:

- the destruction of rare and/or endangered plants during construction, operation, and maintenance;
- minor increased potential for fires;
- introduction of invasive plant species and/or weeds;
- loss of vegetation due to clearing and/or erosion; and,
- contamination of adjacent vegetation and streams due to use of herbicides.

Destruction or damage to rare plants may occur if structure placement or necessary clearing and grubbing coincide with locations of rare plant occurrences. The presence/absence of rare plants and the types of vegetation communities along the proposed route may be established during the planning phase by vegetation and rare plant surveys. A habitat-based approach to risk determination for rare plant species may also be used. It is probable that incidences of sensitive vegetation may be managed on a site-by-site basis.

Tundra vegetation is very slow-growing and is sensitive to disturbance caused by the development of roads or trails, or even the passage of vehicles on non-permanent winter roads (Auerbach et al. 1997; Jorgenson et al. 2010). Disturbed areas of tundra vegetation may take decades to recover, or may not ever return to their previous state (Jorgenson et al. 2010). The passage of vehicles or equipment outside the ROW or other designated construction areas should therefore be avoided whenever possible (INAC 2010). It is further known that some types of vegetation communities differ in their resilience to disturbance; vegetation type should therefore be a consideration in route-planning and/or mitigation (Jorgenson et al. 2010). Use of rig matting for construction trails may be a necessary mitigation, with associated additional cost.

In compliance with the Manitoba Noxious Weeds Act (GM 1988b), equipment entering worksites should be clean to prevent the spread of weeds or non-native plants. While equivalent legislation is not currently in effect within the territory of Nunavut, it is recommended that these provisions be upheld within Nunavut as well as Manitoba for consistency and to uphold best practice procedures. Due to the length of the proposed transmission line route and the relatively pristine environmental setting, equipment should be cleaned prior to site access to prevent the spread of weed seeds or plant pathogens.

Soils and Terrain

Sensitive soil types that are vulnerable to wind or water erosion can occur along the proposed transmission line route (Figure 8). Erosion becomes a risk when vegetative cover and the organic layer are removed and soils become exposed to the effects of wind and water. In general, very sandy soils are most likely to be vulnerable to wind erosion, while fine-textured soils, particularly on sloped ground, are at highest risk for water erosion.

Permafrost soils are present throughout Nunavut and northern Manitoba in continuous or discontinuous permafrost regions (Figure 9). Permafrost soils present unique challenges to construction projects as they are vulnerable to melting, leading to soil instability and major erosional events. In permafrost terrain, highest soil ice content is present in areas of patterned ground, in fine grained soils such as clay, and in wetlands or peatlands (INAC 2010). Melting of permafrost in soil can have other detrimental environmental effects including major changes to terrestrial habitat; for example, permafrost melting in forested areas can result in increased infiltration of water into soils resulting in a shift from forested habitat to sedge meadows, lakes, or fens (Smith 2011; Williams et al. 2013). Aquatic habitats may also be affected drainage patterns and water chemistry of tundra wetlands can be altered by changes in permafrost conditions, leading to loss or alteration of wetland habitat (Jorgenson et al. 2010; Smith 2011; Throop et al. 2012; Williams et al. 2013). Such risks are particularly relevant within the discontinuous permafrost zone, where local melting may trigger a chain reaction leading to a more widespread disturbance (Williams et al. 2013; Matheus and Omtzigt 2013). Such drastic changes to the local environment are a serious consideration and efforts to reduce permafrost melting should be undertaken.

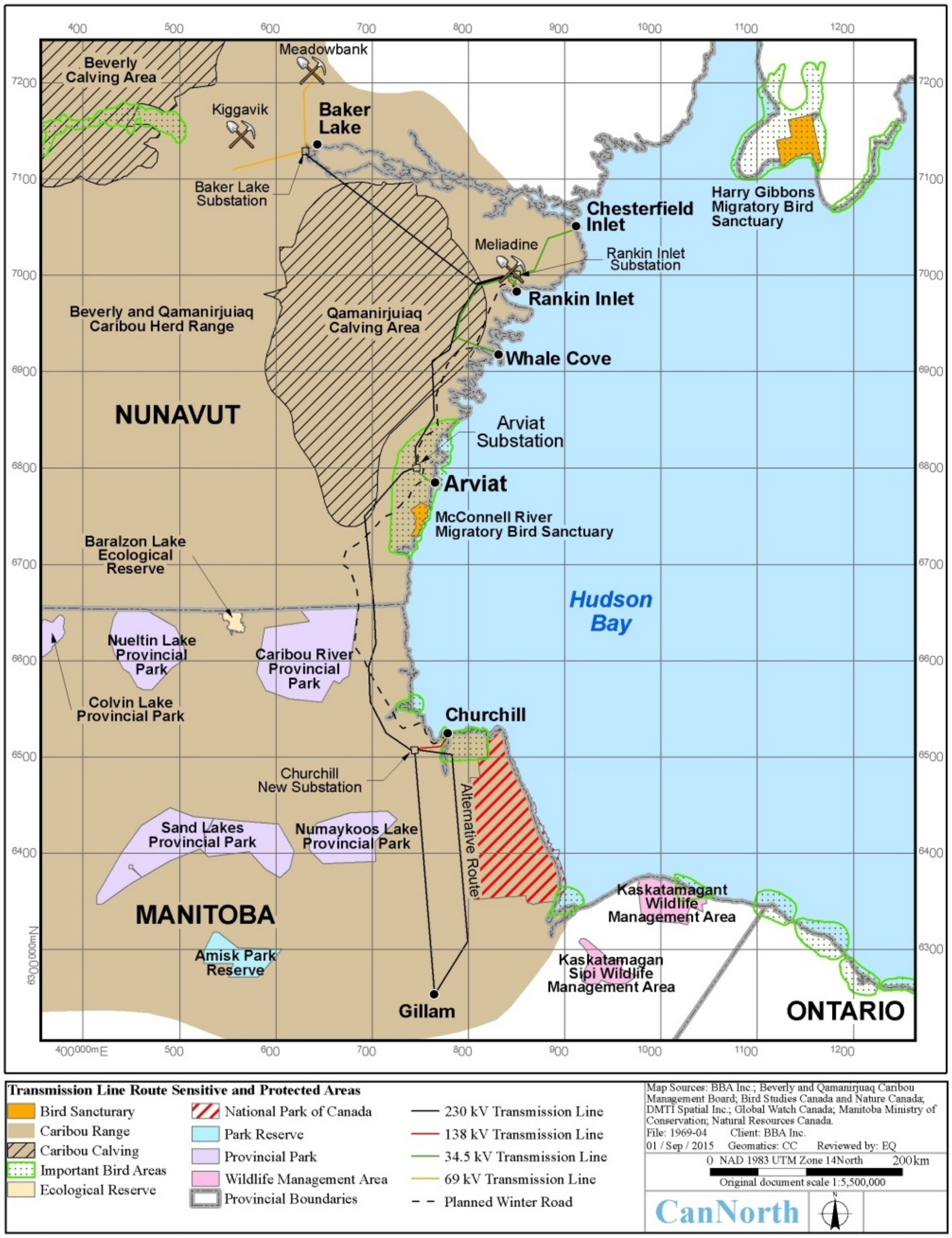


Figure 8: Sensitive and protected areas adjacent to the Nunavut-Manitoba transmission line project

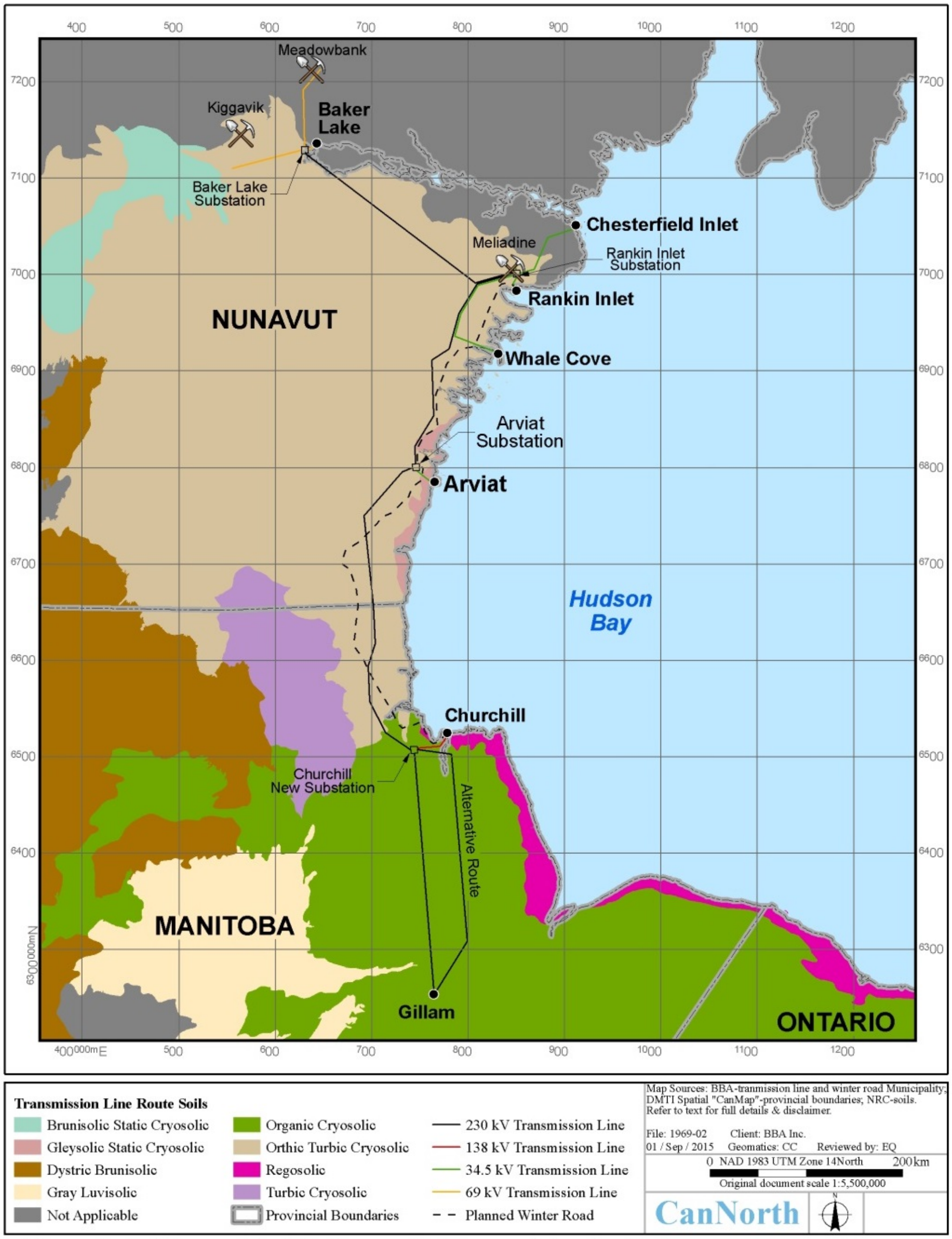


Figure 9: Soil types in the Nunavut-Manitoba transmission line project area

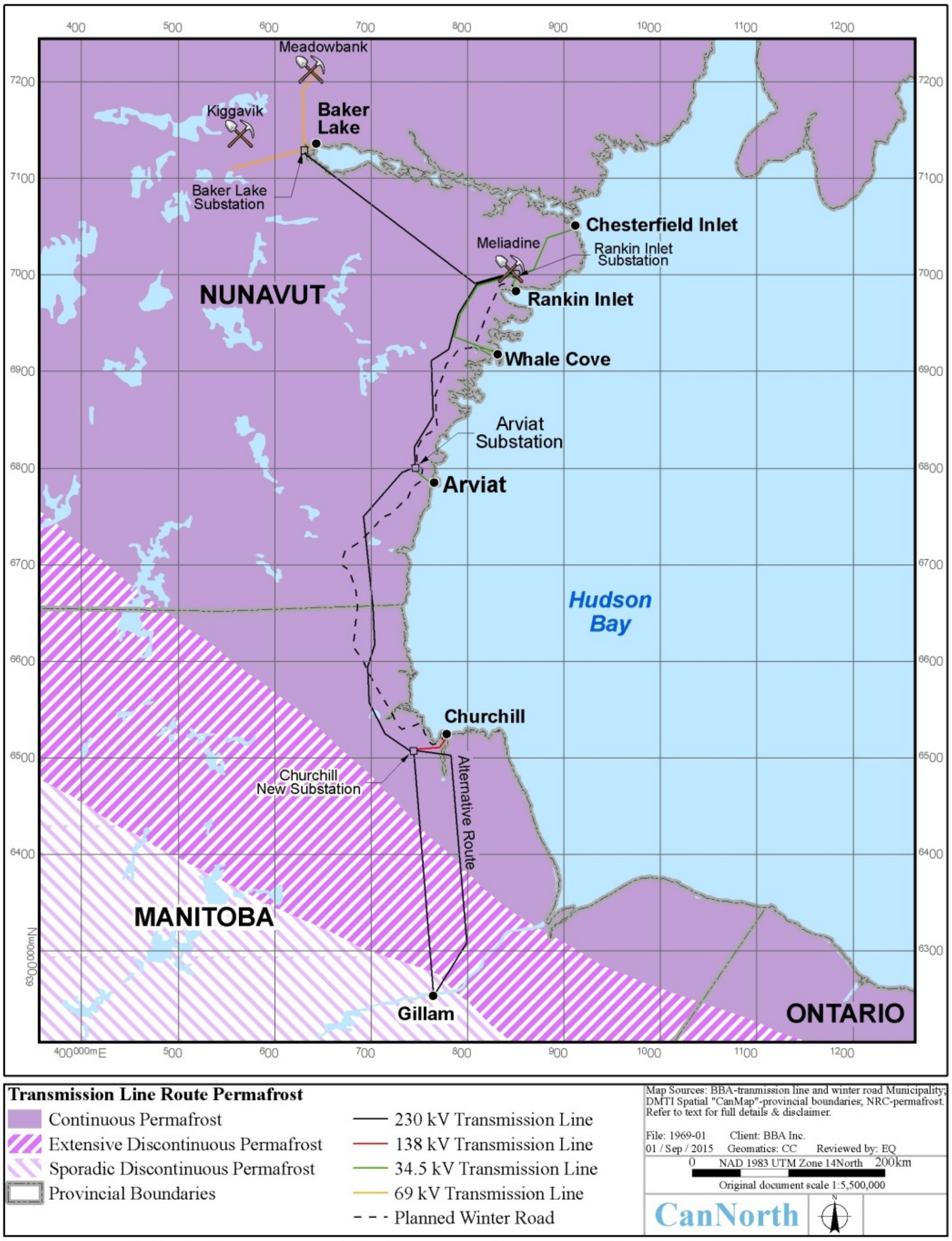


Figure 10: Permafrost soils in the Nunavut-Manitoba transmission line project area

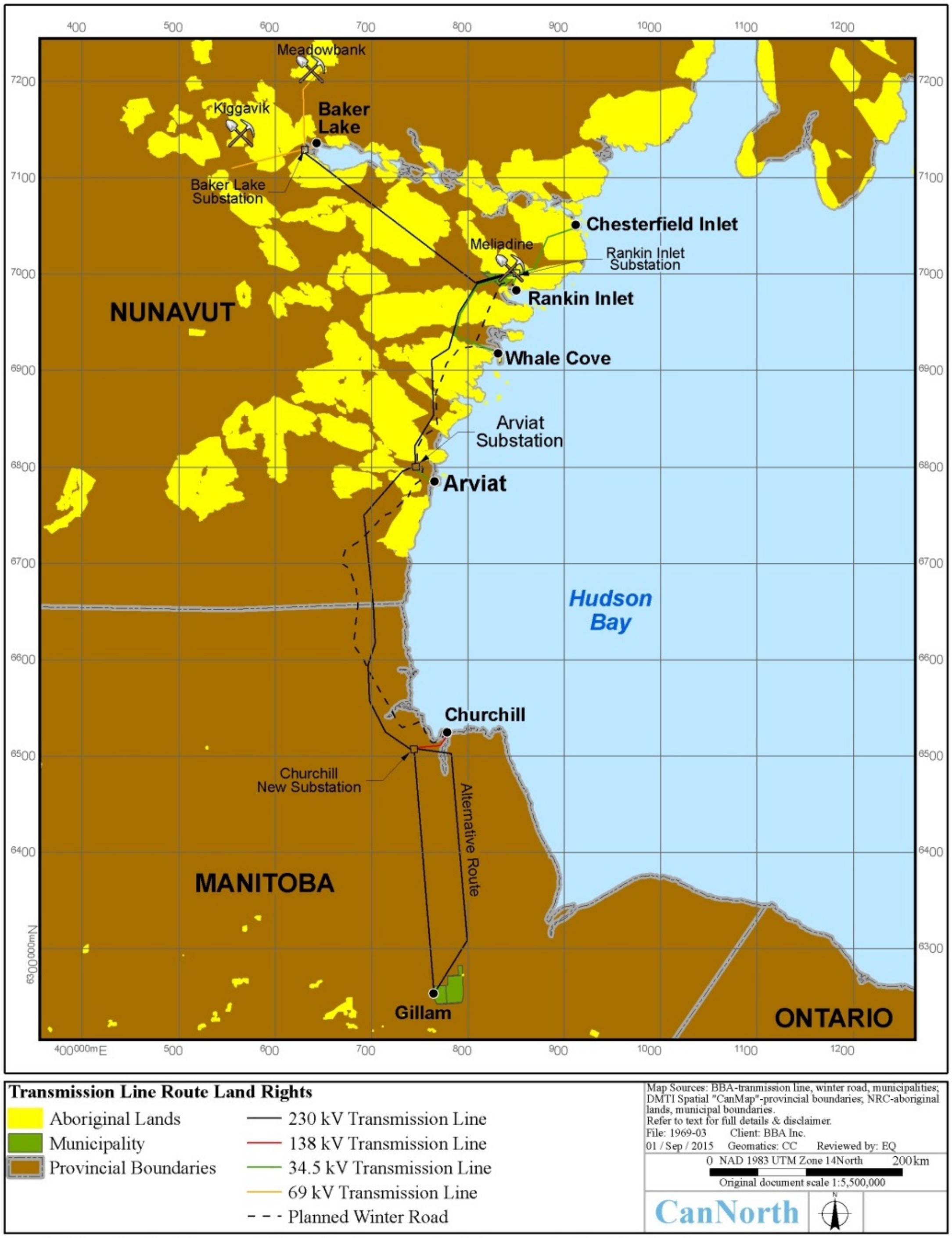


Figure 11: Land rights for the Nunavut-Manitoba transmission line project.

Impacts to permafrost soils, as well as other sensitive soil types, can be minimized by working under frozen conditions where possible, avoiding sensitive soil areas where feasible, limiting grubbing, reducing removal of vegetation, using rig matting on transportation routes, and using erosion control devices where necessary (INAC 2010). After construction activities, re-seeding or other re-vegetation strategies may be necessary to stabilize soil and prevent erosion.

Consideration should also be taken in terms of geological structures such as pingos and eskers. Pingos are unique to permafrost tundra landscapes and both pingos and eskers may provide valuable wildlife habitat for denning animals and sensitive breeding birds (COSEWIC 2007; INAC 2010). Work should not occur within 150 metres of a pingo in order to prevent damage or thawing of permafrost (INAC 2010).

Wetlands, Waterbodies, and Watercourses

Construction-related activities for the project occurring in or around waterbodies have the potential to affect fish and fish habitat directly or indirectly through the use of heavy equipment and/or the installation of the transmission line. Due to the large number of wetlands present along the ROW, there will be numerous cases where construction must occur adjacent to spanning wetlands, including fish-bearing waterbodies.

Under DFO regulations, an in-depth review and assessment may be required if the project is judged to pose serious threat to fish; this includes permanent impact to fish habitat, fish health or survival, and/or fish movement in any fish-bearing waterbody (DFO 2014). The most probable impacts for this project include:

- temporary crossings for project traffic, including ice roads and temporary clear span bridges;
- potential installation of structures built on islands in waterbodies or watercourses in the case of a large span;
- the addition of silt to wetlands during spring runoff due to erosion or sediment movement during construction processes;
- the addition of fuel, herbicides, or other substances deleterious to waterbodies through spills or runoff; and,
- alteration of aquatic habitat through changes in vegetation cover or alteration of waterbody banks during crossings.

If the project is deemed unlikely to cause serious impact to fish habitat, a detailed review will not be required by DFO, although notification including an overview of project details and timing is recommended.

Non fish-bearing wetlands are also considered to be sensitive habitats and may provide important habitat for wildlife, including many birds, rare plants, and species at risk. Wetlands can also provide seasonal habitat for important mammal species. Impact to wetlands should be avoided by:

- preventing alteration of wetland banks (e.g., rutting or erosion) by following stream-crossing guidelines (MDNR and DFO 1996);
- preventing the addition of sediment to wetlands by minimizing disturbance to soils and limiting erosion;
- preventing the addition of deleterious substances to wetlands by adhering to safe fueling guidelines and minimizing use of herbicides;
- developing and adhering to a spill-management plan and following relevant precautions (e.g., use of secondary containment for fuel containers; storing fuel and equipment away from wetlands);
- adhering to construction timing guidelines for spawning fish as outlined by DFO;
- minimizing loss of vegetation adjacent to wetlands and removing any felled timber from the vicinity of waterbody banks; and,
- avoiding or minimizing heavy work adjacent to wetlands when possible.

Provincial Aquatic Habitat Protection Permits (and any territorial equivalent) may be required to work in or adjacent to wetlands, and a protection plan will likely need to be submitted to provincial and territorial governments as part of the environmental approvals process. Avoiding impact to wetlands may constitute a major challenge for this project due to the large number of waterbodies in the project area. Should wetlands be impacted or destroyed by construction, a compensation plan may be required to restore wetlands or mitigate habitat loss; thus routing and budget planning must consider the financial costs of avoiding wetlands and predicted costs of any required mitigation or restoration.

3.4.3 Heritage resources

In Manitoba and Nunavut, heritage resources include Precontact period and Historic period archaeological sites, built heritage sites and structures of historical and/or architectural interest, and paleontological sites. Heritage resources are the property of the Provincial Crown in Manitoba and are the joint property of the government and the Inuit Heritage Trust in Nunavut. Activities potentially affecting heritage resources are regulated through the Heritage Resources and Heritage Manitoba Acts (GM 1986; GM 1988c) in Manitoba and the Nunavut Land Claims Agreement Act (GC 1993a) and the Historical Resources Act (GNWT 1988a) in Nunavut.

Construction activities associated with the project have the potential to negatively impact heritage resources. Heavy equipment can impact heritage resources in a variety of ways; surface features may be crushed and/or displaced by the weight of machinery, while buried cultural materials (e.g., artifacts and features) may be destroyed or moved out of context.

Provincial or Territorial Heritage Resource Impact Assessments (HRIA) will be required to evaluate the potential for impact to heritage resources within the project area. This will include desktop surveys to determine whether known sites exist within the project area, and field surveys to evaluate the potential for new heritage resource sites.

Heritage resources are considered a non-renewable resource; therefore, should heritage resources be found in the project area, mitigation measures may be required. These may include more rigorous excavations and documentation prior to construction activities or avoidance of specific sites. The approach will depend on the nature of the sites located during assessment. Should any additional heritage resources be discovered during construction activities, notification to the Heritage Resources Branch (Government of Manitoba) or the Inuit Heritage Trust (Nunavut) is required.

3.4.4 Human environment

A project of this magnitude may affect the people living in the vicinity in a variety of ways. The overall outcome is expected to be positive, as locals in isolated communities will be provided with affordable and reliable electricity, improving the standard of living. There are several potential negative effects, however, that may apply to local people relying on traditional land use. Communication with communities, aboriginal groups, and elders is recommended, including the incorporation of IQ, Inuit Societal Values, and Traditional Ecological Knowledge (TEK) into Project decisions. Potential impacts to local individuals may include:

- impact to traditional hunting grounds or areas used for traditional plant foods;
- habitat loss or degradation in traditional trapping areas;
- loss of areas used for obtaining traditional carving stone;
- impact to heritage resources;
- changes to property value for landowners; and,
- changes in aesthetic and sensory value to local landscapes.

Consideration of these factors along with input from local stakeholders should play a role in project planning and development. During project planning, data collection, and impact assessment, TEK and IQ should be used in consultation with interested stakeholders.

3.4.5 Potential cumulative effects

Many of the environmental effects discussed previously are spatially and temporally isolated from each other. However, effects may combine and interact and may possibly produce net impacts that exceed the sum of their individual local, short-term effects. Typically, the scale of cumulative impacts differs in geographic and temporal scale from other considered impact scenarios, most of which can be mitigated directly. There is a probabilistic aspect to cumulative impact assessment. Stakeholders contributing to the probability of the occurrence of a cumulative impact include the local communities, existing and potential commercial stakeholders (e.g., outfitters, mining corporations, and regional business groups), and provincial and federal government agencies. Also, the degree to which a cumulative impact occurs is dependent on the involvement of the various stakeholders in mitigation. Potential cumulative impacts are difficult to address without complete foreknowledge of future development in the project region. IQ and TEK should be used as an important source of information in cumulative effects assessment. In general, use of best management practices during construction, focused mitigation measures, environmental monitoring and follow-up, and environmental management as described in Sections 3.4.1 and 3.4.2 will serve to minimize cumulative impacts.

4. POWER LINE DESIGN AND COSTS

4.1 Previous studies

In 1998, under the Canada - Manitoba Economic Development Partnership Agreement, Manitoba Hydro was requested to complete a pre-feasibility study evaluating the viability of constructing a transmission line from Manitoba to the Kivalliq region of Nunavut. As this pre-feasibility study was issued in 1999, no significant action was undertaken beyond this stage due to the lack of external funding.

The Standing Senate Committee on Energy, the Environment and Natural Resources studied non-renewable and renewable energy development, including energy storage, distribution, transmission, consumption and other emerging technologies in Canada's three northern territories. This study, issued in 2015, presented five recommendations to the federal government regarding energy efficiency, reliability, economic viability, planning and asset management.

The respective technical parameters and political strategy of the above two studies are used as references in the current Investment Justification.

4.2 Manitoba Hydro opportunities and challenges

Manitoba Hydro has an important hydropower complex in the northern part of Manitoba. Its power generation capability is suitable to provide power to the Kivalliq region. Manitoba Hydro has one the lowest electricity rates in North America.

However, Manitoba Hydro would likely be able to supply up to 80-100 MW from Churchill without major network investment. Beyond this point, the solution would be to either reinforce the existing network or build a new transmission line from Gillam to Churchill (270-300 km).

4.3 Qulliq Energy Corporation opportunities and challenges

At this point, QEC is only involved in power generation and distribution systems. QEC has no current mandate regarding transmission systems. For the upcoming steps, including the feasibility study, QEC will need to clarify its role in the design, construction, ownership, operation and maintenance of the transmission system.

QEC involvement in the transmission line project might be a challenge considering that approximately 60% of its installed capacity in Nunavut is approaching the end of life. Additional and major maintenance is required to extend the lifetime of this equipment. The older power plants need to be decommissioned and new power plants need to be built, in order to meet the power demand of a fast growing and widely spread population.

4.4 Power generation potential in Nunavut

QEC identified promising hydro sites in the Kivalliq region to service all of the larger regional communities of Baker Lake and Rankin Inlet. Hydro power generation is identified as the most reliable energy source as an alternative to diesel in the Kivalliq region. However, new hydro power generation would need the construction of a transmission system and as well require significant investments (hundreds of millions), extensive environmental studies and means of mitigation regarding water levels and ice jams. Other alternate energy sources could replace part of the diesel power generation but hardly at a competitive price. The capacity to supply power to the mining sector and to meet the growing demand of communities in all cases would be limited in comparison to what could be offered by interconnection to the Manitoba grid.

With this interconnected power system, larger power generation projects could be integrated, further reducing energy rates. However, local power generation would still need to support the amortization cost of the transmission system and the corresponding expenses in Manitoba.

4.5 Technical parameters

The main technical assumptions and parameters used to prepare the implementation strategy are presented in Appendix C and will likely be refined during the feasibility study. These assumptions and justifications are presented separately in an attempt to facilitate the reader's understanding of the overall project.

4.6 Investment costs

The investment costs are summarized in Table 13. The accuracy is expected to be in the order of ±30%. However, the overall concept can still be significantly modified in the feasibility study, thus causing significant changes in the cost. Any supplementary investment should provide additional benefits, which should be considered in the choice of the preferred option.

Table 13 : Capital investment costs

Coastal Scenario	Type	Unit cost	Quantity	Cost ($)
Power line Churchill - Rankin Inlet	230 kV	800k$/km	615km	492M
Churchill substation		$25M	1	25M
Arviat substation		$30M	1	30M
Rankin Inlet terminal station		$40M	1	40M
Lines from substations to Arviat and Rankin Inlet	34.5 kV	150k$/km	60km	9M
Lines from substations to Whale Cove and Chesterfield Inlet	34.5 kV	150k$/km	245km	37M
Community substations Arviat and Rankin Inlet		$4M	2	7M
Community substations Whale Cove & Chesterfield Inlet		$3M	2	6M
Total capital investment for Coastal Scenario				**$646M**
Coastal and Inland Scenario	**Type**	**Unit cost**	**Quantity**	**Cost**
Power line Rankin Inlet - Baker Lake	230 kV	800k$/km	270km	216M
Baker Lake substation		$35M	1	35M
Line from substation to Baker Lake	69 kV	300k$/km	6km	2M
Community substation Baker Lake		$4M	1	4M
Total additional investment for Coastal and Inland Scenario				**$257M**
Total Capital Investment				**$904M**

4.7 Operating costs

As a high level cost estimate, the operation and maintenance costs have been calculated at 3% of total capital expenditure, a ratio that is typical of operating costs in northern conditions.

After discussion with Manitoba Hydro, it was concluded that the maintenance costs of the infrastructure located in the territory of Manitoba would be funded by Manitoba Hydro. Therefore, the capital expenditure items presented in Table 14 were excluded from the calculation of maintenance costs.

Table 14: Capital expenditure items for which maintenance costs will be supported by Manitoba Hydro

Coastal Scenario with Meliadine				
	Type	**Unit cost**	**Quantity**	**Cost**
Power line Churchill - Meliadine/Rankin Inlet	230 kV	850k$/km	175 km	$140M
New substation		$25M	1	$25M
Coastal Scenario: total amount excluded				**$165M**

5. IMPLEMENTATION STRATEGY

5.1 Infrastructure development

The following implementation strategy is based on opportunities, risks and means of mitigation discussed with EOWG. The feasibility study shall further adapt and refine this strategy.

5.1.1 Step 1 - Supplying power from Churchill to Rankin-Inlet

At this stage, the winter road construction is assumed to be completed, thus facilitating the construction of the transmission line. A description of the work included in step 1 is provided below, as well as the underlying conditions leading to this step:

- Manitoba - By Manitoba Hydro:
- New separate substation at 20-30 km inland from Churchill, with a 138-230 kV step-up transformer for the Nunavut network. The metering for Nunavut will be installed on the outgoing feeder of this substation.
- 138 kV line from Churchill and up to the new substation.
- 230 kV line from the new substation up to the Nunavut border (175 km).
- Nunavut - By QEC or other designated party:

- Two new 230 kV substations, one near Arviat and the other near Rankin Inlet.
- 230 kV transmission line from the border to Meliadine/Rankin Inlet (440 km).
- Construction and connection of the new 34.5 kV distribution lines to Meliadine mine (6 km), Rankin Inlet (30 km) and Arviat (30 km).
- Two new 34.5-4.16 kV substations (or extension to the existing power plants), one in Arviat and the other in Rankin Inlet.

With a 230 kV line up to Rankin Inlet, investment decisions for any new mining project along the transmission line corridor and in Baker Lake will take into account the availability of electric power and a purchase price that may be lower than diesel generation. This will allow more accurate planning of future expansion of this transmission system.

At the end of this step, the transmission and distribution systems are assumed to be fully commissioned and supplying power to Rankin-Inlet, Meliadine and Arviat, as well as providing fibre optic communications.

5.1.2 Step 2 - Distribution network expansions up to Whale Cove and Chesterfield Inlet

Distribution lines up to Whale Cove and Chesterfield Inlet would likely be installed along the winter road, with distances from Rankin Inlet terminal substation of approximately 155 km and 90 km, respectively. As these communities have the lowest loads in the coastal region, the feasibility study shall further review if these expansions would be economically justified and if the corresponding investment is the one bringing the highest benefit to these communities. The following items should be considered:

- The energy rate of the distribution network expansions compared to the actual energy rate of the diesel generating plants, including operation and maintenance.
- The benefits of fibre optic communication in these communities.
- The existing diesel power system reliability and forecasted investments.
- The avoided greenhouse gas emissions.

The current evaluation includes the interconnection of these two communities, as the corresponding cost is not significant compared to the overall investment.

6. ECONOMIC VIABILITY ANALYSIS

6.1 Methodology

The methodology used for the analysis of the economic viability of the Manitoba-Nunavut transmission line project basically consisted of estimating the value of the benefits to be created by the infrastructure in terms of fossil fuel savings net of the purchases of electricity from the Manitoba Hydro grid. This methodology is consistent with approaches followed in similar studies.[2] The major steps taken in the analysis were the following:

- Projection of electricity demand in the 5 Kivalliq communities and of potential mining projects according to the Coastal and the Coastal-Inland scenarios;
- Estimation of the capital investment costs of the infrastructure: power lines, substations and distribution networks;
- Estimation of the costs of electricity purchases from Manitoba Hydro and of the operating costs of the infrastructure;
- Estimation of the savings to be realized by replacing diesel power generation by grid supplied power and by converting space heating from oil to electric in the communities
- Estimation of the savings to be realized by replacing diesel power generation by grid supplied power in the mining sector;
- Calculation of the Internal Rate of Return (IRR) and of the Net Present Value (NPV) of the project's benefits represented by the net fossil fuel savings to be made by the Kivalliq communities and by the mining sector;
- Sensitivity analysis of economic viability indicators with respect to key variables;
- Calculation of the unit cost of the electricity, taking into account the amortization of the capital expenditure;

A number of key assumptions were made to perform the analysis:

- The life duration of the project was set at 40 years for the purpose of economic viability calculations; the real physical life of the infrastructure may be longer;
- The price of diesel and heating oil used to calculate savings of petroleum products purchases is assumed to drop by 20% in 2015/16 and thereafter to rise at the rate of 0.8% per annum during the life of the project. This assumption is based on the Reference Case of long term oil price forecasts of the Energy Information Agency (EIA) of the United States contained in its

[2] A good example is given by the "Draft Technical Report and Business Case for the Connection of Remote First Nation Communities in Northwest Ontario For Northwest Ontario First Nation Transmission Planning Committee August 21, 2014 http://www.ieso.ca/Documents/Regional-Planning/Northwest_Ontario/Remote_Community/OPA-technical-report-2014-08-21.pdf

2015 Energy Outlook publication. Various scenarios are considered by the EIA, which are presented in Table 15. Long term forecasts of energy prices are expected to have a low accuracy.

- All values are stated in constant 2015 dollars
- After 2034/35, all values used in calculations such as the population and the number of QEC customers remain constant, at which time the mining projects are closed and electricity purchases remain at the same level; the price of oil is the only variable that continues to grow until 2039/40 and afterwards remains constant.
- Construction of the infrastructure is to start in 2019/20 and the transmission system start-up is to take place in 2024/25
- Capital expenditures are to be distributed over the 5 year construction period as follows: Year-1: 0.5%; Year-2: 1.5%; Year-3: 3,%, Year -4::35%, Year-5: 60%;
- Capital expenditures are debt funded and interest is capitalized and payable in first year of operation Year 1; the interest rate charged is 4%;
- The price of electricity purchases to Manitoba Hydro is set at $0.08/kWh. Manitoba Hydro indicated that the selling price of energy would be in a range of $60 to $100 per MWh. The price retained for the analysis stands in the middle of the range. It is to be noted that Manitoba Hydro cannot grant subsidies to buyers under their Electric Power Export Policy, Manitoba Hydro is committed to not granting any subsidy to buyers. The $0.08/kWh price is understood to be all inclusive and to cover any applicable charges for reserved capacity.
- The calculation of capital cost amortization is based on a 40 year pay-back period and a 4% interest rate.
- Transmission losses for the project infrastructure were set at 10%.
- The energy demand projections used for the no transmission line case and to estimate oil savings for power generation and space heating are based on power production parameters of QEC production equipment in each community (Table 16). The key variable is the specific consumption of diesel per kilowatt hour produced (See Table 4). Average load factors were used to calculate peak loads.
- Savings to be realized in the replacement of diesel power were augmented by $0.05/kWh in order to take into account other savings resulting from the replacement of diesel power by the grid.

Table 15: Long term oil price forecasts

Scenario	Price per million Btu in 2013 dollars		
	2013	2040	Average annual increase
Reference scenario	28.2	34.7	0.77%
Low economic growth	28.2	33.5	0.64%
High economic growth	28.2	36.2	0.93%
Low oil price	28.2	22.1	-0.90%
High oil price	28.2	55.6	2.55%

Source: 2015 Energy Outlook, United States Energy Information Agency.

Table 16: Installed capacity and output profile of QEC power stations 2014/15

	Installed capacity (kW)			Power stations production profile				
	Total	Largest unit	Firm capacity	Peak load	Energy GWh	Station Service	System losses	Load factor
Arviat	3,110	960	2,150	1,734	8.9	2.5%	7.6%	58%
Baker Lake	3,420	1,150	2,270	2,188	8.9	2.8%	1.1%	47%
Chesterfield Inlet	1,000	360	540	389	2.1	3.5%	2.7%	61%
Rankin Inlet	6,200	2,150	4,050	3,130	17.8	3.5%	3.4%	65%
Whale Cove	1,070	320	750	430	2.0	6.9%	2.6%	52%

Source: Qulliq Energy Corporation.

6.2 Economic viability analysis results

6.2.1 Heating oil and diesel oil savings

Fossil fuel savings is the key justification factor used in the economic viability analysis of the transmission line project.

At the level of the five communities, it was estimated that once conversion to electric heating is completed, fossil fuel savings for the purpose of space heating would be in the order of 20 million litres annually, while diesel oil savings for power generation in QEC installations would be in the order of 15 million litres.

The bulk of fossil fuel savings however would take place in the mining sector where, according to the scenario considered, savings would amount to about 60 million litres per year for the Coastal scenario and of around 100 million litres annually for the Coastal and Inland scenario. However those savings would disappear after the closure of the Meliadine and the Kiggavik mines, but could be maintained to about 90 million litres per year if the other mining operations follow the two advanced stage projects.

The value of fossil fuel savings was estimated and is illustrated in Figure 12. According to the assumptions made, the replacement of oil heating by electric heating would generate gross savings of about $21M, while connecting to the grid would allow gross savings of $18M on diesel based power generation, for total gross savings of around $40 million annually in the communities.

Finally, the present value (PV) of fossil fuel savings was estimated (Table 17) for the two scenarios and for two oil prices in 2024/25 when the line comes into operation, one being the $0.90/litre price used in the base case, and the other being a price of $1.13/litre representing a 25% increase over the base case price. The estimates reveal the following:

- diesel fuel savings by the mining sector would represent more than 50% of total saving in all cases except that of the Coastal scenario with no long term mining sector clients, nevertheless, fossil fuel savings in the communities will be very large, for both QEC power generation and for oil heating;
- if there are no long term mining sector clients, the net present value (NPV) of the project is negative in both scenarios for the base case $0.90/litre oil price (the net present value of the project is the NPV of oil savings, that is gross savings minus other cost elements such as electricity purchases, operating costs and amortization charges);
- although oil prices are currently (September 2015) very depressed, it is not unthinkable that in 2024/25, they could have recovered to what they were just a few years ago, around $1.13/litre, so that oil savings could be much larger;
- however, as seen from Table 17, even with an oil price 25% higher than in the base case, the NPV remains negative for the two scenarios if there are no long term mining clients;
- the key factor for assuring the viability of the transmission system is for new mining operations to be started after (or before) the closure of Meliadine and Kiggavik; only then do NPVs become positive and significant in relation to the investment.

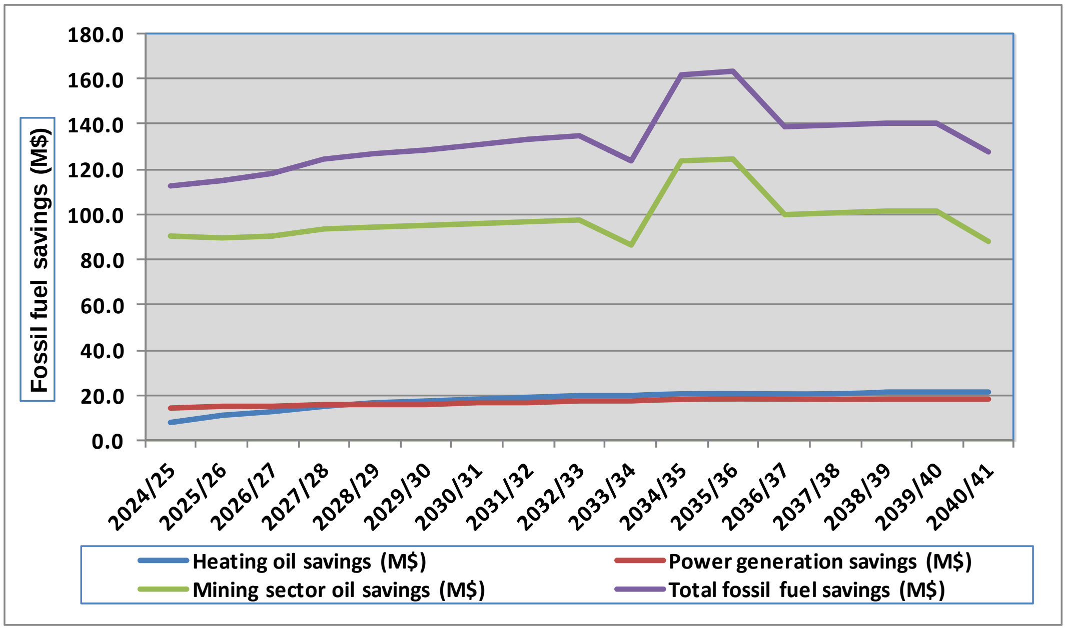


Figure 12: Estimated annal heating oil and diesel oil gross savings in $M

Table 17: Present value of fossil fuel gross and net savings

Scenario	Coastal		Coastal Inland	
Oil price in 2024/25	**\$0.90/litre**	**\$1.13/litre**	**\$0.90/litre**	**\$1.13/litre**
Base case with no long term mining sector clients	**PV (M\$)**	**PV (M\$)**	**PV (M\$)**	**PV (M\$)**
PV of QEC Power generation savings	258	309	341	391
PV of Kivalliq hamlets Oil heating savings	268	335	368	460
PV of Mining sector diesel oil savings	460	575	833	1,042
PV of Total gross savings	**987**	**1,219**	**1,543**	**1,893**
PV of Total Costs	**1,352**	**1,352**	**1,973**	**1,973**
Net Present Value	**-366**	**-134**	**-430**	**-80**
Base case with long term mining sector clients	**PV (M \$)**	**PV (M \$)**	**PV (M \$)**	**PV (M \$)**
QEC Power generation savings	258	309	341	391
Kivalliq hamlets Oil heating savings	268	335	368	460
Mining sector diesel oil savings	974	1,217	1,861	2,327
Total gross savings	**1,501**	**1,861**	**2,571**	**3,178**
Present Value of Total Costs	**1,516**	**1,516**	**2,300**	**2,300**
Net Present Value	**-16**	**345**	**271**	**878**

The calculations however did not take into account the following elements:

- In addition to money savings, the interconnection to the Manitoba grid would strongly contribute to the reduction of greenhouse gas (GHG) emissions in the communities and from future mining operations. Should a carbon tax be applied in Nunavut, the viability of the project would be significantly improved. Using the British Columbia carbon tax rate of $0.0767 per litre, this would translate into annual benefits valued at $2.7M for an annual consumption of 35 million litres in the communities. In the mining sector, annual benefits would be in a range of $4.6M to $7.7M respectively for the Coastal and the Coastal-Inland scenarios.
- The replacement of diesel power generation by grid supplied electricity would also reduce capital expenditures to be incurred by QEC to replace aging diesel equipment, even though some generating capacity would still be required as backup. It would also reduce the need for expanding the capacity of diesel generation and of associated fuel handling and storage equipment.[3]
- Conversion to electric heating would involve significant costs, which are difficult to estimate at present. However, it has been confirmed that conversion would be fairly straightforward since oil furnaces can be easily replaced by electric furnaces and at a reasonable cost. Furthermore, the Nunavut Housing Corporation each year manages sizable budgets for housing renovation and retrofits that could be used for conversion of heating systems.

Finally, there would be costs to account for the use of diesel power during transmission line power outages. The standard assumption is to use diesel for emergency during 5% of the time.

Detailed results for power generation and space heating savings in each community are presented in Appendix Table 5.

6.2.2 Economic viability indicators

Calculation of IRR and NPV were made for the two scenarios and for different sensitivity analysis assumptions. Results are presented in Table 18.

[3] QEC's Chair stated, at the Standing Senate Committee on Energy, the Environment and Natural Resources, that "QEC's infrastructure is aging. Power plants with 40-year lives have a $15 million to $25 million replacement cost. Generator sets are more in the order of 10 years, and can be installed for $2 million. roughly $1,000 per kilowatt to purchase a generator and another $1,000 per kilowatt for installation. –Committee Proceedings - November 20, 2014

Table 18: Economic Viability Indicators

Scenarios	Coastal		Coastal Inland	
Indicators	**IRR**	**NPV (M$)**	**IRR**	**NPV (M$)**
Base case without long term mining sector clients	*null*	-366	*null*	-430
Sensitivity analysis				
Discount rate at 8% instead of 4%	*null*	-389	*null*	-480
Purchase price of electricity ($0.07/kWh)	-5.0%	-313	-4.8%	-351
Purchase price of electricity ($0.09/kWh)	*null*	-418	*null*	-509
Capital expenditure - 20%	-0.9%	-160	0.6%	-142
Oil price +25% in 2024/25 (-$1.13/l)	0.9%	-134	2.5%	-80
Capex -20% and oil price + 25%	5.9%	72	8.2%	208
Base case with long term mining sector clients	3.8%	-16	6.0%	271
Sensitivity analysis				
Discount rate at 8% instead of 4%	3.8%	-233	6.0%	-168
Purchase price of electricity ($0.07/kWh)	4.7%	58	6.9%	390
Purchase price of electricity ($0.09/kWh)	2.9%	-89	5.2%	151
Capital expenditure - 20%	6.6%	190	9.0%	558
Oil price +25% in 2024/25 (- $1.13/l)	7.8%	345	10.2%	878
Capex -20% and oil price + 25%	11.4%	551	14.1%	1,166

The major conclusions that can be drawn from the results of the economic viability analysis are as follows:

- In the base case without long term mining sector clients, the analysis yields negative economic viability results for both the Coastal and the Coastal and Inland scenarios;
  - the results are slightly improved but remain negative with a price of $0.07/kWh for electricity instead of $0.08/kWh;
  - a 20% reduction of the capital expenditure would not be sufficient either to move the project in positive territory;
  - a 25% rise of the price of oil to $1.13/litre with respect to the base case of $0.90/litre would lead to small but positive IRRs, although the NPV at 4% discount would still be negative;
  - the relatively unlikely combination of a 20% reduction of capital expenditure and of a 25% increase in the price of oil would however produce relatively good IRRs and NPVs.
- It is only under the assumption that other mining projects of a similar magnitude are undertaken and remain in activity after the announced closure years of Meliadine and Kiggavik that positive IRRs and NPVs are obtained; the sensitivity analysis also indicates the following in the case of long term mining sector clients:

- the base case gives positive IRRs but the NPV is significant only for the Coastal-Inland scenario;
- a price of $0.07/kWh for electricity instead of $0.08/kWh improves IRRs by about 1%, while a price of $0.09/kWh reduces IRRs also by about 1%;
- -20% for capital expenditures would mean relatively good IRRs of 6,6% and 9.0% respectively for the two scenarios;
- a 25% increase in the price of oil up to $1.13/litre in 2024/25 and beyond would yield attractive IRRs for both scenarios, but especially for the Coastal-Inland scenario with a 10.2% IRR.

▪ In summary:
  - the economic viability of the project is highly dependent on the continuation of mining operations at a significant scale over the long term;
  - the Coastal and Inland scenario appears more viable than the Coastal scenario because it allows for spreading the investment costs over a larger power demand by the mining sector; however, uncertainty about future mining projects in the Baker Lake area is greater than for the Coastal scenario where the Meliadine gold mine is close to getting the final go ahead signal;
  - the project is highly sensitive to the price of oil and shows attractive returns, if at the time of start-up oil prices return to their mid-2014 level.

6.2.3 Unit cost calculations

Finally, the cost of energy was calculated after including the amortization of capital investment costs for the project. For this an amortization period of 40 years and an interest rate of 4% were used, resulting in annual debt repayments of $33.9M for the Coastal Scenario and of $47.4M for the Coastal and Inland scenario.

When looking at the Coastal and Inland scenario, the unit cost of energy hovers around $0.20 per kilowatt hour purchased, when the Meliadine and Kiggavik mining projects are in activity, but climbs

to $0.36/kwh, once demand from the mines evaporates (

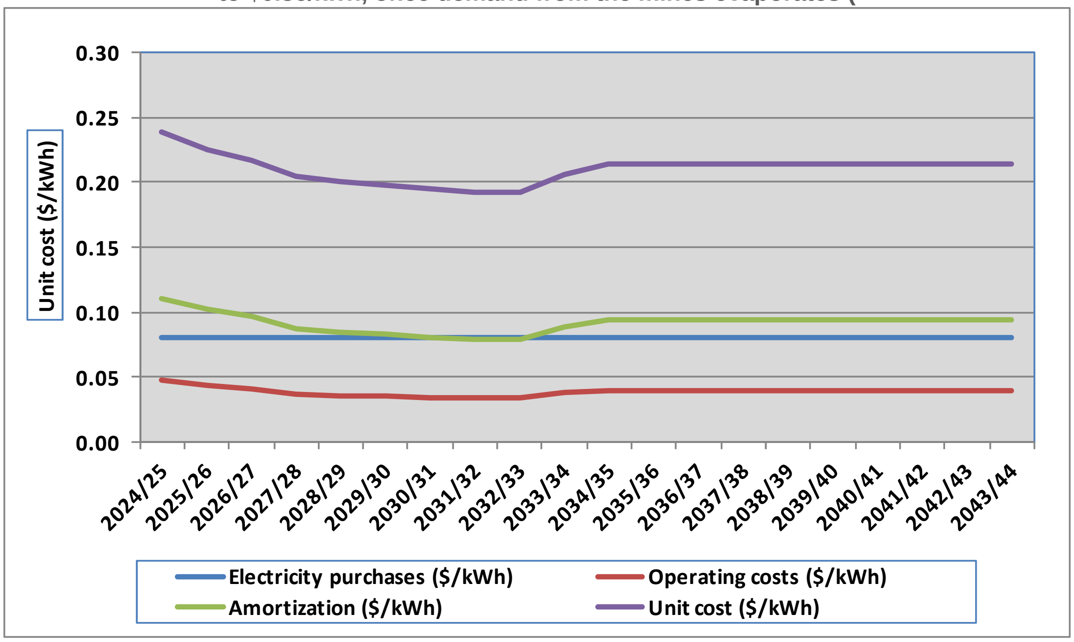


Figure 13). However, should long term mining sector clients effectively materialize, the unit cost of electricity purchased through the transmission system would, according to the assumptions made, remain around $0.20 per kilowatt hour. Estimations of unit costs for the Coastal scenario produced almost identical results and, therefore, are not presented here.

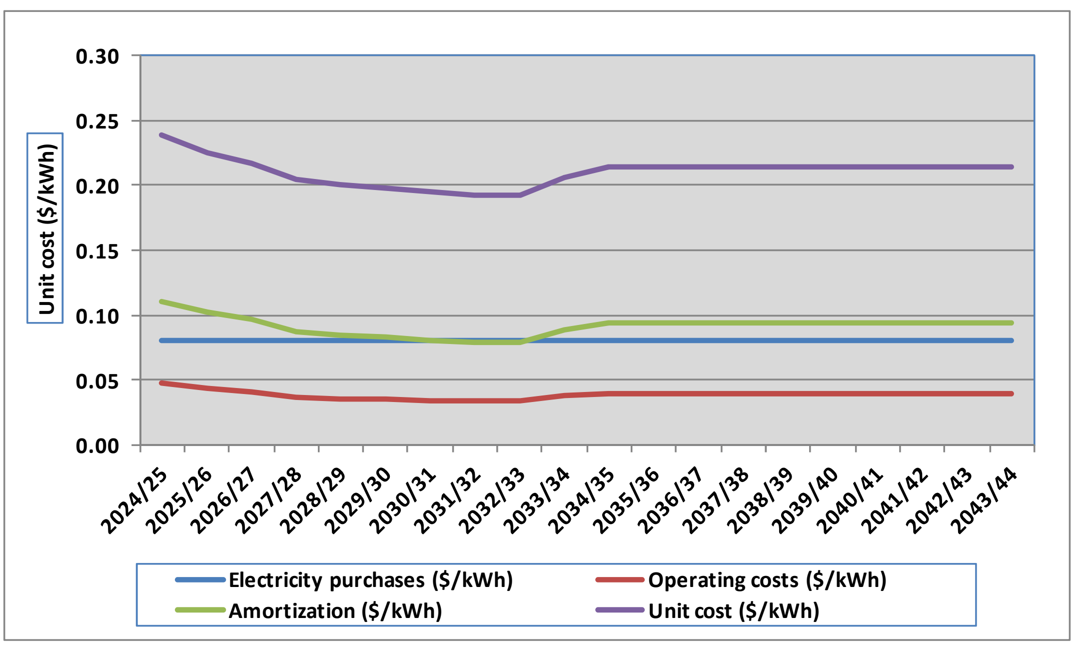


Figure 13: Unit costs per kWh of energy purchased for Coastal-Inland scenario without long term mining clients

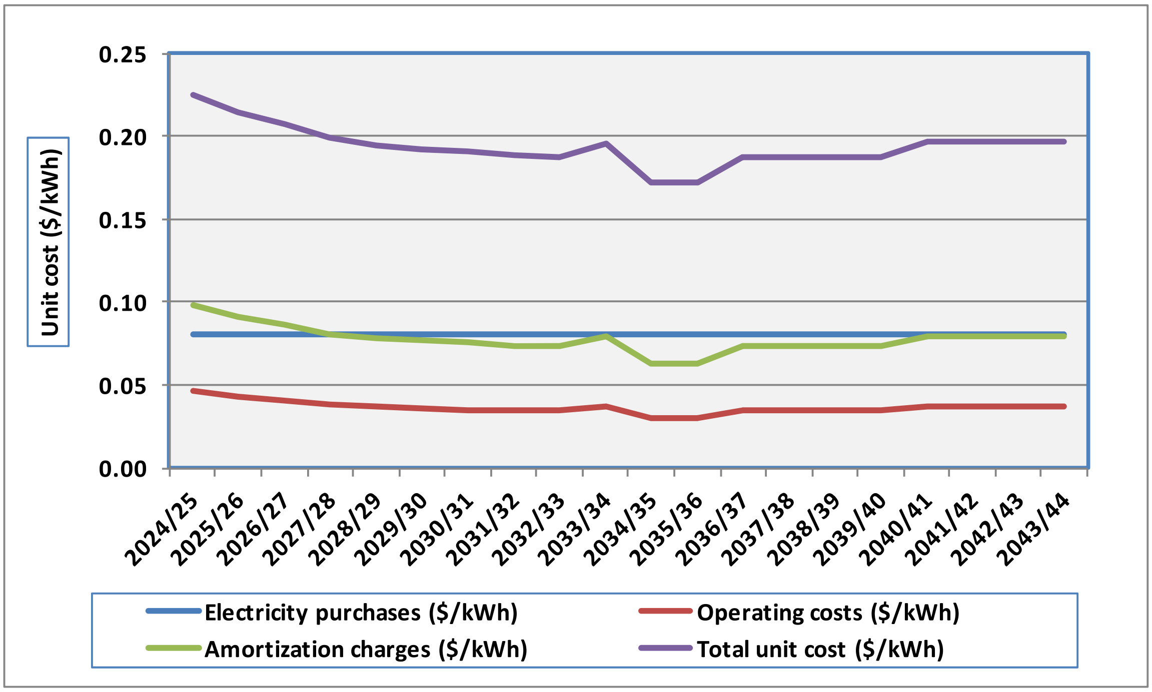


Figure 14: Unit cost per kWh of energy purchased for Coastal-Inland scenario with long term mining clients

Although the amortization parameters used in the unit cost estimations incorporate a large subsidy element, since debt repayment over 40 years and at 4% interest is not representative of market conditions, and by far, the unit cost estimations made are not unrealistic because power infrastructure in Nunavut has been in the past entirely subsidized by the Government of Canada. Furthermore, considering that QEC's cost of generation currently stands at $0.30/kWh for diesel oil only (see Table 4), excluding any capital cost allowance and other associated operating and maintenance costs, the unit costs of electricity purchased through the transmission system appear to be competitive with diesel power generation in the Kivalliq region.

6.3 Economic and social impact

The scoping study was limited in its attempts to identify and analyze the social and economic impacts of the transmission line project. No site visits were made and no detailed social context study was undertaken. Nevertheless, with respect to the economic impact of the project the scoping study notes the following points:

- Although the transmission line project may improve the economics of mining in the Kivalliq region, the extent of this effect is difficult to assess since, other than Meliadine and Kiggavik, no mining project is at a stage of development where the availability of power may be factored into an investment decision;
- In the case of the two advanced stage projects of Meliadine and Kiggavik, their development has not been tied to the construction of the line and they most probably would go ahead even if the transmission line is not built. As a result, the significant economic impacts of these projects in terms of job creation and of local purchases would take place anyway;
- Furthermore, the issue of the selling price of electricity by QEC to the mining companies has been kept out of this scoping study and left for the interested parties to discuss. It is premature therefore to assess the economic impact of an electricity tariff that is still undetermined;
- The direct and indirect economic impacts in terms of jobs and local purchases of the power line would be significant during construction, but relatively limited during the operational phase;
- The direct economic benefits of increased power availability for the population of the Kivalliq hamlets to be interconnected would largely depend on the tariff policy to be implemented by QEC and the Government of Nunavut and the extent to which the population of Kivalliq is offered reduced electricity rates;
- The quality of life in Kivalliq hamlets would be improved with the use of a clean energy source entailing the elimination of fuel odours, fuel spills and combustion fumes; the quality of air would be improved markedly;
- The use of optical power ground wire (OPGW) as a sky wire would allow high-speed fibre optics telecommunications and procure associated benefits to households and businesses;
- The benefits to the Government of Canada would largely correspond to the net value of fossil energy savings, less the cost of its participation to the funding of the infrastructure;
- The benefits to QEC would be very significant in terms of reduced maintenance and operations costs of diesel power plants and generators, reduced investments for the renewal of generation equipment used as reserved capacity;
- The benefits for mining companies would be in the form of net diesel oil savings and of reduced GHG emissions.

Another impact of significant importance is that the he transmission system option is one that allows to minimize several types of risks.

- The most important risk is that of a rise of oil prices that would make power generation and space heating recurrently costlier and lead to larger subsidy payments by the federal government. The oil price risk has to be compared to the limited risk of price increases of the power to be delivered by Manitoba Hydro.

- Although mining sector development is not necessarily dependent on grid supplied power, not building the line creates the risk of missing out on future mining projects that could be attracted by the availability and affordability of electricity; additionally it creates the risk of missing out on supplying clean energy to proposed projects.
- The line also reduces the risks of diesel generation equipment breakdown, since it would only be used as back-up during line outages.

7. THE WAY FORWARD

7.1 Project development

This scoping study is a first step in the development of the project. It has resulted in the definition of a project concept, in a preliminary assessment of its economic viability and in the identification of the regulatory processes and environmental assessment requirements that must be satisfied before undertaking the final design and construction phases. These results form a valid justification and basis to continue with the development of the project

The next steps will consist of conducting a feasibility study and the preliminary environmental studies allowing for the start of the community engagement process and to initiate discussions with the Federal Government and other interested parties regarding the viability and the financing of the project.

Assuming that stakeholders adhere to the project concept and to the process proposed and they express their will to initiate technical studies and the regulatory approval process, the EOWG and the HBRRT will have to present a formal request for assistance to the Federal Government. It is to be decided if the request is to be presented directly by the Government of Nunavut or by Qulliq Energy Corporation, as the future owners of the infrastructure, or by the EOWG and the HBRRT on their behalf. A clarification of the roles of stakeholders may be necessary.

In order to proceed to the next steps, it would be required to prepare in the immediate future a Project Brief or concept paper that would summarize the agreed upon elements of the Scoping Study, the objectives targeted by the project, the activities to be undertaken, the roles and responsibilities of stakeholders, a timeline and preliminary critical path and a budget estimate for the studies to be conducted over the next three to four years up to the design Licensing and Design Phase.

7.2 Potential assistance from CanNor

The BBA team has contacted the Canadian Northern Economic Development Agency (CanNor) to enquire about the economic development programs and the type of assistance it offers for large infrastructure projects of this kind and to groups such as the EWOG and the HBRRT.

The offices that were contacted and their specific roles and type of assistance provided are described below.

Northern Projects Management Office (NPMO)

The NPMO would be a key partner of the project's proponents for the purpose of facilitating the regulatory process. The NPMO was established to improve the environmental review process for proposed major resource development and infrastructure projects in northern Canada. NPMO has a mandate to improve the timeliness, predictability and transparency of northern regulatory processes to foster a more stable and attractive investment climate in the territories. The NPMO

- coordinates federal efforts related to northern regulatory review processes, and publicly tracks the progress of projects;
- provides advice and issues management among federal and territorial governments, industry, regulatory and review boards, Aboriginal groups and communities;
- oversees federal Crown consultations with Aboriginal communities related to the environmental process; and
- works with partners to advance community readiness, helping to maximize the positive socio-economic opportunities of major projects for northern communities.[4]

When contacted, the NPMO Iqaluit representative mentioned that NPMO was ready to work with the EOWG.

Economic Development Section of the CanNor Nunavut Regional Office

CanNor administers a number of programs that could provide financial assistance for conduction feasibility studies and support the work of the EOWG and of the HBRRT. The most appropriate among those programs are:

- Strategic Investments in Northern Economic Development (SINED). The SINED was renewed as part of Canada's Economic Action Plan 2014. The program has been provided with $40 million over two years, starting April 1st, 2014-15. Under SINED's Targeted Investment Program, CanNor works with territorial governments and other key stakeholders to identify potential projects and investment priorities. Enhancing the Economic Infrastructure

[4] Source: http://www.cannor.gc.ca/eng/1370267347392/1386867947473

Base by supporting the planning and development of multi-user physical infrastructure critical to economic growth is one of the major themes of the program under which it provides funding for feasibility studies and for business cases for public-private partnerships.

- Strategic Partnerships Initiative (SPI) The (SPI), led by Aboriginal Affairs and Northern Development Canada, supports Aboriginal participation in the economy, with a particular focus on the forestry, fisheries, mining, energy and agriculture sectors. A key component of the new Federal Framework for Aboriginal Economic Development, SPI enables more than a dozen partnering federal departments and agencies, including CanNor, to provide a co-ordinated federal response to existing and emerging Aboriginal economic development opportunities. SPI builds partnerships among federal departments, Aboriginal communities, provincial and territorial governments and the private sector to help Aboriginal Canadians take advantage of complex market-driven opportunities in key sectors of the economy. The funding for the initiative is intended to fill gaps that cannot be addressed by existing programs.

Again, the Economic Development officer contacted by the BBA team confirmed that CanNor was ready to work with the EOWG and project stakeholders to further its advancement.

7.3 Coordination between stakeholders on electricity pricing and financing issues

The scoping study has left open the issues of how the capital investment would be financed and what QEC's selling price would be for electricity to industrial clients and to customers in the communities. Manitoba Hydro explained what the mechanics of electricity pricing would be and hinted that the selling price would be in a range of $60 to $100 per GWh. The issues of electricity pricing and of project financing are tied together. Therefore, it would help the advancement of the project if stakeholders could somehow establish criteria for their collaboration and positioning on these issues and investigate together the possibility of innovative financing approaches such as Public Private Partnerships or other mechanisms. Some basic understanding on key issues would help to obtain assistance from the Federal Government.

In this respect Recommendation V of the Standing Senate Committee on Energy, the Environment and Natural Resources should be reminded to stakeholders:

> *The committee considered whether the Government of Canada commitment to provide a loan guarantee for the Lower Churchill projects in 2011 could be a model for major territorial energy projecs.iii The three conditions for the federal loan guarantee was that the projects have regional and national significance, economic and financial merit and significantly reduce greenhouse gas emissions in Canada. Federal officials with Natural Resources Canada told the committee that the federal government is open to discussing similar arrangements with territorial proponents if proposed projects carried similar characteristics.*

The loan guarantee for the Lower Churchill projects has further terms and conditions requiring the provinces to put in place regulatory regimes that would recover project costs from electricity ratepayers, thus servicing the debt that was guaranteed. While this may limit some major project proposals in the territories due to small rate bases, the committee believes that terms and conditions for federal loan guarantees must ultimately have financial merit and be paid by ratepayers.[5]

In summary, the Senate Committee identified a federal loan guarantee as one possible funding avenue, but insisted on the conditions attached to it, in particular concerning the financial merit of the projects proposed and the repayment of the guarantee by rate payers through a proper regulatory regime.

The Senate Committee also recommended that the federal government set up an infrastructure program for territorial energy projects that promote cleaner air and reduce GHG emissions, benefits which will be generated on a large scale by the project.

In summary, it appears that the project responds to the funding criteria of the programs and of Northern Development policy makers.

7.4 Scope of the feasibility study

Below is a non-exhaustive list of items that could be included in the Feasibility Study.

Economic component

- Refinement of demand forecasts.
- Socioeconomic survey and assessment of socioeconomic impacts
- Refinement of viability analysis
- Design of a project funding strategy

Technical component

The following design options shall be refined:

- The voltage level of the transmission line
- The transmission line conductor size
- The transmission line layout

Also, the following strategies shall be further developed:

[5] Standing Senate Committee on Energy,the Environment and Natural Resources, Powering Canada's Territories, 41st Parliament, -2nd Session, 2015.

- Analysis of the impact of an islanded network during a failure of the transmission line
- Implementation strategy within the communities in Nunavut
- Implementation strategy of the telecommunication system for the transmission line, as well as within the communities
- Strategy to mitigate the impact of not having the winter road built before the transmission system
- Procurement strategy for major equipment items
- Means of mitigation for the risks identified during all project phases
- Strategy for the operation and maintenance of the transmission line

The following deliverables shall be prepared:

- Layout of the transmission line
- Single-line diagrams of all substations
- Report from communities consultations
- Survey
- Construction strategy

Environmental component

The main goal of the environmental component of the feasibility study is to identify the environmental impacts of the project lifecycle and to reduce those impacts as much as possible. The exact scope of work will need to be clarified based on the role of various stakeholders. Field studies will be performed at this step. An early partnership will be required with communities in both Nunavut and Manitoba.

The environmental component will take place in two phases. Phase 1 (2015-2018) will essentially consist in data gathering for the technical studies (route, habitat, field scoping and access), for Traditional Ecological Knowledge and Inuit Qaujimajatuqangit (IQ/TEK), and the planning of the community engagement process. Phase 2 (2018-2020) would consist in carrying out field studies, community engagement and the preparation of assessments, mitigation strategies and submissions.

7.5 Timeline

It has been determined on the basis of the usual duration of environmental studies and of the normal course of regulatory processes that the timeline for approvals and construction would delay the start-up of the transmission system up to 2024/25, at least nine years from now. This timeline means that the project will potentially miss out on several years of power demand from

Meliadine mining operations due start in 2019 and completely on demand from the Amaruq-Meadowbank extension due to close down in 2022.

It would be of great importance and benefit for the project for stakeholders to define a strategy to accelerate the studies and approval process. In particular, environmental studies should commence within the shortest possible delay.

7.6 Other recommended actions

The following aspects of the project would likely require special attention on the part of the EOWG and other interested parties:

- Strategy to integrate future mines and industries. A mineral sector experts group should be created in order to provide realistic projections on expected developments.
- The collaboration of First Nations, communities and land owners in Manitoba and in Nunavut is essential to ensure the success of this project, as well as establishing a long-term development strategy in this area. The EOWG shall investigate the best ways to involve these groups during all phases of the project, as well as establishing efficient communication channels.
- The scope of work of all involved parties for the feasibility study shall be clarified. Manitoba Hydro is expected to be responsible for the design up to the Nunavut border.
- The winter road will have a significant impact regarding the construction, operation and maintenance of the transmission system. At some point, members of the Hudson Bay Regional Roundtable will play a more significant role in some aspects of these projects. Concerted actions shall continue to be taken to guarantee the success of both projects as well as ensure that the required funding will be available at critical steps in the process.

Appendix A: Detailed Data

Appendix Table 1:
Number of QEC customers and power consumption by customer class and by community

	Number of customers			Energy (GWh)			kWh/customer		
	2012/13	2013/14	2014/15	2012/13	2013/14	2014/15	2012/13	2013/14	2014/15
Arviat									
Commercial–Priv.	50	36	41	1.6	1.7	2.0	31,173	47,326	48,431
Commercial-Public	85	87	86	2.5	2.6	2.6	29,499	29,412	29,766
Housing-Private	219	209	209	1.4	1.4	1.4	6,437	6,744	6,598
Housing-Public	332	375	373	1.9	2.1	2.0	5,832	5,540	5,465
Baker lake									
Commercial–Priv.	76	75	68	2.0	2.1	2.2	26,579	28,035	31,864
Commercial-Public	102	109	110	2.4	2.7	2.6	23,765	24,368	23,385
Housing-Private	196	214	216	1.4	1.4	1.5	6,956	6,449	6,861
Housing-Public	388	425	423	2.3	2.5	2.4	5,875	5,975	5,622
Chesterfield Inlet									
Commercial–Priv.	19	20	21	0.6	0.6	0.6	29,933	30,784	29,404
Commercial-Public	39	36	35	0.6	0.6	0.6	14,442	17,432	17,282
Housing-Private	31	32	32	0.2	0.2	0.2	6,393	6,954	6,493
Housing-Public	81	95	94	0.5	0.5	0.5	6,059	5,297	5,512
Rankin Inlet									
Commercial–Priv.	145	120	131	4.7	4.5	4.6	32,519	37,668	35,287
Commercial-Public	106	117	115	5.8	6.2	6.3	54,565	52,968	54,725
Housing-Private	483	538	534	3.1	3.3	3.4	6,393	6,100	6,300
Housing-Public	342	384	381	2.3	2.3	2.3	6,609	5,991	5,960
Whale Cove									
Commercial–Priv.	12	11	13	0.4	0.4	0.4	31,065	33,225	30,623
Commercial-Public	31	32	35	0.5	0.6	0.7	17,502	19,318	20,097
Housing-Private	27	32	27	0.1	0.2	0.2	5,454	5,609	7,036
Housing-Public	70	87	83	0.5	0.5	0.5	6,936	5,992	5,983
Grand Total									
Commercial–Priv.	302	262	274	9.2	9.3	9.8	30,581	35,526	35,732
Commercial-Public	363	381	381	11.8	12.7	12.7	32,565	33,223	33,422
Housing-Private	956	1,025	1,018	6.2	6.5	6.6	6,492	6,316	6,506
Housing-Public	1,213	1,366	1,354	7.5	7.9	7.7	6,144	5,814	5,689
Total Customers	**2,834**	**3,034**	**3,027**	**34.7**	**36.4**	**36.8**	**12,249**	**11,991**	**12,174**

Source: Qulliq Energy Corporation

Appendix Table 2:
Volume and price per litre of Heating Oil sold by PPD. Volume of Diesel Fuel purchased by QEC

Hamlet	Year	Heating Oil		Diesel fuel used for power generation
		Volume (litres)	$/litre	
Arviat	2008-2009	2,849,376	$1.20	
	2009-2010	2,630,206	$1.20	2,042,908
	2010-2011	2,701,302	$1.17	1,801,648
	2011-2012	3,168,423	$1.14	2,161,297
	2012-2013	2,974,762	$1.12	2,570,716
	2013-2014	3,303,271		2,100,987
Baker Lake	2008-2009	3,522,278	$1.21	
	2009-2010	3,565,419	$1.21	2,072,064
	2010-2011	3,724,369	$1.18	2,103,027
	2011-2012	3,994,930	$1.15	2,300,576
	2012-2013	4,111,868	$1.13	2,158,809
	2013-2014	3,819,490		2,344,692
Chesterfield Inlet	2008-2009	795,223	$1.20	
	2009-2010	812,991	$1.20	665,251
	2010-2011	784,553	$1.17	545,079
	2011-2012	857,432	$1.14	606,618
	2012-2013	821,747	$1.11	463,240
	2013-2014	899,384		664,950
Rankin Inlet	2008-2009	4,686,956	$1.20	
	2009-2010	4,828,498	$1.20	3,992,296
	2010-2011	4,990,918	$1.17	4,237,866
	2011-2012	6,539,177	$1.14	4,385,939
	2012-2013	5,598,152	$1.11	4,818,641
	2013-2014	5,767,699		4,376,841
Whale Cove	2008-2009	606,326	$1.20	
	2009-2010	647,057	$1.18	536,652
	2010-2011	611,745	$1.16	598,334
	2011-2012	717,617	$1.13	482,816
	2012-2013	688,478	$1.10	187,570
	2013-2014	719,583		449,052

Hamlet	Year	Heating Oil		Diesel fuel used for power generation
		Volume (litres)	$/litre	
5 Kivalliq Hamlets	2008-2009	12,460,160	$1.21	
	2009-2010	12,484,171	$1.20	9,309,171
	2010-2011	12,812,887	$1.17	9,285,954
	2011-2012	15,277,579	$1.14	9,937,246
	2012-2013	14,195,007	$1.12	10,198,976
	2013-2014	14,509,427		9,936,522

Source: Energy Secretariat and Petroleum Products Division

Appendix Table 3:
Diesel fuel used for power generation and costs per kilowatt hour.

	FY2010/11	FY2011/12	FY2012/13	FY2013/14	FY2014/15
Arviat					
Diesel fuel used (litres)	2,084,282	2,147,693	2,159,135	2,200,632	2,520,031
Energy produced (kWh)	7,660,284	8,134,213	8,028,691	8,107,968	8,852,004
Litres per kWh	0.272	0.264	0.269	0.271	0.285
Cost of fuel $	$1,709,111	$2,190,647	$2,288,683	$2,266,651	$2,721,633
Cost of fuel per litre	$0.82	$1.02	$1.06	$1.03	$1.08
Cost of fuel per kWh	$0.22	$0.27	$0.29	$0.28	$0.31
Baker lake					
Diesel fuel used (litres)	2,157,129	2,323,232	2,312,481	2,403,679	2,390,720
Energy produced (kWh)	8,255,114	8,879,899	8,921,435	9,072,142	8,949,600
Litres per kWh	0.261	0.262	0.259	0.265	0.267
Cost of fuel	$2,308,128	$2,462,626	$2,428,105	$2,595,973	$2,773,235
Cost of fuel per litre	$1.07	$1.06	$1.05	$1.08	$1.16
Cost of fuel per kWh	$0.28	$0.28	$0.27	$0.29	$0.31
Chesterfield Inlet					
Diesel fuel used (litres)	597,268	551,593	565,326	611,653	628,116
Energy produced (kWh)	1,843,146	1,930,650	2,002,200	2,110,200	2,076,600
Litres per kWh	0.324	0.286	0.282	0.290	0.302
Cost of fuel	$645,049	$623,300	$604,899	$703,401	$753,739
Cost of fuel per litre	$1.08	$1.13	$1.07	$1.15	$1.20
Cost of fuel per kWh	$0.35	$0.32	$0.30	$0.33	$0.36
Rankin Inlet					
Diesel fuel used (litres)	4,237,407	4,410,575	4,617,561	4,699,312	4,760,405
Energy produced (kWh)	15,693,893	16,708,536	17,396,062	17,725,772	17,777,180
Litres per kWh	0.270	0.264	0.265	0.265	0.268
Cost of fuel	$3,517,048	$4,278,258	$4,894,615	$4,793,298	$5,093,633
Cost of fuel per litre	$0.83	$0.97	$1.06	$1.02	$1.07
Cost of fuel per kWh	$0.22	$0.26	$0.28	$0.27	$0.29
Whale Cove					
Diesel fuel used (litres)	547,491	529,687	565,326	513,968	539,547
Energy produced (kWh)	1,805,219	1,954,548	1,753,236	1,822,591	1,975,320
Litres per kWh	0.303	0.271	0.322	0.282	0.273
Cost of fuel	$487,267	$550,874	$604,899	$421,454	$609,688
Cost of fuel per litre	$0.89	$1.04	$1.07	$0.82	$1.13
Cost of fuel per kWh	$0.27	$0.28	$0.35	$0.23	$0.31

	FY2010/11	FY2011/12	FY2012/13	FY2013/14	FY2014/15
Grand Total					
Diesel fuel used (litres)	9,623,577	9,962,780	10,219,829	10,429,244	10,838,819
Energy produced (kWh)	35,257,656	37,607,846	38,101,624	38,838,673	39,630,704
Litres per kWh	0.273	0.265	0.268	0.269	0.273
Cost of fuel	$8,666,604	$10,105,705	$10,821,200	$10,780,777	$11,951,929
Cost of fuel per litre	$0.90	$1.01	$1.06	$1.03	$1.10
Cost of fuel per kWh	$0.25	$0.27	$0.28	$0.28	$0.30

Source: Qulliq Energy Corporation

Appendix Table 4: Power demand forecasts for Coastal and Inland Communities

		Coastal Hamlets Power Demand														Inland Power Demand								Kivalliq Total	
		Coastal Hamlets Energy (GWh)					Coastal Peak load (MW)					Meliadine Mine		Coast Total		Baker Lake Hamlet		Kiggaviq Mine		Meadowbank Mine		Inland Total			
Year	Fiscal Year	Arviat	Rankin Inlet	Whale Cove	Chest-erfield Inlet	**Total Coastal**	Arviat	Rankin Inlet	Whale Cove	Chester-field Inlet	**Total Coastal**	Energy GWh	Peak load MW	Energy GWh	Peak load MW	Energy GWh	Peak load MW	Energy MWh	Peak load MW	Energy GWh	Peak load MW	Energy GWh	Peak load MW	**Energy GWh**	**Peak load MW**
-4	2019/20	9.8	19.7	2.1	2.3	**34.0**	1.9	3.7	0.4	0.4	**6.5**	215.4	24.6	249.4	**31.1**	10.6	2.0	0.0	0.0	33.5	15.5	44.0	17.5	**293.4**	**48.6**
-3	2020/21	10.0	20.0	2.2	2.4	**34.6**	1.9	3.8	0.4	0.5	**6.6**	214.8	24.5	249.4	**31.1**	10.7	2.0	0.0	0.0	135.8	15.5	146.5	17.5	**395.9**	**48.6**
-2	2021/22	10.3	20.3	2.2	2.4	**35.2**	2.0	3.9	0.4	0.5	**6.7**	213.7	24.4	248.8	**31.1**	10.9	2.1	0.0	0.0	135.8	15.5	146.7	17.6	**395.5**	**48.7**
-1	2022/23	10.5	20.6	2.3	2.4	**35.7**	2.0	3.9	0.4	0.5	**6.8**	252.0	28.8	287.8	**35.6**	11.0	2.1	0.0	0.0	100.4	15.5	111.5	17.6	**399.2**	**53.2**
0	2023/24	10.7	20.9	2.3	2.5	**36.3**	2.0	4.0	0.4	0.5	**6.9**	250.7	28.6	287.0	**35.5**	11.2	2.1	0.0	0.0	0.0	0.0	11.2	2.1	**298.2**	**37.7**
1	2024/25	18.8	34.6	3.9	4.2	**61.6**	3.6	6.6	0.7	0.8	**11.7**	244.2	27.9	305.7	**39.6**	19.6	3.7	156.0	20.8	0.0	0.0	175.6	24.5	**481.3**	**64.1**
2	2025/26	29.2	52.2	5.9	6.5	**93.8**	5.6	9.9	1.1	1.2	**17.9**	238.4	27.2	332.3	**45.1**	30.3	5.8	156.0	20.8	0.0	0.0	186.3	26.6	**518.6**	**71.6**
3	2026/27	36.0	63.4	7.2	7.9	**114.4**	6.8	12.1	1.4	1.5	**21.8**	238.4	27.2	352.9	**49.0**	37.1	7.1	156.0	20.8	0.0	0.0	193.1	27.9	**546.0**	**76.8**
4	2027/28	42.9	74.8	8.5	9.4	**135.6**	8.2	14.2	1.6	1.8	**25.8**	250.7	28.6	386.3	**54.4**	44.0	8.4	156.0	20.8	0.0	0.0	200.0	29.2	**586.3**	**83.6**
5	2028/29	48.0	83.0	9.4	10.4	**150.9**	9.1	15.8	1.8	2.0	**28.7**	250.7	28.6	401.6	**57.3**	49.0	9.3	156.0	20.8	0.0	0.0	205.0	30.1	**606.5**	**87.4**
6	2029/30	50.9	87.7	10.0	11.1	**159.7**	9.7	16.7	1.9	2.1	**30.4**	250.7	28.6	410.3	**59.0**	51.8	9.8	156.0	20.8	0.0	0.0	207.8	30.6	**618.1**	**89.6**
7	2030/31	53.9	92.5	10.6	11.7	**168.7**	10.2	17.6	2.0	2.2	**32.1**	250.7	28.6	419.3	**60.7**	54.6	10.4	156.0	20.8	0.0	0.0	210.6	31.2	**629.9**	**91.9**
8	2031/32	56.9	97.4	11.2	12.3	**177.8**	10.8	18.5	2.1	2.3	**33.8**	250.7	28.6	428.5	**62.4**	57.5	10.9	156.0	20.8	0.0	0.0	213.5	31.7	**642.0**	**94.2**
9	2032/33	57.8	98.7	11.3	12.5	**180.3**	11.0	18.8	2.2	2.4	**34.3**	250.7	28.6	430.9	**62.9**	58.3	11.1	156.0	20.8	0.0	0.0	214.3	31.9	**645.2**	**94.8**
10	2033/34	58.7	100.0	11.5	12.6	**182.8**	11.2	19.0	2.2	2.4	**34.8**	201.4	23.0	384.1	**57.8**	59.0	11.2	156.0	20.8	0.0	0.0	215.0	32.0	**599.1**	**89.8**
11	2034/35	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**	0.0	0.0	185.3	**35.3**	59.7	11.4	156.0	20.8	0.0	0.0	215.7	32.2	**401.0**	**67.4**
12	2035/36	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**	0.0	0.0	185.3	**35.3**	59.7	11.4	156.0	20.8			215.7	32.2	**401.0**	**67.4**
13	2036/37	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**	0.0	0.0	185.3	**35.3**	59.7	11.4	52.0	6.9			111.7	18.3	**297.0**	**53.5**
14	2037/38	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4	52.0	6.9			111.7	18.3	**297.0**	**53.5**
15	2038/39	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4	52.0	6.9			111.7	18.3	**297.0**	**53.5**
16	2039/40	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4	52.0	6.9			111.7	18.3	**297.0**	**53.5**
17	2040/41	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4	0.0	0.0			59.7	11.4	**245.0**	**46.6**
18	2041/42	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4	0.0	0.0			59.7	11.4	**245.0**	**46.6**
19	2042/43	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4	0.0	0.0			59.7	11.4	**245.0**	**46.6**
20	2043/44	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4	0.0	0.0			59.7	11.4	**245.0**	**46.6**
21	2044/45	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**
22	2045/46	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**
23	2046/47	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**
24	2047/48	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**
25	2048/49	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**
26	2049/50	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**
27	2050/51	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**
28	2051/52	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**
29	2052/53	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**
30	2053/54	59.6	101.3	11.7	12.8	**185.3**	11.3	19.3	2.2	2.4	**35.3**			185.3	**35.3**	59.7	11.4					59.7	11.4	**245.0**	**46.6**

Appendix Table 5: Forecasts of volume and value of heating oil savings and of diesel fuel and other power generation savings

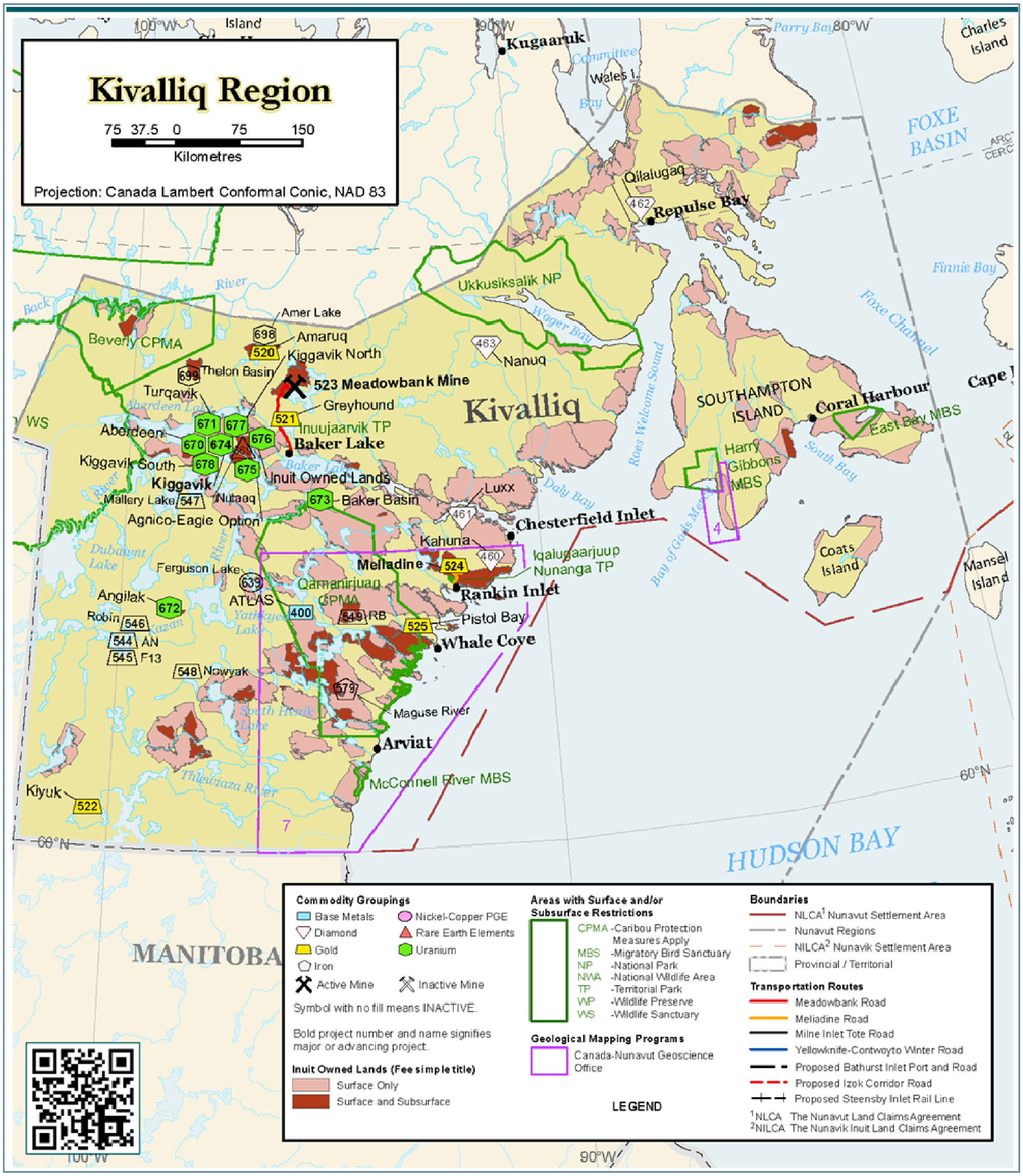
		Volume and Value of Heating Oil Saved											Volume and Value of Diesel Oil and other savings by QEC											Total Savings		
		Volume of Heating oil saved (million litres)							Value of Heating oil saved ($ M)				Volume of Diesel oil Saved (million litres)							Value of savings ($ M)						
Year	Fiscal Year	Arviat	Rankin Inlet	Whale Cove	Chest-erfield Inlet	Total Volume Coastal	Baker Lake	5 communities	Average cost per litre	Total Cost Coastal	Baker Lake	5 communities	Arviat	Rankin Inlet	Whale Cove	Chest-erfield Inlet	Total Coastal	Baker Lake	5 communities	Average cost per litre	Total Cost Coastal	Baker Lake	5 communities	Total Cost Coastal	Baker Lake	Total Savings
-4	2019/20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0.0	0	0.0	0.0	0	0.0
-3	2020/21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0.0	0	0.0	0.0	0	0.0
-2	2021/22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0.0	0	0.0	0.0	0	0.0
-1	2022/23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0.0	0	0.0	0.0	0	0.0
0	2023/24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0.0	0	0.0	0.0	0	0.0
1	2024/25	0.8	1.4	0.2	0.2	2.6	0.9	3.5	1.00	2.6	0.9	3.5	2.9	5.7	0.6	0.7	10.0	3.1	13.1	0.96	11.0	3.5	14.5	13.5	4.4	18.0
2	2025/26	1.9	3.1	0.4	0.5	5.8	2.1	7.9	1.01	5.9	2.1	8.0	3.0	5.8	0.7	0.7	10.2	3.2	13.4	0.96	11.2	3.6	14.8	17.1	5.7	22.8
3	2026/27	2.5	4.2	0.5	0.6	7.9	2.8	10.7	1.02	8.0	2.9	10.9	3.1	5.9	0.7	0.7	10.3	3.2	13.6	0.97	11.5	3.7	15.2	19.5	6.6	26.1
4	2027/28	3.2	5.3	0.7	0.8	10.1	3.6	13.7	1.03	10.3	3.7	14.0	3.1	6.0	0.7	0.7	10.5	3.3	13.8	0.97	11.7	3.8	15.5	22.0	7.5	29.5
5	2028/29	3.7	6.1	0.8	0.9	11.6	4.1	15.7	1.03	11.9	4.3	16.2	3.2	6.1	0.7	0.7	10.7	3.3	14.0	0.97	12.0	3.9	15.9	23.9	8.2	32.1
6	2029/30	4.0	6.6	0.8	1.0	12.4	4.4	16.9	1.04	12.9	4.7	17.6	3.2	6.2	0.7	0.7	10.8	3.4	14.2	0.98	12.3	3.9	16.2	25.2	8.6	33.7
7	2030/31	4.3	7.0	0.9	1.1	13.3	4.7	18.0	1.05	13.9	5.0	18.9	3.3	6.2	0.7	0.7	11.0	3.4	14.4	0.98	12.5	4.0	16.5	26.4	9.0	35.4
8	2031/32	4.6	7.5	0.9	1.1	14.2	5.0	19.2	1.06	15.0	5.4	20.4	3.3	6.3	0.7	0.7	11.1	3.5	14.6	0.99	12.8	4.1	16.8	27.7	9.5	37.2
9	2032/33	4.7	7.6	1.0	1.2	14.4	5.1	19.5	1.07	15.3	5.5	20.8	3.4	6.4	0.7	0.8	11.3	3.5	14.8	0.99	13.0	4.1	17.2	28.3	9.6	38.0
10	2033/34	4.8	7.7	1.0	1.2	14.6	5.2	19.8	1.08	15.6	5.6	21.2	3.4	6.5	0.7	0.8	11.4	3.5	14.9	1.00	13.3	4.2	17.5	28.9	9.8	38.7
11	2034/35	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.08	16.0	5.7	21.7	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.00	13.5	4.3	17.8	29.5	10.0	39.5
12	2035/36	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.09	16.1	5.8	21.9	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.00	13.6	4.3	17.9	29.7	10.1	39.8
13	2036/37	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.10	16.2	5.8	22.1	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.7	4.4	18.0	29.9	10.2	40.1
14	2037/38	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.11	16.4	5.8	22.2	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.7	4.4	18.1	30.1	10.2	40.4
15	2038/39	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
16	2039/40	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
17	2040/41	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
18	2041/42	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
19	2042/43	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
20	2043/44	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
21	2044/45	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
22	2045/46	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
23	2046/47	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
24	2047/48	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
25	2048/49	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
26	2049/50	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
27	2050/51	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
28	2051/52	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
29	2052/53	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6
30	2053/54	4.8	7.8	1.0	1.2	14.8	5.2	20.0	1.12	16.5	5.9	22.4	3.4	6.6	0.8	0.8	11.6	3.6	15.1	1.01	13.8	4.4	18.2	30.3	10.3	40.6

Appendix B: Mineral Exploration and Mining Activity in the Kivalliq Region

List of Kivalliq Mineral Exploration and Mining Projects

Number	Project	Operator	Status
BASE METALS			
400	ATLAS	Anconia Resources Corp.	Active
DIAMONDS			
460	Kahuna	Dunnedin Ventures Inc.	Active
461, 462	Luxx, Qilalugaq	North Arrow Minerals Inc.	Active
463	Nanuq	Peregrine Diamonds Ltd.	Active
GOLD			
520	Amaruq	Agnico Eagle Mines Limited	Active
521	Greyhound	Aura Silver Resources Inc.	Active
522	Kiyuk	Prosperity Goldfields Corp.	Active
523	**Meadowbank Mine**	**Agnico Eagle Mines Limited**	**Active**
524	**Meliadine**	**Agnico Eagle Mines Limited**	**Active**
525	Pistol Bay	Northquest Ltd.	Active
544 – 546	Angikuni Lake (AN – 544, F13 – 545, Robin – 546)	Adamera Minerals Corp.	Inactive
547	Mallery Lake	Adamera Minerals Corp.	Inactive
548	Nowyak	Adamera Minerals Corp.	Inactive
549	RB	Anconia Resources Corp.	Inactive
IRON			
579	Maguse River	Ridgemont Iron Ore Corp.	Inactive
NICKEL-COPPER-PGE			
639	Ferguson Lake	Canadian North Res. and Dev. Co.	Inactive
RARE EARTH ELEMENTS			
669	Nutaaq	Forum Uranium Corp.	Inactive
URANIUM			
670, 671	Aberdeen, Turqavik	Cameco Corporation	Active
672	Angilak	Kivalliq Energy Corporation	Active
673	Baker Basin	Kivalliq Energy Corporation	Active
674	**Kiggavik**	**AREVA Resources Canada Inc.**	**Active**
675 – 678	North Thelon (Agnico Eagle Option – 675, Inuit Owned Lands – 676, Kiggavik North – 677, Kiggavik – 678)	Forum Uranium Corp.	Active
698	Amer Lake	Adamera Minerals Corp.	Inactive
699	Thelon Basin	NexGen Energy Ltd.	Inactive

Map of Kivalliq Mineral Exploration and Mining Projects



Appendix C: Technical parameters

This Appendix presents some technical assumptions and justifications for some of the design decisions used in this report.

Voltage Level

The current Investment Justification considers a 230 kV voltage level for the transmission system. Based on the updated load forecast, a lower voltage level such as 138 kV would not likely be able to support the load growth in the Kivalliq region. The consideration of 230 kV remains restrictive for the economic analysis, as the ultimate mining development in the region is unknown and the currently identified load is below 80 MW. However, a 138 kV line would already not be suitable for the identified load growth. A 138 kV transmission line is expected to supply up to approximately 40-50 MVA, while the 230 kV would be able to reach up to 140-150 MVA. As the cost of a 230 kV line is not significantly higher than the 138 kV line compared to the increase of power transfer capability, the 230 kV line is expected to be more suitable for power delivery above 40-50 MW. The feasibility study might wish to review the transmission line parameters and investigate other voltages.

Preliminary evaluation from Manitoba Hydro suggests that the existing line feeding Churchill could supply power to Nunavut up to 80-100 MW, which is more that the currently identified load forecast.

Line Reliability

Even though the new line would be located in an area of low lightning occurrence, it would still require a sky wire to maximize line reliability. Using an optical power ground wire (OPGW) as a sky wire would allow bringing fibre optic communication to the communities and mines. Fibre optics have very high speed capability and can handle a wide variety of business, tele-education and tele-medicine applications, beyond what is needed for the operation of the power line.

The design shall take into consideration the environmental conditions to maximise the system reliability. For example, the transmission line design parameters such as high-speed single pole switching, line transposition, ground wire, counterpoise and low tower footing resistance could be considered. The existing transmission line between Gillam and Churchill is not equipped with a ground wire and counterpoise and the tower footing resistance is relatively high, which decreases the reliability of the system. The feasibility study could evaluate possible improvements to the Manitoba Hydro existing network in order to increase the system reliability..

Line Structure

Along the transmission line’s proposed routing, the bedrock is expected to be close to the surface and most of the routing is in permafrost. Under these conditions, steel structures become more economical than wooden poles as they allow longer span length. For northern conditions, Manitoba Hydro generally uses lattice or tubular single tower structures with guy wires. Across

Canada, the life expectancy of a steel structure can be more than 80 years whereas it is usually considered 40-50 years for wooden poles. The feasibility study could refine the transmission line life expectancy based on specific design criteria.

Substations

In order to transfer power over a long transmission line, compensation will be required inside the substations. Reactive power compensation will also be required at the substations near the mines to mitigate the impact of a low short-circuit level that is not suitable for the mines loads. The Arviat substation is required for the technical performance of the transmission system. It includes switching reactors that are considered in the cost estimate to mitigate the impact of an operation at low load.

Local distribution

The communities that are expected to be connected to the transmission system presently have a local distribution network at 4.16 kV. An intermediate network between the transmission line substations and the existing systems will be required. Based on preliminary distances and load forecast, both 34.5 kV and 69 kV intermediate systems are assumed. The feasibility study should address whether the distribution systems inside the communities should remain at 4.16 kV or if they should gradually be converted to a higher voltage level. QEC is expected to play a major role in the elaboration of this strategy.

For Whale Cove, an alternate to building a 155 km long 34.5 kV line from the Rankin Inlet substation would be to use power potential transformers on the 230 kV transmission line on the nearest location from Whale Cove. This would prevent the extension of a 34.5 kV line up to Rankin Inlet substation. This could reduce the overall cot and could be analysed in the feasibility study.

The optimal transmission lines configuration for the first 45 km from Rankin Inlet should be further reviewed. The cost estimate considers two transmission lines in parallel, which is a conservative scenario adapted to the proposed multi-step approach. A more adapted scenario will likely be presented in the feasibility study, based on more precise transmission line routing and forecasted loads.

Appendix D: Map sources and disclaimers

CanNorth has exercised all reasonable care in the compilation, interpretation, and production of the map figures contained in this document. However, it is not possible to warrant or guarantee the accuracy, precision, currency, suitability, or reliability of any of the displayed or underlying data contained in the figures. Therefore, these are presented for reference and/or illustrative purposes; they are neither intended for legal delineation of any geographic feature nor for navigational use. The user must accept the data "as is" and CanNorth assumes no responsibility for loss or damage incurred as a result of any user reliance on this data.

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PLANNED WINTER ROAD
POWER LINES
230 kV
138 kV OR 230 kV
69 kV
34.5 kV
MEADOWBANK
95 km
BAKER LAKE SUBSTATION
BAKER LAKE
85 km
KIGGAVIK
6 km
235 km
90 km
CHESTERFIELD INLET
6 km
45 km
MELIADINE
TERMINAL SUBSTATION
30 km
RANKIN INLET
155 km
WHALE COVE
220 km
ARVIAT SUBSTATION
30 km
ARVIAT
175 km (FROM BORDER)
MB-NU BORDER
175 km (TO BORDER)
138 kV INTERCONNECTION LINE 25 km
CHURCHILL
CHURCHILL NEW SUBSTATION
NEW LINE ROUTE 270 km
ALTERNATIVE NEW LINE ROUTE (ADJACENT TO EXISTING LINE) 300 km
GILLAM

Schedule B. Proposed Kivalliq Mobile Caribou Conservation Measures

Mobile Caribou Conservation Measures for the Kivalliq Region, Nunavut

Draft report for Kivalliq Inuit Association

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12 November 2015

Executive Summary

Mobile caribou conservation measures are a flexible tool that can be used to reduce mining and exploration-related disturbance to caribou. Mobile measures 'travel with' the caribou, providing greater adaptability for protection and safeguarding caribou without unnecessary restrictions on land use activities. Here we propose Mobile Caribou Conservation Measures for use in the Kivalliq Region, Nunavut, to adaptively mitigate effects of industrial exploration on migratory barren-ground caribou. Mobile Caribou Conservation Measures, as have been called for in the past, link monitoring and site-specific mitigation with the susceptibility of caribou to disturbance, which varies seasonally. This seasonal variation in susceptibility coupled with period of exposure helps determine vulnerability and risk to caribou. For land and wildlife managers, understanding the likelihood of caribou encountering industrial exploration activities and experiencing negative effects from exposure to those activities is necessary to effectively manage disturbance to caribou without unnecessarily limiting economic development. The objectives of these proposed Mobile Caribou Conservation Measures are to reduce encounters and exposure of the caribou to disturbance and other impacts through avoiding and minimizing effects during industrial exploration activities. These proposed mobile measures can be implemented in concert with protected areas, and can also provide conservation of caribou regardless of distribution or season.

Mobile Caribou Conservation Measures are a rules-based approach with three main components:

(i) Agreed-upon areas within which monitoring and mitigation is directed. These areas give predictability to the land-user and land-manager as to when caribou may encounter a site;
(ii) When caribou actually encounter the site is determined through monitoring of distribution and movements to trigger the mitigation actions; and
(iii) The mitigation actions that apply to the land use operation are to avoid or minimize (reduce) effects on caribou.

An outline to the development and application of these mobile Measures is:

1. Develop least risk timing windows for caribou based on seasonal difference in the predictability of caribou encounters, susceptibility and behaviour;
2. Identify seasonal Caribou Conservation Areas through collaborative mapping. These areas provide predictability as to where and when caribou are expected to occur;
3. Surveillance for caribou operates within three concentric zones, which are a hierarchy of increasing surveillance effort. The sizes of the zones are scaled to risk category as well as season, (speed and direction of movements vary seasonally);
4. Government and land use operator will establish monitoring and surveillance requirements for a proposed operation. The responsibility for monitoring will be with the operator. The monitoring may include aerial or ground-based (locally-hired) monitoring. The territorial government may provide caribou collar locations. The frequency of the monitoring influences the intensity of the mitigation – infrequent monitoring may require more intensive mitigation;

5. The mitigation thresholds or triggers will be based on season and area (susceptibility), and numbers and proximity of caribou to the operation, including monitoring thresholds for when mitigations will be stepped up or down;
6. Apply the hierarchy of mitigation — avoidance followed by minimization — to reduce encounters and exposure of caribou to operations to decrease sensory disturbance and risk of injury and death; and
7. The mobile Measures can be applied during all seasons, traditional migratory routes and water crossings.

List of acronyms

BQCMB	Beverly and Qamanirjuaq Caribou Management Board
CCA	Caribou Conservation Area
CPM	Caribou Protection Measures
DIAND	Department of Indian Affairs and Northern Development
DOE-GN	Department of Environment, Government of Nunavut
IQ	Inuit Qaujimajatuqangit
KivIA	Kivalliq Inuit Association
KRLUP	Keewatin Regional Land Use Plan
MCCM	Mobile Caribou Conservation Measures
MVEIRB	Mackenzie Valley Environmental Impact Review Board
NIRB	Nunavut Impact Review Board
NLUP	Nunavut Land Use Plan
NPC	Nunavut Planning Commission
ZOI	Zone of Influence

Table of Contents

Introduction

Maintaining the integrity of seasonal migrations and habitat are an essential part of conserving migratory barren-ground caribou (*Rangifer tarandus groenlandicus*). Globally, many migratory mammals are struggling as agriculture and development encroach on their seasonal habitats and interrupt migration corridors (Berger 2004). For land and wildlife managers, understanding the likelihood of caribou encountering industrial exploration activities and experiencing negative effects from exposure to those activities is necessary to effectively conserve caribou without unnecessarily limiting economic development. It is also necessary to consider the susceptibility of caribou, which varies seasonally, during encounters and periods of exposure to exploration activities to determine the risk to caribou.

In this paper we propose Mobile Caribou Conservation Measures as a conservation tool to help protect caribou within the Kivalliq Region. We define Mobile Caribou Conservation Measures as those necessary to protect and minimize effects on caribou when exposed to human disturbance through linking monitoring with site-specific mitigation. We propose risk timing categories to identify when monitoring and mitigation should be intensified. The Mobile Caribou Conservation Measures detailed here provide examples of mitigation options, but recognizes that further operational details can be developed after collaborative refinements to the framework from industry, government, Elders, regional Inuit organizations, Hunters and Trappers Organizations and other interested parties. Mobile Caribou Conservation Measures have the advantage that they will accommodate trends in caribou distribution such as the change in size and location of fall and winter ranges as herd size changes. Additionally, the Mobile Measures accommodate unusual years; for example when the Qamanirjuaq herd calved outside the Caribou Protection Area after the unusual 2004–05 winter with severe icing in the fall, which influenced caribou movements and delaying some cows from reaching the calving ground (Gunn et al. 2007).

The Nunavut Planning Commission (NPC) has proposed a Draft Nunavut Land Use Plan (NLUP; NPC 2014) that provides categories of land designation, including a Protected Area Land Use Designation for core calving and post-calving habitat. The Mobile Caribou Conservation Measures proposed here are designed to conserve caribou use of seasonal ranges, whereas Protected Area designations can be used to conserve caribou habitat. Mobile Caribou Conservation Measures can work in concert with and provide additional buffer to Protected Areas, but can also provide conservation of caribou regardless of distribution or season.

Background

A key step in conserving migratory wildlife is to recognize which seasonal habitats and migratory corridors are important even if they are relatively small areas and/or occupied for a short time (Runge et al. 2014). Crucial habitats require special measures within an overall scheme of maintaining the integrity of all seasonal habitats. The susceptibility of caribou to disturbance seasonally changes depending on, for example, the presence of newborn calves, the degree of aggregation and dispersal, and other influences such insect harassment (Table 1). Identifying the least-risk timing windows is used, for example, in northeastern British Columbia for managing development activities relative to caribou and other wildlife (British Columbia Ministry of Environment 2009). Crucial and cautionary risk timing windows cover the time when a species is most susceptible to disturbance, and low risk timing windows are defined when species are less susceptible to disturbance.

Table 1. Summarizing seasons, risk category, timing, relative size and location predictability, and susceptibility of barren-ground caribou to disturbance based on life-history characteristics.

Season	Risk Category	Timing[1]	Relative size and location predictability	Caribou susceptibility and behaviour
Spring migration/ pre-calving	Cautionary	Apr - Jun	Narrow, predictable	Narrow corridors of cows often rapidly moving together with occasional staging in large aggregations
Calving	Crucial	May - Jun	Small area, predictable	High densities of cows at annually lowest part of condition cycle and with newborn calves so the cows are responsive to disturbances
Post-calving/ insect season	Crucial	Jun – Jul	Larger, less predictable	Cows and calves aggregating into large groups and calves susceptible to abandonment and loss from disturbance; aggregations susceptible to disturbance at traditional water crossings
Summer/insect season	Cautionary	Jul - Aug	Larger, less predictable	Cows and calves aggregating into large groups; aggregations susceptible to disturbance at traditional water crossings
Fall migration/ pre-rut	Cautionary	Aug - Sep	Larger, less predictable	Caribou often more dispersed and regaining body condition prior to breeding
Rut	Low	Oct	Smaller, less predictable	Caribou either migrating or staging
Post-rut/fall migration	Low	Nov - Dec	Larger, less predictable	Caribou either migrating or staging
Winter	Low	Dec - Apr	Larger, less predictable	Caribou in aggregations over a large area and less movement

[1] The actual dates differ among herds.

The crucial seasons for barren-ground caribou are calving and post-calving, and migratory pathways including water-crossings are also important. Calving grounds are the smallest seasonal ranges and are occupied by all the cows with their newborn calves of any one herd. During calving, caribou densities are high. Cows are initially dispersed and later start to aggregate into larger groups when the calves are a few days old. The locations of the calving grounds are mostly predictable and largely overlap between years. However, there are occasional larger-scale shifts (Nagy et al. 2011, Gunn et al. 2012) interspersed by decades of annually consistent use. Archaeological sites and knowledge of Inuit elders indicate that many migratory pathways and summer water-crossings have persisted for 100s to1000s of years (Gordon 2005).

In Nunavut, the protection of calving grounds and water-crossings for the Beverly and Qamanirjuaq herds go back to the 1970s when the people of Baker Lake took the government to court over industrial development. The result was DIAND's 1978 Caribou Protection Measures which are area-based measures applied seasonally to separate calving and post-calving caribou from land use activities. DIAND's Caribou Protection Measures have flexibility in that a land use inspector can designate areas that can be opened for land use activity if the caribou do not use the area, and provide protection for the caribou if they calve outside of normal calving areas because blasting, overflights and use of ATVs or snowmobiles are prohibited where caribou are located. The existing Caribou Protection Measures in the Keewatin Regional Land Use Plan (KRLUP) are based on those original Caribou Protection Measures.

Gunn et al. (2007) reviewed the 1978 Beverly and Qamanirjuaq Caribou Protection Measures and determined that, with few exceptions, they generally were effective in separating pre-calving, calving, and early post-calving (to 15 July) caribou from land use activities between 1980 and 2006. The original (DIAND) area-based measures were developed for cumulative calving grounds mapped over decades (within Caribou Protection Areas) for the Beverly and Qamanirjuaq herds. However, one problem is that any mapped protected areas have fixed boundaries which limit their protective role if caribou calve or use the area adjoining, such as if deep snow delays pre-calving migration or caribou altered their movement patterns as their abundance increases or decreases. The earlier DIAND Caribou Protection Measures relied on aerial surveys to map caribou distribution to determine if the boundaries were effective in protecting caribou, but due to the costs the surveys were halted in 1990 (Gunn et al. 2007). A second problem with fixed protected areas with limited monitoring was that large areas were seasonally closed to mineral exploration, which led to different opinions of how to protect caribou without unnecessarily constraining economic development. Wide-ranging consultations in 2000 led to proposed policies for management of human activities on caribou calving grounds (Weihs and Usher 2001). That report recommended an overall approach to managing human activities on caribou calving grounds, including land use planning, mobile caribou protection measures, and additional compliance and enforcement activities. However, the recommendations have not yet been implemented. Our approach to mobile measures addresses a portion of those recommendations.

Recently, the Government of Nunavut's Caribou Strategy Framework (Nunavut Department of Environment, undated) identified calving grounds as a sensitive habitat, and outlined seven action items, with a recommendation to develop and test mobile caribou protection measures based on satellite telemetry (e.g., short term area closures when caribou are in the vicinity) (Nunavut Department of Environment, undated, Action 3.2e). Similarly, the Beverly and Qamanirjuaq Caribou Management Board recommended in 2004 and again in 2014 that the Caribou Protection Measures be updated and improved to increase their effectiveness for protecting caribou, and that mobile caribou protection measures should be considered as part of a system of conservation measures that also includes prohibition of any new exploration and development activities and seasonal shutdown of ongoing exploration and mining activities on calving and post-calving areas (BQCMB 2004, 2014).

One of the original criticisms of the DIAND Caribou Protection Measures was that the Caribou Protection Areas were fixed, and given some mobility of calving and post-calving areas did not always afford effective protection from disturbance (Weihs and Usher 2001). Caribou in other seasons of the year, while not as susceptible as calving and post-calving cows and calves, also require protection to reduce disturbance and subsequent stress and energetic costs to individuals. However, mobile measures have not been yet formalized for caribou. A pilot project testing mobile measures was conducted on the winter range of the Bluenose-East herd in 2009 (Gunn and Poole 2009).

The Nunavut Planning Commission (NPC) proposed Draft Nunavut Land Use Plan (NLUP; NPC 2014) has two categories of land designation, a Protected Area Land Use Designation and a Special Management Area Land Use Designation (Fig. 1). The Protected Area Land Use Designation includes core caribou calving and post-calving areas that prohibits ‘incompatible uses’ (NPC 2014; Schedule A and Table 1 – Site # 47). Prohibited uses within Protected Areas 47 are mineral exploration and production; oil and gas exploration and production; quarries; hydro developments; all-weather roads; and related research. The Protected Areas include National Parks which provide permanent protection to caribou habitat as well as the caribou. In Nunavut, the Lorillard herd calves partially within Ukkusiksalik National Park (Campbell et al. 2012), established in 2003.

Adjacent to the Protected Areas 47 are Special Management Area Land Use Designations (NPC 2014; Schedule A and Table 1 – Site # 48). These areas include core caribou calving and post-calving areas which have been identified for high mineral potential (Fig. 1); it is not clear how protection for habitat will be addressed.

The Kivalliq Inuit Association (KivIA) has queried how the Draft Nunavut Land Use Plan will effectively deal with caribou management and issues at the community and regional scale of land use (KivIA 2013). Concerns include predicting future resource values and land use patterns overlap among proposed land use designations, overall balance among strict conservation areas, special management areas and the mixed use areas, and the balance between mineral exploration and mining as economic drivers, and caribou as a traditional food source.

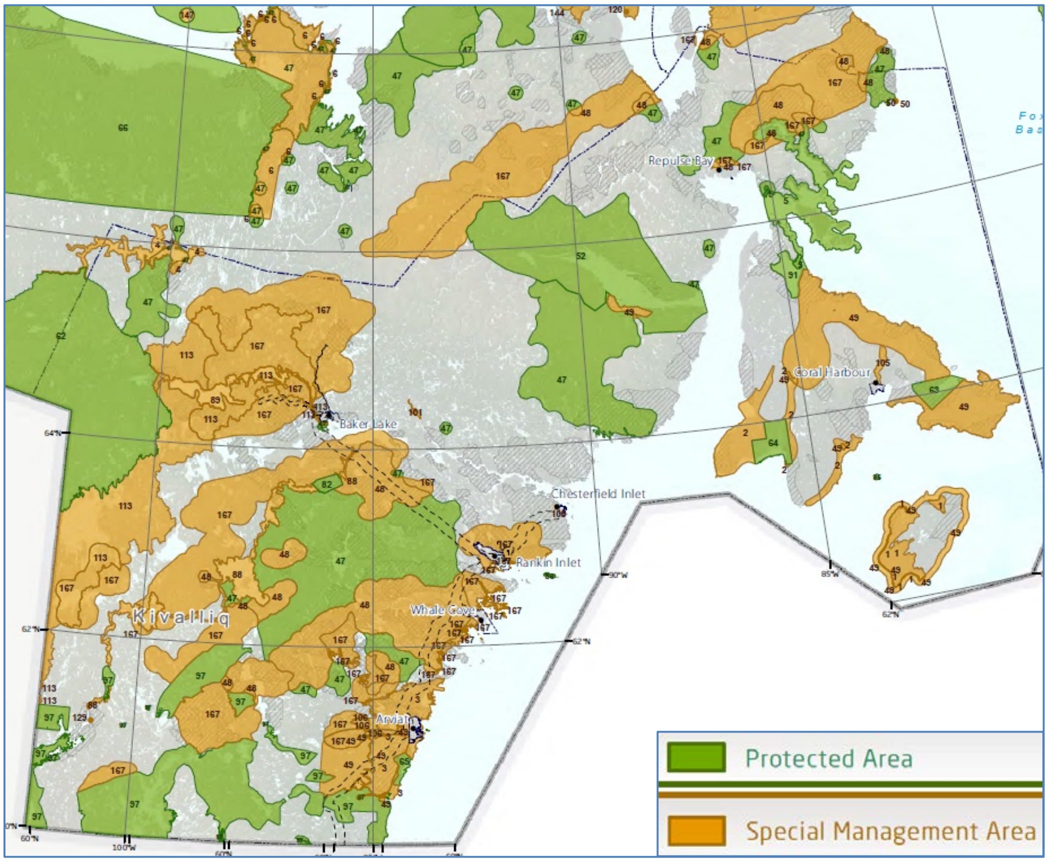

Figure 1. Kivalliq portion of draft Schedule A, Nunavut Land Use Plan Land Use Designations (NPC 2014). The protected areas includes calving and post-calving areas (designated as Site # 47) and Special Management Areas include core caribou calving and post-calving areas with high mineral potential (designated as Site # 48).

Given the previous suggestions of mobile protection measures and KivIA's concerns about safeguarding caribou and their habitat without unnecessarily restricting other land uses, our objective in this report is to propose **Mobile Caribou Conservation Measures** for the Kivalliq Region. Inuit have long had rules governing human behaviour to ensure respect for caribou, and our approach builds on that knowledge and respect.

We have used the term Mobile Caribou Conservation Measures to avoid confusion with the existing (DIAND) Caribou Protection Measures, as for example appended to the 2000 KRLUP (NPC 2000: Appendix H). We define Mobile Caribou Conservation Measures as those necessary to protect and minimize effects on caribou when exposed to industrial disturbance through linking monitoring with site-specific mitigation. We suggest these Measures are more conservative than the Caribou Protection Measures, as measures are not just applied to designated areas, but would, for example, follow with the caribou and provide protection for caribou outside of designated Protected or Special Management areas. We explain the background and how the Measures would provide for the collaborative conservation of caribou as well as flexibility to land-users. At this stage in discussions, the framework and examples presented here are not yet an operations manual for in the field. An operations manual is a subsequent step after collaborative refinements to the framework.

The current approaches to managing industrial activity interaction with caribou attempt to spatially and temporally separating caribou and industrial activities. The emphasis of this management directive is on separating industrial exploration from calving and post-calving caribou, which are crucial time periods and places. At the highest level of protection, calving areas are designated as closed to both exploration and development activity, and protection of the habitat is year-round; an example would be Ukkusiksalik National Park. The second level of protection is similar in that there is a protected area but the restrictions are seasonal. The effect is seasonal separation of calving, but from industrial exploration only (thus habitat is not protected) and the question of development is not explicitly addressed. This approach is exemplified by DIAND's Caribou Protection Measures. The third level which is proposed here is that the measures 'travel' with the caribou rather being applied to a fixed area. In this case, even if deep snow delayed pre-calving migration, the calving cows would still be protected even if they did not reach their usual calving ground. These measures would also apply to other seasons outside of the pre-calving to post-calving period.

Mobile caribou conservation measures are a tool to separate exploration activities from caribou based on rules for the conduct of industrial activities that land managers can incorporate into a land use permit or other land use activities that may cause disturbance to caribou. Caribou vulnerability varies seasonally (Table 1); cows and calves often react more strongly and are more vulnerable during pre-calving, calving and post-calving or at water-crossings (Williams and Gunn 1982, Murphy and Curatolo 1987, Wolfe et al. 2000, Taillon et al. 2012). Similarly, as summers become warmer over years as a result of climate change and insect harassment increases, minimizing disturbance to caribou as they forage prior to the rut will become more important as caribou need uninterrupted foraging to compensate for lost foraging time during periods of insect harassment.

Proposed Mobile Caribou Conservation Measures for the Kivalliq Region

Mobile Caribou Conservation Measures for the Kivalliq Region can be used to adaptively mitigate effects of industrial exploration on migratory barren-ground caribou. Mobile Caribou Conservation Measures, as have been called for in the past, link monitoring and site-specific mitigation with the susceptibility of caribou to disturbance, which varies seasonally. This seasonal variation in susceptibility coupled with period of exposure helps determine risk to caribou. For land and wildlife managers, understanding the likelihood of caribou encountering industrial exploration activities and experiencing negative effects from exposure to those activities is necessary to effectively conserve caribou without unnecessarily limiting economic development. The objectives of Mobile Caribou Conservation Measures are to reduce encounters and exposure of the caribou to disturbance and other impacts during industrial exploration activities through avoiding and minimizing effects.

Most of the focus of minimizing disturbance is on industry, rather than considering how tourism or hunting (or scientific research) may be a disturbance (e.g., Golder 2014). In Norway, recreational tourism is an additional concern for wild reindeer (Nellemann et al. 2010). Our focus is industry-based activities such as when caribou are in the proximity of mineral or oil and gas exploration activities which may be fixed sites (e.g., a drill camp with aerial support), or a larger area (e.g., airborne geophysical survey). These Measures are intended to be applied as conditions of land use permits, and can also be adapted to exploration activities within caribou range that may not have triggered the requirement for a land use permit.

Mobile Caribou Conservation Measures have three main components:

(i) Agreed-upon areas within which monitoring and mitigation is directed. These areas give predictability to the land-user and land-manager as to when caribou may encounter a site;

(ii) When caribou actually encounter the site is determined through monitoring of distribution and movements to trigger the mitigation actions; and

(iii) The mitigation actions that apply to the land use operation to avoid and minimize (reduce) effects on caribou.

The broad sequence of steps needed to develop and conduct Mobile Caribou Conservation Measures is listed below, with details provided in the following sections.

1. Develop least risk timing windows for caribou based on seasonal difference in the predictability of caribou encounters, susceptibility and behaviour;
2. Identify seasonal Caribou Conservation Areas through collaborative mapping. These areas provide predictability as to where and when caribou are expected to occur;
3. Surveillance for caribou operates within three concentric zones, which are a hierarchy of increasing surveillance effort. The sizes of the zones are scaled to risk category as well as season, (speed and direction of movements vary seasonally);
4. Government and land use operator will establish monitoring and surveillance requirements for a proposed operation. The responsibility for monitoring will be with the operator. The monitoring may include aerial or ground-based (locally-hired) monitoring. The territorial government may provide caribou collar locations. The frequency of the monitoring influences the intensity of the mitigation — infrequent monitoring may require more intensive mitigation;
5. The mitigation thresholds or triggers will be based on season and area (susceptibility), and numbers and proximity of caribou to the operation, including monitoring thresholds for when mitigations will be stepped up or down;
6. Apply the hierarchy of mitigation — avoidance followed by minimization — to reduce encounters and exposure of caribou to operations to decrease sensory disturbance and risk of injury and death; and
7. The mobile Measures can be applied during all seasons, traditional migratory routes and water crossings.

Caribou Conservation Areas

The proposed Mobile Caribou Conservation Measures for the Kivalliq Region require designation of seasonal **Caribou Conservation Areas** (CCAs) through mapping both Inuit Qaujimajatuqangit (IQ) and scientific data to the annual range of the caribou herds. These Caribou Conservation Areas will identify seasons and areas where caribou are likely to occur, thus providing a degree of predictability to both operators and regulators. We acknowledge that past movements and distribution do not necessarily predict future movements and distribution; however, mobile measures can address unexpected caribou distribution. The Mobile Caribou Conservation Measures can be used to provide buffers to Protected Areas as proposed in the draft Nunavut Land Use Plan (NPC 2014). Some of these seasonal Caribou Conservation Areas will overlap with Special Management Area Land Use Designations from the draft Nunavut Land Use Plan (NPC 2014).

The intensities and types of monitoring and mitigation will differ among the various seasonal Conservation Areas based on differences in caribou susceptibility, sensitivity and behaviour. For example, herds with larger annual ranges generally have higher rates of movements (Table 2). Mapping of seasonal Conservation Areas must be collaborative, use all information available, and be transparent; scientific and IQ data, methodology and analyses used in map production must be clearly described. Analyses of prior information on caribou distribution will estimate both annual variation and the change in distribution as abundance changes; updating seasonal Conservation Areas on a 3-year (as recommended in Taillon et al. 2012) or 5-year interval (similar to recommendations in Gunn et al. 2007) may be appropriate to capture broad changes in seasonal ranges and migration corridors, and to ensure that caribou are protected while land use activities are not unduly restrained. The Caribou Conservation Areas will be compatible with the NPC's draft land-use maps, but will have a broad information basis beyond satellite telemetry of caribou cows.

On post-calving, summer and fall ranges, caribou swim or wade across lake narrows and rivers at traditional water crossing sites (Williams and Gunn 1982). "Designated" water crossings were mapped within the Caribou Protection Map within the original DIAND Caribou Protection Measures. Water crossings were further mapped in the early 1980s (Williams and Gunn 1982) and through the Nunavut Atlas (Riewe 1992), and updated information is available from scientific and IQ reports and environmental assessments such as for AREVA (AREVA 2014a). The list of "designated" water crossings should be updated by the territorial government or regional Inuit organization; regional Inuit organizations and Hunters and Trappers Organizations should be consulted to develop current and updated maps of traditional ("designated") caribou water crossings.

Table 2. Daily movement rates (km/day (± SD)) by activity period for four caribou herds within the Kivalliq Region based on satellite telemetry of cows 1993–2009 (Nagy 2011). These seasons are provided as an example from the literature; further analysis is needed to amalgamate seasons that will be practical for mobile measures monitoring and mitigation.

Activity period	Beverly/Ahiak	Qamanirjuaq	Lorillard	Wager Bay
Calving	7 ± 7.0	9 ± 10.0	4 ± 5.2	6 ± 12.5
Post-calving	13 ± 8.1	15 ± 13.0	12 ± 12.3	4 ± 5.4
Early summer	23 ± 12	28 ± 21.8		
Mid-summer	14 ± 10.3	18 ± 18.7		
Late summer	7 ± 5.5	10 ± 11.5	5 ± 7.9	3 ± 4.2
Fall, pre-breeding	12 ± 8.4	14 ± 12.9	15 ± 14.9	17 ± 18.6
Breeding	12 ± 8.1	16 ± 14.8	18 ± 18.3	27 ± 19.5
Post-breeding, late fall	9 ± 10.5	14 ± 14.2	12 ± 10.7	10 ± 9.5
Early winter	5 ± 4.9	8 ± 10.2	5 ± 5.2	4 ± 6.1
Mid-winter	4 ± 3.5	5 ± 7.8		
Late winter	3 ± 3.5	4 ± 5.8	6 ± 8.5	9 ± 10.3
Spring migration	13 ± 10.7	12 ± 14.2		

Monitoring

Monitoring is an essential component of Mobile Caribou Conservation Measures (Weihs and Usher 2001), and is required both to know when the caribou are in the proximity of industrial activity (to trigger mitigation) and also to determine if mitigation is effective. Local knowledge (IQ, elder's knowledge), caribou trails, archaeological information and scientific information (aerial- and ground-based surveys, collar data) are required to determine the likelihood that caribou will be seasonally present, which provides relative certainty to the land-use activity that they will have to implement the mitigation measures. The mitigation measures will need to be more protective when monitoring is minimal or absent and uncertainty about caribou distribution is high.

The monitoring objective for the Mobile Caribou Conservation Measures is achieved through surveillance around an exploration site. While collared caribou may provide the first level of monitoring, the land use permit operator would be responsible for conducting and financing local monitoring. If there are caribou in the vicinity, the land use permit operator cannot open the camp. If the camp is in operation and there are caribou in the vicinity, the land use permit operator will modify or suspend exploration activities, or remove camp personnel, which will reduce disturbance and impose spatial separation between industrial exploration activities and caribou. If no information on caribou distribution is collected or available close to the exploration site (see below), then the site cannot be released for activity during the season of likely caribou distribution.

The Mobile Caribou Conservation Measures operate with three concentric zones, as a hierarchy of increasing surveillance effort (Fig. 2). An outer 'Early Warning Zone' relates to the presence or absence of collared caribou, or an estimated likelihood of caribou presence based on local or scientific knowledge. The size of the Early Warning Zone is scaled to the caribou season as movement rates and directionality varies seasonally (Tables 1, 2). For example, a smaller Early Warning Zone is used during winter when movement rates are generally lower and less directional. A larger Early Warning Zone is used during spring migration/pre-calving when distances moved are generally larger and more directional.

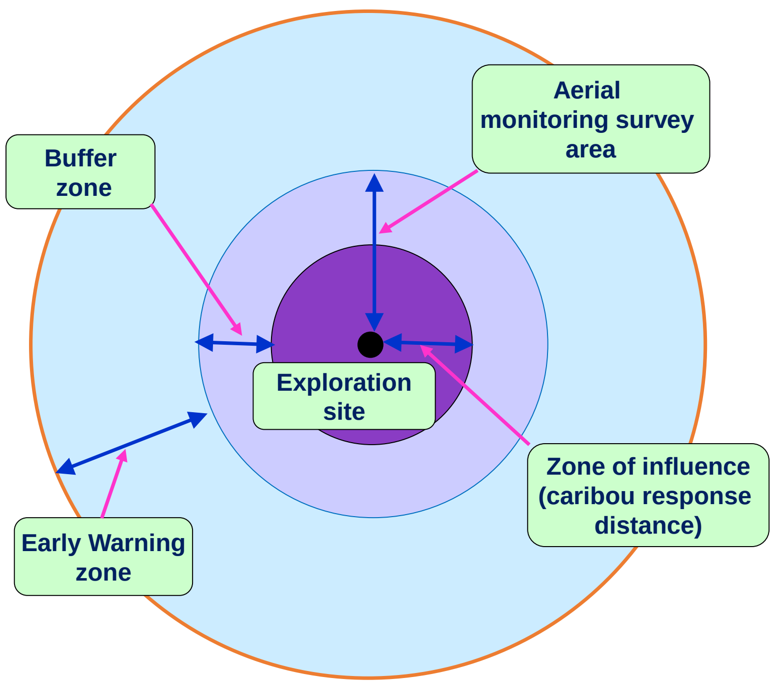

Figure 2. Schematic relationship between an exploration site, Zone of Influence, Buffer Zone, Early Warning Zone, and monitoring survey area.

Inside the Early Warning Zone, a 'Buffer Zone' is where aerial surveys, collared caribou or possibly ground surveillance are used to assess the presence of caribou. These two outer zones operate as information zones, indicating the possibility of caribou moving into the third, most inner 'Zone of Influence'. The Zone of Influence is the area around a site of human activity where the behaviour and relative abundance of caribou may change in response to the site and its associated activities. The zone of influence for caribou around large-scale and operational diamond mines in the Northwest Territories has been estimated at 14 km (Boulanger et al. 2012). While the zone of influence for different types of exploration camps and activities have not been measured, a conventional extent for exploration sites is 5 km as applied in cumulative effects assessments (e.g., DDEC 2014).

The presence of caribou in the Buffer Zone would indicate to the exploration manager and the land use inspector of a potential requirement for mitigation should caribou enter the Zone of Influence. The presence of caribou within the Zone of Influence would initiate mitigation, ranging from altered or reduced activity to a temporary suspension of exploration activities and other mitigation methods to protect the caribou. The timing and number of caribou in the Zone of Influence would trigger increased or reduced mitigation for the site.

The size of the zones would be previously agreed upon between the land manager and the project operator prior to permitting, and determined from rules based on the season and daily rates of movements from satellite-collared caribou (Table 2). Suggested seasons and distances are provided in Table 3 to give an idea of relative areas among risk categories, acknowledging that there are different ways of defining and amalgamating seasons and that further analysis and discussion may be required to define seasons that are workable for mobile measures. During a pilot project in the Sahtu in April 2009 (Gunn and Poole 2009), the threshold was one collared caribou in the Early Warning Zone which was the trigger for an aerial survey. For the Kivalliq region there will also have to be a threshold for incidental sightings such as during supply flights to a camp, especially in areas of caribou distribution where the number of collars is low relative to herd size and distribution. In the late winter Sahtu pilot project, 50 caribou spotted in the Buffer Zone would have justified notice to the exploration manager and the land use inspector of the possibility of enhanced mitigation should caribou enter the Zone of Influence, and 25 caribou observed in the Zone of Influence from an aerial survey would have triggered modification or suspension of mineral exploration activities (Gunn and Poole 2009).

Although the use of satellite collars contributes to monitoring, this method has limitations that include location upload timing (how frequently the caribou locations are summarized by the satellites) and frequency (how often collar locations are transmitted to the project manager; generally the Government of Nunavut Department of Environment supplies the locations) relative to daily movement distances, availability of and access to the information, and variable support for collaring within communities (e.g., AREVA Kiggavik final hearings, Baker Lake, NU, March 2015[1]).

Frequently, only adult cows in some herds are collared and the number of collars is few relative to the size of the herd, which raises a question of how well the satellite-collared caribou represent the entire herd’s distribution. In the Sahtu project, collars were relatively predictive of caribou numbers within the inner zones (Gunn and Poole 2009) but this was in late winter when daily movement rates are low. The collar locations reveal where caribou are, but the absence of collared caribou does not necessarily reveal the absence of caribou. Experience at diamond mines in the Northwest Territories found that the incidental and remote camera sightings did not correlate with the encounter rates of collared caribou (Jay Project Developer's Assessment Report, Information Request Responses[2]). This suggests that at

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[1] ftp://ftp.nirb.ca/02-REVIEWS/ACTIVE%20REVIEWS/09MN003-AREVA%20KIGGAVIK/2-REVIEW/10-FINAL%20HEARING/08-TRANSCRIPTS/

[2] DAR-MVEIRB-IR2-08; http://www.reviewboard.ca/upload/project_document/EA1314-01_ORS_Review_comment_table_IR2_and_Response.PDF

Table 3. Season, risk category, and suggested zone sizes and thresholds of caribou numbers counted in the Early Warning Zone, Buffer Zone, and Zone of Influence (ZOI) to trigger corresponding mitigation actions. Analysis of movement rates and local input are needed to refine the dates and number of seasons.

Season	Risk category	Timing[1]	Suggested zone radii (km)			Threshold number of adult caribou[2]			Mitigation actions if thresholds passed in ZOI[4]
			Early Warning Zone	Buffer Zone	ZOI	Early Warning Zone[3]	Buffer Zone	ZOI[4]	
Spring migration/ pre-calving	Cautionary	Apr - Jun	50	20	15	5/25	50	25/50	Suspend flights and ground operations within 36 hrs/ Close camp within 48 hrs
Calving	Crucial	May - Jun	50	15	10	1/10	20	5/10	Suspend flights and ground operations within 24 hrs/ Close camp within 24 hrs
Post-calving/insect season	Crucial	Jun - Jul	50	15	10	1/10	20	5/10	Suspend flights and ground operations within 24 hrs/ Close camp within 24 hrs
Summer/insect season	Cautionary	Jul - Aug	30	15	10	5/25	50	10/25	Suspend flights and ground operations within 36 hrs/ Close camp within 48 hrs
Fall migration/pre-rut	Cautionary	Aug - Sep	30	10	10	5/25	50	10/25	Suspend flights and ground operations within 36 hrs/ Close camp within 48 hrs
Rut	Low	Oct	30	10	5	5/50	100	25/50	Reduce above-ground operations within 48 hrs/ Suspend above-ground operations within 72 hrs
Post rut/fall migration	Low	Nov - Dec	50	15	10	5/50	100	25/50	Reduce above-ground operations within 48 hrs/ Suspend above-ground operations within 72 hrs
Winter	Low	Dec - Apr	30	10	5	5/50	100	25/50	Reduce above-ground operations within 48 hrs/ Suspend above-ground operations within 72 hrs

[1] The actual dates differ among herds.

[2] Proposed numbers based on differences in relative risk during each season. Caribou thresholds (generally collared individuals or incidental sightings) within the Early Warning Zone would trigger surveys within the Buffer Zone and Zone of Influence. Caribou thresholds (generally from aerial surveys) in the Buffer Zone would justify notice to the exploration manager and the land use inspector of a potential suspension should caribou enter the Zone of Influence.

[3] xx/yy represent number of collared/observed caribou within the Early Warning Zone.

[4] xx/yy represent thresholds of number of collared/observed caribou to trigger main sets of mitigation responses.

most sites supplementary information will be required, such as aerial and/or ground monitoring of caribou distribution.

The Government of Nunavut has raised concerns about aerial surveys disturbing caribou and has consequently placed greater emphasis on using collars, mostly deployed on mature cows (e.g., Golder 2014:8). Although concerns must be balanced between potential disturbance resulting from collars or aerial surveys, well-designed aerial surveys provide accurate and instantaneous monitoring of distribution of all sex and age classes of caribou within a study area (as opposed to the distribution of selected collared individuals), as well as allowing mapping of track frequency and direction in winter, and can be conducted in ways to minimize potential disturbance. Aerial surveys to monitor caribou distribution could be flown at higher altitudes (perhaps 300 m agl) than normally used for population census counts (125 m agl) as an accurate count of individuals is not required. Responses to both fixed-wing and rotary-wing aircraft are less at higher flight altitudes of 300–400 m agl (Wolfe et al. 2000). Helicopters are often available but are noisier and at lower altitudes often cause greater reactions in caribou than fixed-wing aircraft (Wolfe et al. 2000). Reductions in noise production should be considered during selection of survey aircraft.

Technology is advancing such that use of remote drones may become feasible to monitor caribou. Drones have been tested in relation to mining projects in several areas of the Arctic (H. O'Keefe, Dominion Diamond Ekati Corp., pers. comm.), and have been used in other open habitats (e.g., Koh and Wich 2012, Hodgson et al. 2013). While there will be development costs and effort (as well as issues with permitting), over the long term proponents may realize significant cost savings using drones, and greatly reduce or eliminate concerns over disturbance of caribou from aircraft.

Ground surveillance may be feasible in some situations. Height-of-land surveys (essentially scanning from hilltops) can detect approaching caribou at some distances, although the scale needed for use with mobile Measures may not be adequate. Snowmobile surveys can provide good coverage and detect both tracks and animals, but bring their own issues with disturbance (Wolfe et al. 2000). As far as is practical, the coverage of the zones should be systematic and the intensity of coverage would reflect the risk category, with higher coverage in higher risk categories. For example, coverage within zones would be a minimum of 30% for crucial; 20% for cautionary and 8–10% for low risk categories. Approximately 8–10% represents reconnaissance survey coverage, while approximately 30% coverage has been used for visual estimates during calving ground surveys (Campbell et al. 2010, Poole et al. 2014).

The effectiveness of collared caribou to trigger mobile measures was tested in the Sahtu for the winter range only and found to be relatively efficient when combined with aerial surveys (Gunn and Poole 2009). The satellite-collared cow locations were, within the scale of the pilot project, relatively predictive of the overall numbers of caribou within the Buffer Zone and the Zone of Influence. However, the use of the collars alone without aerial surveys could result in either unnecessary restrictions or loss of protection for caribou. Collars generally are predictive of regional, not site specific distribution at the scale of 10s of kilometres. Although all eight sites in the Sahtu pilot project had satellite-collared caribou within the Early Warning Zone, the aerial surveys showed that only three sites would have had enough caribou for temporary suspension of any exploration activities (Gunn and Poole 2009).

For the Mobile Measures the thresholds of caribou numbers in the Early Warning and Buffer zones would depend on the risk category (crucial, cautionary or low). The thresholds would change with caribou season and movement rates for the herd in that particular area (Table 2 provided as an example from the literature) and be higher, for example, when movement rates are low. But this would be offset by the need for more stringent thresholds (lower numbers of caribou) during the crucial risk windows of calving and post-calving (~mid-May – mid-July) (Table 3). The number of collared or observed caribou within the Early Warning Zone would be used to trigger aerial surveys of the two inner Buffer and Influence zones. Thresholds of the number of caribou observed within the Zone of Influence would trigger mitigation actions (Fig. 3).

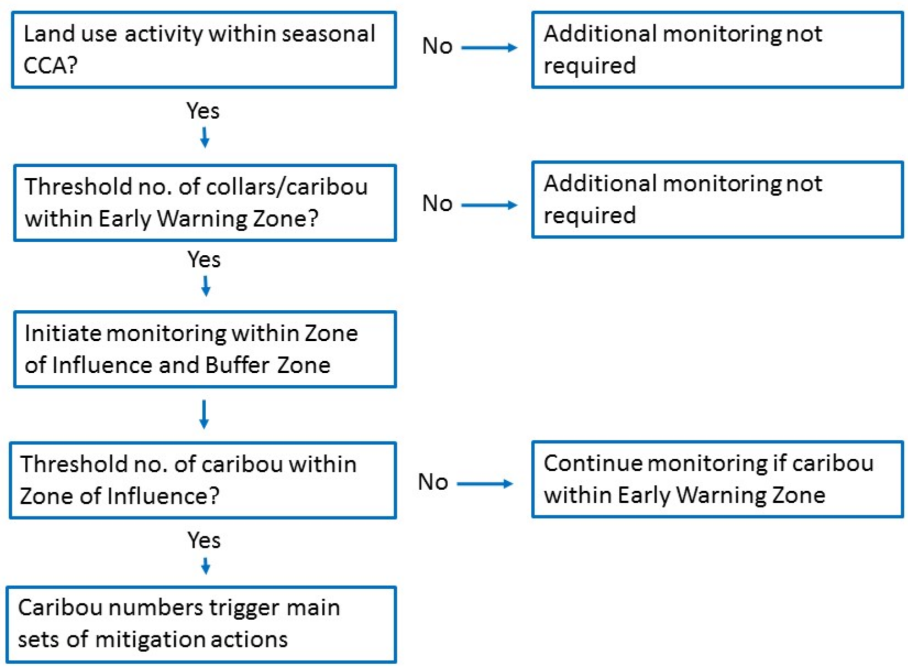

Figure 3. Monitoring and mitigation decision tree for Mobile Caribou Conservation Measures.

Operating conditions would be applied to seasonal Caribou Conservation Areas during specific seasons according to risk categories. Outside of these seasons the area would be open to exploration, recognizing that project operations may be reduced, suspended or prohibited when caribou are present.

Mitigation

Mobile Caribou Conservation Measures will reduce encounters and exposure of caribou to exploration camps, aircraft, roads, and related activities through avoiding and minimizing impacts. Although the hierarchy of mitigation is to avoid, minimize, rehabilitate, and offset (compensatory mitigation) (Jakle 2012, BBOP 2015), we have not included rehabilitation or restoration of sites and structures, as we assume the land use permits associated with exploration will include clauses to rehabilitate areas disturbed by exploration activities. We also have not addressed offsetting in mitigation options, as currently residual effects of development are not measured at the exploration stage (BBOP 2015).

In the following sections, we give examples of mitigation options, but recognize that further operational details will depend on a collaborative approach among industry, government, regional Inuit organizations and wildlife boards, Hunters and Trappers Organizations and other interested parties. It is important to be aware of industrial exploration practices and flexibility when designing mitigation effective for caribou. Generally, the first steps are to reduce then halt movement of vehicles and aircraft operations. The next step is to halt operations involving people moving around such as drilling and trenching, and camp operations. Removing camps or people would be used in some situations, but may involve more disturbance than simply suspending activities. Thus our proposed mitigations depend on risk timing (season, Table 1), with faster application and lower thresholds to trigger mitigations during higher risk seasons. For example, during calving fewer collars or individuals will trigger mitigation that will need to be conducted within a shorter time period.

Avoidance

Exploration sites

The first category of mitigation is *avoiding* effects through area and season-based measures such as reducing the size of the exploration footprint, and avoiding construction of structures and operational activities in certain seasonal ranges at certain times. The Mobile Measures would enable flexibility by allowing opening of exploration camps if caribou are not in the vicinity within a seasonal Conservation Area. However, exploration camps may not be activated or will be de-activated during a particular season if the thresholds for caribou numbers in the Zone of Influence are exceeded. The strongest avoidance is to not open the camp until the high-risk season, such as calving or post-calving, is finished and caribou are not present. The next levels of action taken to avoid effects on caribou from sensory disturbance are to eliminate movement of vehicles, aircraft, and other above-ground activities, and then to suspend camp operations (remove people and ensure that machinery is not operating beyond care and maintenance).

Water crossings

Caribou may abandon or postpone water crossings in response to disturbance (summarized in Williams and Gunn 1982; Baker Lake HTO 2015). Although Inuit have hunted caribou at water-crossings, they also have gone to considerable lengths to avoid disturbing caribou (Baker Lake HTO 2015). Based on interviews in the Baker Lake area in the late 1970s, recommendations were developed to prohibit exploration activity with 4.8 km (3 miles) of major water crossings (summarized in Gunn et al. 2007). The

Baker Lake HTO have recently recommended a 25 km buffer of no mining or exploration activity around water crossings (Baker Lake HTO 2015). We suggest that monitoring within wider Early Warning and Buffer zones would provide sufficient time to reduce exploration activity and eliminate sensory disturbance within 10 km of water crossings. Given the vulnerability of caribou at water-crossings and typically a rapid approach, the Early Warning Zone, Buffer Zone and Zone of Influence would be relatively large, such as a 25 km, 15 km, and 10 km, respectively. Mitigation to avoid altering migration patterns and fragmenting use of caribou seasonal ranges would include not constructing camps or permanent structures or caching fuel, or blasting conducted within 10 km of designated water-crossings between 15 May and 1 September, and not permitting exploration activities within 5 km of water-crossings between 15 May and 1 September. These are the same guidelines as the original DIAND Caribou Protection Measures, where “designated” crossings were mapped within the Caribou Protection Map; our Zone of Influence guidelines for water crossings matches the larger DIAND distance.

Minimization

The second broad category of mitigation of exploration is *minimizing* effects, with the intensification of the mitigation intended to reduce the frequency and duration of encounters and the exposure of caribou to exploration activities within Caribou Conservation Areas.

Sensory disturbance

To minimize effects on caribou movement and behaviour, mitigation is required to reduce the behavioural responses to an exploration site, structures and activities. Those activities can cause caribou to alter their behaviour and movements. Increases in walking or running and decreases in foraging have energetic costs which can accumulate to reduce the chance of a cow having enough body fat to become pregnant and to reduce calf survival:

- To minimize behavioural responses, direct movement of equipment and people toward caribou will be avoided;
- Vehicles including all-terrain vehicles and snow machines should neither approach caribou nor stop within the sight of caribou;
- Aircraft and helicopter flights over the pre-calving, calving and post-calving Caribou Conservation Area and near identified caribou water crossings when sites are active should be at least 610 m above ground level and avoid areas of known caribou concentrations when possible (subject to pilot discretion regarding aircraft and human safety) (e.g., AREVA 2014b). Outside of these seasons, lower altitudes, such as 300 m above ground level, could be imposed.

Non-vehicle mortality

Injury and mortalities to caribou can occur that are not related to vehicle movement. Examples include entanglement in fencing or wires, or hazardous terrain within the project footprint. Operators should ensure that best management practises are followed to minimize injury and mortalities (e.g., AREVA 2014b, Golder 2014). Minimizing caribou deaths includes ensuring that waste management reduces attractions to predators and that no feeding of wildlife and no-dog rules are strictly enforced. Any fences to exclude wildlife have to be maintained at sufficient tension to reduce chance entanglements with antlered caribou. The fences have to be constructed to allow escape routes as experience at other mines is that wolves take advantage of structures such as fences or berms to ambush caribou. Wires used in seismic programs must also be picked up to reduce entanglement.

Mortality from vehicle collisions

Exploration roads are typically winter roads. Mitigation measures are designed to minimize caribou mortality from collisions (as well as reduce deflections on roads) such that drivers understand when and how they may encounter caribou on roads and what actions they take.

Mitigation from the vehicle driver's perspective:

- Provide caribou awareness training;
- Establish the predictability of encounters by zoning sections of any roads as low, moderate or high probability of caribou encounters based on available scientific and IQ data; this is more applicable to any permanent roads more so than winter roads.
- Design and modify road configuration to maximize sightlines for drivers and avoid blind spots (corners and steep berms onto the road surface);
- Set speed limits, use signage for known caribou crossings and always provide wildlife the right-of-way;
- Use driver-to-driver radio for updating information to drivers;
- Provide drivers with a set of pre-designed measures to implement including reduced speed or waiting at designated areas to allow caribou on or near the road to leave. These measures would include education about typical caribou behaviour on a road and crossing a road, including the tendency to move parallel to vehicles or cut across, and the reluctance of caribou to leave a hard packed surface;
- Managing snow clearing and height of snow berms so that they do not restrict vision for drivers and caribou to see each other; and
- During snow-clearing ensure that snow banks are maintained at less than 1 m (and preferably at less than 0.5 m based on research at the Ekati diamond mine; Rescan 2011) and are broken into sections with plowed out gaps so caribou are not 'trapped' on the roadbed.

Concluding comments

The proposed Mobile Caribou Conservation Measures offer considerable benefits to land users through their flexibility and through adding predictable rules for land use operations. However, the flexibility for land-users requires a commitment to monitoring and for land managers to have follow-up and enforcement capabilities. We also recommend that the Mobile Caribou Conservation Measures have annual reporting requirements to land and wildlife managers. The reports should ensure that details of monitoring, caribou numbers detected, and any land use decisions are documented.

The Mobile Caribou Conservation Measures can be conditions applied in federal land use permits and Inuit land use licenses to conserve caribou use of seasonal ranges, whereas protected area designations or conditions applied in permits and Inuit land use licenses can be used to conserve caribou habitat. The Mobile Caribou Conservation Measures are an example of adaptive management through monitoring relative to thresholds and subsequent actions. Experience with Mobile Caribou Conservation Measures will also contribute to monitoring and mitigation as practiced at industrial developments such as mines and all-season roads. Conducting monitoring (surveys, whether aerial or ground based, and telemetry) relative to thresholds trigger enhanced or reduced intensity of mitigation, for example, in the Caribou Roads Mitigation Plan (CRMP) for the proposed Dominion Diamond's Jay project[3]. Proposed developments, primarily mineral developments and all-season roads, are subject to environmental assessment within the Nunavut Impact Review Board (NIRB) and Mackenzie Valley Environmental Impact Review Board (MVEIRB) processes within Nunavut and the NWT, respectively, and have associated detailed and comprehensive management and monitoring plans developed (e.g., Golder 2014; Dominion Diamond CRMP, cited above).

Summary of recommendations

1. Mapping of seasonal Caribou Conservation Areas must use all valid forms of information and be transparent; scientific and IQ data, and methodology and analyses used in map production must be clear. Updating seasonal Caribou Conservation Areas on a 5-year interval may be appropriate.
2. Analyses and inclusion of local knowledge are needed to refine the dates and number of seasons.
3. The list of "designated" water crossings should be updated by the territorial government or regional Inuit organization; regional Inuit organizations and Hunters and Trappers Organizations should be consulted to develop current and updated maps of traditional ("designated") caribou water crossings.
4. Aerial surveys to monitor caribou distribution could be flown at higher altitudes (perhaps 300 m agl) than normally used for population census counts (125 m agl) as an accurate count of individuals is not required.
5. Reductions in noise production should be considered during selection of survey aircraft.
6. Use of remote drones for monitoring should be further explored; over the long term proponents may realize significant cost savings using drones, and greatly reduce or eliminate concerns over disturbance of caribou from aircraft.
7. For monitoring, the coverage of the survey zones should be systematic and the intensity of coverage would reflect the risk category, with higher coverage in higher risk categories. For example, coverage within zones could be 30% for crucial; 20% for cautionary and 8–10% for low risk categories.
8. Examples of mitigation recommendations are provided in the appropriate sections.

[3] http://www.reviewboard.ca/upload/project_document/EA1314-01_Jay_Project_WEMP_and_CRMP_July_31__2015.PDF

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Schedule C. Kivalliq Inuit Association Recommendations for Caribou Protection

Caribou Technical Session: recommendations on caribou protection to the NPC

Prepared for

Kivalliq Inuit Association

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15 February 2016

Summary:

Management of caribou must be predicated on Inuit Qaujimajatuqangit (IQ) and scientific data related to caribou ecology and known or assumed vulnerability to disturbance, while acknowledging a balance between caribou protection and economic development opportunities. Following are a summary of Kivalliq Inuit Association's (KivIA) positions and recommendations to the Nunavut Planning Commission (NPC) regarding caribou issues for both mainland migratory and tundra wintering herds related to the Nunavut Land Use Plan (NLUP):

1. KivIA supports identification of core calving areas using IQ, scientific survey and collar data, and temporal trends to identify the core areas used by calving and immediately post-calving caribou (during **extent of calving** - peak of calving plus 3 weeks).
2. **Core calving areas** (areas used by caribou from peak of calving through to 3 weeks of age – extent of calving) mapped using IQ, aerial surveys and the most recent 10 years of satellite telemetry, will be closed to development (**year-round Protected Area status**).
3. **Core calving areas that overlap areas of High Mineral Potential** should be provided **seasonal Special Management Area status**, within which stringent measures, based on proposed Kivalliq Mobile Caribou Conservation Measures (MCCM), will be applied for any development contemplated within those areas.
4. Develop a 25-km buffer around core calving areas and apply **mobile protection measures** as per the draft Kivalliq MCCM.
5. The immediate area around **identified water crossings** should be within **year-round Protected Areas**, with the size of the area tailored to traditional caribou approach characteristics based on IQ. Around water crossings we recommend a 10 km radius zone within which **mobile protection measures** would be applied.
6. **For other seasonal ranges** (including as defined here post-calving/summer, late summer/pre-rut, fall migration/rut, winter and spring migration), apply **mobile protection measures** with different criteria and timing for different seasons within anticipated seasonal boundaries and types of exploration or development activities.
7. Major **transportation corridors** and **infrastructure** of significant economic important to the Kivalliq Region (e.g., the Nunavut-Manitoba Road) should be granted **Special**

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Management Area status with appropriate (and if required, stringent) mobile measures applied.

8. For the purposes of caribou protection and conservation, season designations and dates should be decided through a collaborative exercise, but should consider the practicality of managing.
9. Use only the most recent 10 years of collaring data and address annual trends in seasonal ranges, especially for calving/post-calving areas. Weighting for core ranges should be equally applied among years and non-breeding cows should be screened out from mapping calving grounds.

Background:

The Nunavut Planning Commission (NPC) is organizing the Fourth Technical Meeting[3] for developing the Nunavut Land Use Plan (NLUP). The meeting, scheduled for early March 2016 in Iqaluit, includes a 3-day session on the identification of seasonal caribou habitat and the most effective methods to manage land use in these areas.

Kivalliq Inuit Association's (KivIA) interests include caribou – specifically balancing caribou conservation and economic development. Inuit, especially in the Kivalliq Region, have been clear and consistent since the 1970s about their desire to protect caribou especially on calving grounds and at water-crossings. (Caribou water crossings are traditional fixed locations with unique geographical characteristics – juxtaposition between larger lakes or landscape terrain, narrows, shallows, etc.) The desire for protecting caribou was the basis for the Baker Lake Hunters and Trappers Association seeking an injunction against uranium exploration in 1977[4]. In 1978, Judge P. M. Mahoney wrote: "The weight of evidence leads to the conclusion that exploration and mining activity is incompatible with the natural use by caribou of their habitat at times and at places where they congregate in large numbers". The 1978 court case resulted in area-specific seasonal measures for the calving and post-calving areas and water-crossings, which are areas where large numbers of caribou congregate and thus are vulnerable to disturbance. Those measures (Caribou Protection Measures (CPM)) were developed and applied by the Department of Indian Affairs and Northern Development (DIAND) as conditions for land use permits (most mineral exploration) within Caribou Protection Areas. The history and effectiveness of the boundaries for the Caribou Protection Areas were reviewed in 1984[4] and 2007[5]. In addition to these documents, for this report we have also drawn on the considerable information presented at the November 2015 Nunavut Wildlife Management Board (NWMB) workshop on Protecting Caribou and Their Habitat held in Iqaluit[6].

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[3] http://www.nunavut.ca/en/news/2016-notice-draft-nunavut-land-use-plan-fourth-technical-meeting

[4] Mychasiw, L. 1984. Five-year review of the Beverly and Kaminuriak caribou protection measures. Department of Resources, Wildlife and Economic Development File Report No. 42. 133pp.

[5] Gunn, A., K. G. Poole, J. Wierzchowski and M. Campbell. 2007. Assessment of Caribou Protection Measures. Unpublished report Submitted to Indian and Northern Affairs Canada, Gatineau, Québec, 45pp.

[6] http://www.nwmb.com/en/public-hearings-a-meetings/workshops/november-2015-protecting-caribou-and-their-habitat-workshop#document-resource-development-and-caribou-in-nunavut-finding-a-balance-eng.

Report Objectives:

To support the KivIA in developing their position for NPC's technical meeting, we have compiled information and made recommendations on the following:

1. The current proposed Protected and Special Management Areas;
2. Position on how seasonal boundaries for Protected and Special Management Areas should be developed and reviewed;
3. Review caribou seasonal susceptibility/sensitivity to disturbance;
4. Position on protection strategies and what strategies could be applied to which seasonal ranges and categories of caribou herds;
5. Position on how to integrate permanent, seasonal, and/or mobile restrictions or prohibitions to balance caribou conservation and economic development; and
6. Additional recommendations related to caribou.

These recommendations pertain to both **mainland migratory and tundra wintering herds**. Note that KivIA has not had access to caribou collar data that can be used to explore various mapping options for calving and other seasonal ranges, thus provision of proposed revised boundaries to NPC was not possible. We do, however, recommend methodology to use in deriving revised boundaries.

Terminology

There are a number of terms which have been used in different ways to describe calving grounds and other seasonal ranges. These different uses can cause confusion. Following are suggested terminology we use in this report:

Seasonal range: The area used by caribou in any one season. A seasonal range may include different habitats (vegetation and terrain). **Annual range** is the area used by caribou during the entire year.

Core: Government of Nunavut (GN) uses the term 'core' for each of nine seasons based on a statistical analysis of the satellite-collared caribou[7], using a different estimate of core for spring and fall migrations (80% utilization distribution kernel) and a broader estimate for the other seasonal ranges (95% kernel). Without getting overly technical, a 95% utilization distribution kernel surrounds an area within which (in this case) about 95% of the collar locations are found, and an 80% kernel surrounds about 80% of the locations[8]. The proportional area covered by 95% and 80% kernels depends on the pattern (mainly the relative concentration) of collar distribution on the landscape, but 95% kernels may cover from one-quarter to 2-3 times the area of an 80% kernel. There is no justification or explanation provided for the biological reasoning behind these selections.

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[7] Caslys Consulting Ltd. (2015). Barren-Ground Caribou Analysis Methods Summary Report - Draft. Prepared for Government of Nunavut Department of Environment, Wildlife Research Branch. July 2015. 12 pp.

[8] Seaman et al. 1999. Effects of sample size on kernel home range estimates. Journal of Wildlife Management 63:739-747.

Extent of calving[9]: This term, widely accepted among caribou biologists, is based on cow-calf behavior – the calf is completely dependent on nursing from the cow for the about the first 3 weeks after birth. The extent of calving refers to the area used from the peak of calving and for the following approximately 3 weeks. Depending on the timing of calving, extent of calving often extends to the last week or 10 days of June. Movements in the first weeks subsequent to calving remain relatively low[5]. This definition recognizes the time when calves are most sensitive to the maternal and environmental conditions that affect their growth and when they are most vulnerable to predation and disturbance[10].

KivIA suggests that the extent of calving should be considered as equivalent to core calving areas.

Peak of calving[9]: The date (or range of dates, depending on calculation method) when 50% of cows have calved.

Compared to GN seasons the extent of calving largely overlaps calving and immediate post-calving, but GN does not identify the peak of calving. For collared caribou approximate calving date (and location) can be estimated by determining the point of reduced daily distance moved by the cow[5].

Polygon: The NPC refers to the seasonal ranges as polygons: a polygon is a shape enclosed by a line and is a quite general term. It is makes more sense to refer instead to seasonal ranges.

1. Proposed boundaries to describe Protected and Special Management Areas

The KivIA is concerned that there are different ways to describe Protected and Special Management Areas: current Caribou Protection Measures (CPM); Government of Nunavut (GN) Protected and Special Management areas; and Mobile Caribou Conservation Measures (MCCM).

i) Current Caribou Protection Measures

The current Caribou Protection Measures[11] are based on DIAND's CPM developed in 1978. Initially, the CPM were applied to the *Traditional Calving and Post-calving Areas* for the Beverly and Qamanirjuaq herds[4] based on Inuit knowledge and aerial surveys (1950s-1978). However, subsequent monitoring in the 1980s led to changes in the Traditional Calving Grounds and the modified boundaries were re-named as the *Caribou Protection Areas*. Subsequent annual monitoring flights led to further boundary adjustments to the Caribou Protection Areas[4,5]. The Caribou Protection Areas had only seasonal restrictions (15 May–31 July) on land use permits and did not provide habitat protection or restrict non-land use permit activities, which led to

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[9] Russell, D.E., G. Kofinas, and B. Griffith. 2002. Barren–Ground caribou Calving Ground Workshop: Report of Proceedings. Technical Report Series No. 390. Canadian Wildlife Service, Ottawa, Ontario, 39pp.

[10] Wolfe, S. A., B. Griffith, and C. A. G. Wolfe. 2000. Response of reindeer and caribou to human activities. Polar Research 19:63–73.

[11] The Keewatin Regional Land Use Plan http://www.npc.nunavut.ca/eng/regions/Keewatin/keewatin_screen_complete.pdf

criticism[12]. The mapped Qamanirjuaq and Beverly calving areas are not comparable to the two Caribou Protection Areas which reflects the very different methods of mapping, date ranges, and information sources.

An assessment of the Beverly Protection Areas boundaries based on aerial monitoring found that calving was within the Caribou Protection Areas (and adjacent Thelon Game Sanctuary) for 13 of 15 years[5]. For the other 2 years (1984 and 1987), the extension of calving outside the Caribou Protection Areas was partial and within 10–20 km of the boundary.

By the mid-1990s, caribou cow movements were being tracked with satellite collars. The information from the year-round locations (weekly or daily) replaced information from aerial monitoring used to map calving and post-calving areas. Based on the 1993-2006 satellite-collar locations average, 68% of the Qamanirjuaq annual calving grounds (peak plus 3 weeks post-calving), were within the Caribou Protection Area[5]. The calculated centre of each annual calving ground (1993-2005) were within the Caribou Protection Area except 2005 when the cows were late reaching the calving grounds[5].

Thus up to the assessment in 2006, the Caribou Protection Areas for the Qamanirjuaq and Beverly herds, based on Inuit Qaujimajatuqangit (IQ) and aerial surveys prior to the 1980s, were relatively effective[5]. However as the Caribou Protection Areas are based on a long period of time, they are larger than the areas that the caribou use currently[5].

ii) GN protected areas

NPC's 2014 map[13] of Protected Areas for calving grounds (Protected Areas #47) shows calving grounds that have many tiny isolated areas and are fragmented by areas with high mineral potential (Special Management Areas #48). Some areas such as Southampton Island and Victoria Island are shown without Protected Areas for calving grounds. GN's June 2015 recommendations to NPC[14] provides revised and smaller core calving areas and key access corridors compared to those mapped in the 2014 NPC map (Fig. 1). The November 2015 presentation to the Nunavut Wildlife Management Board (NWMB)[15] provides additional mapping based on GN's analysis of satellite collars (1993-2013)[7]. According to the GN submission in June 2015, GN is recommending Protected Area status for all core calving grounds and key access corridors, regardless whether the areas have been identified as having

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[12] Beverly Qamanirjuaq Caribou Management Board. 2004. Protecting calving grounds, post-calving areas and other important habitats for Beverly and Qamanirjuaq caribou. Beverly Qamanirjuaq Caribou Management Board. http://www.arctic-caribou.com/pdf/Position_Paper.pdf

[13] http://www.nunavut.ca/files/2014DNLUP/2014_DNLUP_Schedule_A_Designations.pdf

[14] GN Recommendation: Caribou Core Calving Areas and Key Access Corridors. Map submitted to the Nunavut Planning Commission, dated June 19, 2015 [Online.] Available at http://www.nunavut.ca/files/2015-06-19_GN%20Recommendation_CoreCalvingKeyAccess.pdf

[15] Campbell, M. 2015. Resource Development and Caribou in Nunavut: Finding a Balance. Presentation for Nunavut Wildlife Management Board Workshop: Protecting Caribou and their Habitat, Rankin Inlet, Nunavut. Available at http://www.nwmb.com/en/public-hearings-a-meetings/workshops/november-2015-protecting-caribou-and-their-habitat-workshop#document-resource-development-and-caribou-in-nunavut-finding-a-balance-eng.

High Mineral Potential[16]. However, KivIA is unsure why the proposed GN Protected Areas for main of the mainland herds differs from the NPC map (Fig. 1).

Additionally to the differences between the mapped areas, KivIA has two main concerns with GN's approach:

1. KivIA could not determine if and how IQ was included, as the maps appear to only depend on the satellite collars; and
2. KivIA is concerned that the maps show seasonal ranges averaged over 1993-2013 – a long period, but the length of which period varies among herds. The maps are based on collars for the cumulative period and do not examine whether there are annual trends in the boundaries over that 20 year period.

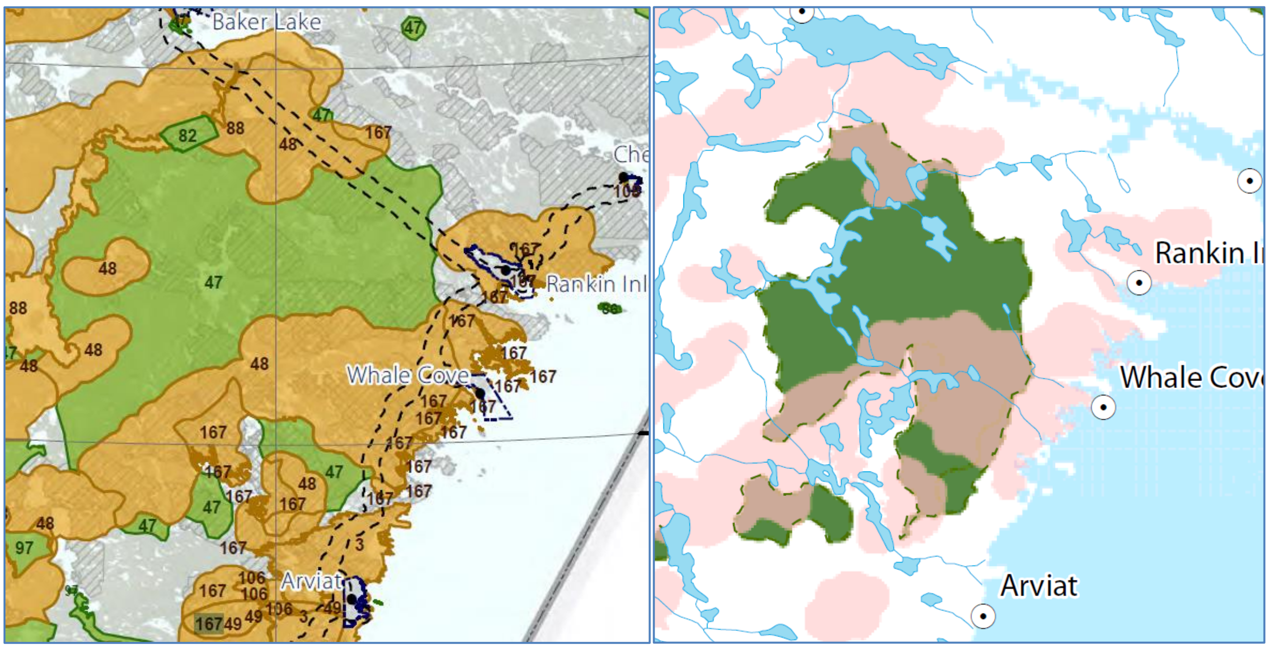

Figure 1. Example of the differences in Qamanirjuaq caribou core calving ground and key access areas from (left map) NPC draft NLUP Schedule A map[13] (Sites #47 are Protected Areas and #48 are Special Management Areas), and (right map) GN's June 2015 submission to the NPC (green areas are recommended calving core range and key access corridors and enclosed light brown areas are areas of high mineral potential)[14].

Seasonal ranges can change in size and location, especially during winter with consequent implications to spring migration routes. The longer the period of time of monitoring, the larger the cumulative area, especially for winter and spring migration ranges[17]. Typically calving grounds are the smallest seasonal range and the least variable in location (cows mostly show fidelity to their calving grounds). A further problem is that the timing of a seasonal use may

[16] http://nunavut.ca/en/draft_plan/consultation_record

[17] Gunn, A., K.G. Poole, and J. Wierzchowski. 2008. A geostatistical analysis for the patterns of caribou occupancy on the Bathurst calving grounds 1966–2007. Unpublished report prepared for Indian and Northern Affairs Canada, Yellowknife, NWT.

vary[18]. For example, between 1993 and 2005, Qamanirjuaq cows were arriving on average approximately 2 weeks later and leaving the calving ground approximately 1 week later[5].

GN's maps of calving and other seasonal ranges have technical limitations:

- The maps use satellite collars (which generally obtained locations every 1-7 days) and GPS collars (which obtain multiple locations each day), and it is unclear how these 2 different data sources are blended in the analysis, as the more frequent GPS locations may disproportionately outnumber the earlier satellite collar data;
- Collar sample size is uneven and mostly low (especially for the earlier satellite collar data and for the smaller herds)[19]. For example, between 1993 and 2003 the number of collars on Qamanirjuaq caribou was less than 10 cows annually;
- There are uncertainties how the satellite locations were used, especially the rationale for buffering the locations by 11-20 km and the use of either 80% or 95% kernels for different seasonal ranges;
- There is no clarification whether non-breeders were included (which may explain the scattered small isolated calving areas);
- The collars reflect primarily cow caribou movements, which are appropriate for calving and post-calving ranges, but ignore the bull movements for other seasons;
- There is no clarity on how individuals were assigned to subpopulations, nor whether individuals were assigned on an annual or lifetime basis; and
- Relying only on the collar locations means size of the calving grounds (potential Protected Areas) is not related to the numbers of caribou, which is a measure of vulnerability to disturbance.

iii) Mobile Caribou Conservation Measures

An approach to Mobile Measures was developed on behalf of KivIA[20] and was presented at the November 2015 NWMB workshop[21]. The Mobile Measures framework was well received by workshop participants and was included in the NWMB workshop recommendation #9: "Mobile caribou conservation measures deserve careful examination and consideration – for example, within buffer zones in the vicinity of a protected area." Maps of seasonal Caribou Conservation Areas, seasonal areas where caribou are likely to occur (thus providing a degree of predictability to both operators and regulators) and within which Mobile Measures would be implemented, have not been developed but would involve collaborative mapping using both IQ and scientific data[20].

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[18] Gunn, A., and K.G. Poole. 2010. Environmental trends across the range of the Bathurst caribou herd and timing of the arrival of cows on their calving ground 1996–2009. Unpublished report for Environment and Natural Resources, Yellowknife, NWT.

[19] Nagy, J.A., D.L. Johnson, N.C. Larter, M.W. Campbell, A.E. Derocher, A. Kelly, M. Dumond, D. Allaire, and B. Croft. 2011. Subpopulation structure of caribou (*Rangifer tarandus* L.) in Arctic and subarctic Canada. Ecological Applications 21:2334–2348.

[20] Poole, K. G., and A. Gunn. 2015. Mobile Caribou Conservation Measures for the Kivalliq Region, Nunavut. Draft Report for the Kivalliq Inuit Association. November 12, 2015.

[21] http://www.nwmb.com/en/public-hearings-a-meetings/workshops/november-2015-protecting-caribou-and-their-habitat-workshop#document-mobile-caribou-conservation-measures-eng

KivIA's position is that Mobile Measures can be adapted to reflect the vulnerability of caribou on seasonal ranges and at water crossings, and can also be applied in a land-use zone (Special Management Area) around core calving grounds.

2. Position on how seasonal boundaries should be developed and reviewed

Number of seasons

Management of caribou must be predicated on IQ and scientific data related to caribou ecology and known or assumed vulnerability to disturbance, while acknowledging a balance between caribou protection and economic development opportunities. We caution against placing excessive dependence on management around land ownership or mineral (potential or actual) dependence boundaries.

KivIA is concerned that for practical purposes management of too many seasons becomes more difficult. In addition, the dates for seasons proposed in the various GN documents[15],[15] are only based on satellite-collared caribou, do not incorporate IQ, and are insensitive to temporal trends over time. Developing seasonal boundaries first requires collaborative agreement on the season dates. For use of collar data, non-breeder cows have to be screened out as they typically arrive later or not at all on calving grounds; this can be achieved by inspection of the rates of movements as cows slow down when giving birth[5]. The frequency when seasonal boundaries should be reviewed is relative to anticipated changes in herd abundance and pre-calving migration, but should be conducted at least every 5 years.

Risk categories should be used to inform the extent of monitoring and mitigation within seasons. Table 1 is a proposed outline of the seasons and risk categories that could be used with this approach (modified from[20]). (Note that extent of calving as proposed will cover the calving and a portion of the post-calving season. We have combined some seasons (e.g., fall migration and rut) for ease of logistics and simplicity.) Crucial and cautionary risk timing windows cover the time when a species is most susceptible to disturbance, and low risk timing windows are defined when species are less susceptible to disturbance.

Some seasons will be easier to map and are predictable, while others are less so. To summarize and for the purposes of the March 2016 NPC caribou workshop, we tentatively suggest the following seasons:

- Spring migration
- Calving (to include extent of calving)
- Post-calving/summer (insect season)
- Late summer/pre-rut
- Fall migration/rut
- Winter

Table 1. Summarizing seasons, risk category, timing, relative size and location predictability, and susceptibility of barren-ground caribou to disturbance based on life-history characteristics. Modified from [20]

Season	Risk Category	Timing[1]	Relative size and location predictability	Caribou susceptibility and behaviour
Spring migration (pre-calving)	Cautionary	Apr - Jun	Narrow, predictable	Narrow corridors of cows often rapidly moving together with occasional staging in large aggregations
Calving (extent of calving)	Crucial	Jun	Small area, predictable	High densities of cows at annually lowest part of condition cycle and with newborn calves so the cows are responsive to disturbances
Post-calving/ summer (insect season)	Crucial	Late Jun – Aug	Larger, less predictable	Cows and calves aggregating into large groups; calves susceptible to abandonment from disturbance; aggregations susceptible to disturbance at traditional water crossings
Late summer/ pre-rut	Cautionary	Aug - Oct	Larger, less predictable	Caribou often more dispersed and regaining body condition prior to breeding; aggregations susceptible to disturbance at traditional water crossings
Fall migration/ rut	Low	Oct - Nov	Larger, less predictable	Caribou either migrating or staging; aggregations susceptible to disturbance at traditional water crossings
Winter	Low	Dec - Apr	Larger, less predictable	Caribou in aggregations over a large area and less movement

[1] The actual dates differ among herds.

Recommendations for mapping seasonal core ranges

KivIA supports GN's mapping of core calving ranges with the following modifications and additional analyses:

1. For the purposes of caribou protection and conservation, season designations and dates should be decided through a collaborative exercise, but should consider the practicality of managing.
2. Core calving areas should address the extent of calving (peak of calving plus 3 weeks), and should consider IQ and scientific (survey, collar) data.
3. Satellite collar locations should not be arbitrarily buffered by a set distance (11-20 km with previous mapping[7]), as the GIS mapping technique applies buffers around locations and IQ may provide information on calving area boundaries.
4. For core calving area integrate GN's information with IQ and aerial surveys (including aerial surveys conducted for calving ground distribution or population estimates). IQ often can most readily be obtained from research conducted for environmental assessments.
5. Screen out non-breeding cows from calving area delineation (as noted above).

6. Use only the most recent 10 years of collaring data and address annual trends in seasonal ranges, especially for calving/post-calving areas. Weighting for core ranges should be equally applied among years. The satellite collars can be analysed annually to indicate the centre and dispersion of calving which adds emphasis to trends in annual use (some calving grounds have concentrated while others have more dispersed calving).

Examples of the scientific data available for mapping core calving areas are provided in Figures 2 and 3. Figure 2 (left panel) is the Bathurst herd's calving grounds and shows the relationship between the collar locations at peak calving, with the red dot the center of those collared cows; the red lines the different levels of probability of distribution based on the collars (50%, 90% and 95% kernels) and the green areas mapped according to the number of caribou/km^2 with the light green dot representing the center of the aerially mapped distribution. The right panel shows the centers of the calving grounds 1996-2007 (red dots) based on satellite collars and the size of the circles indexes how tight the collars were together.

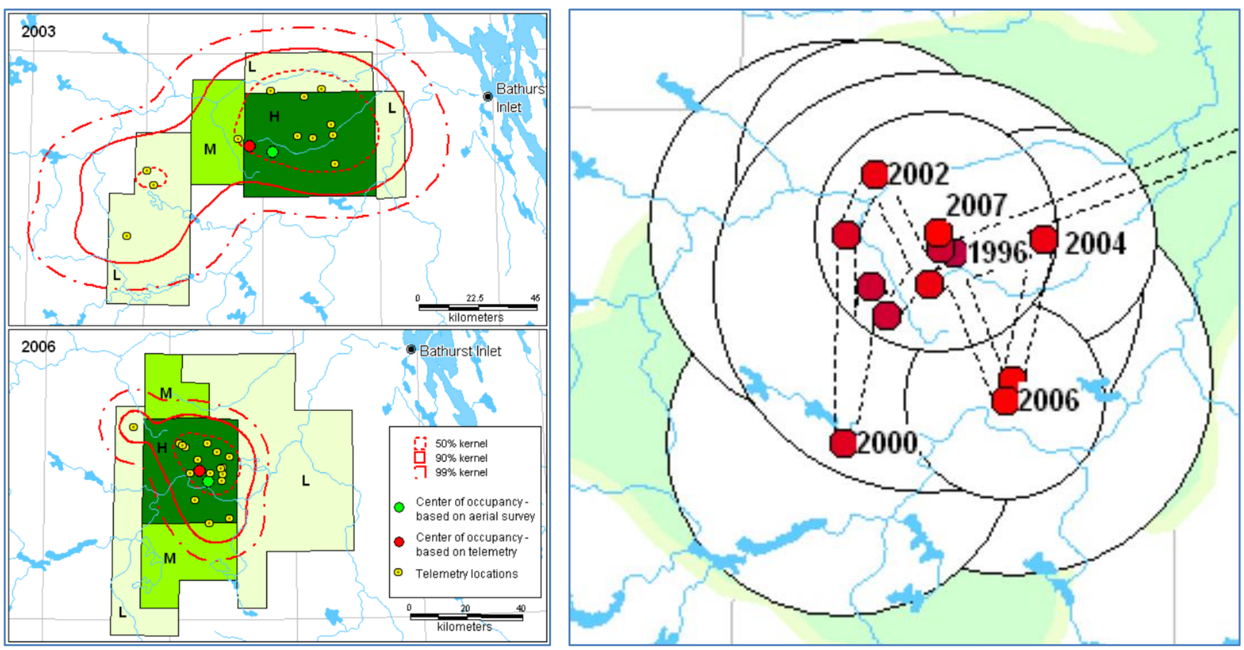

Figure 2. Left map: Relationship for the Bathurst caribou herd between peak calving grounds as determined by satellite collars and peak calving grounds as determined from stratification from aerial surveys. Right map: peak calving ground centroids for the Bathurst herd, 1996-2007. Source[1717].

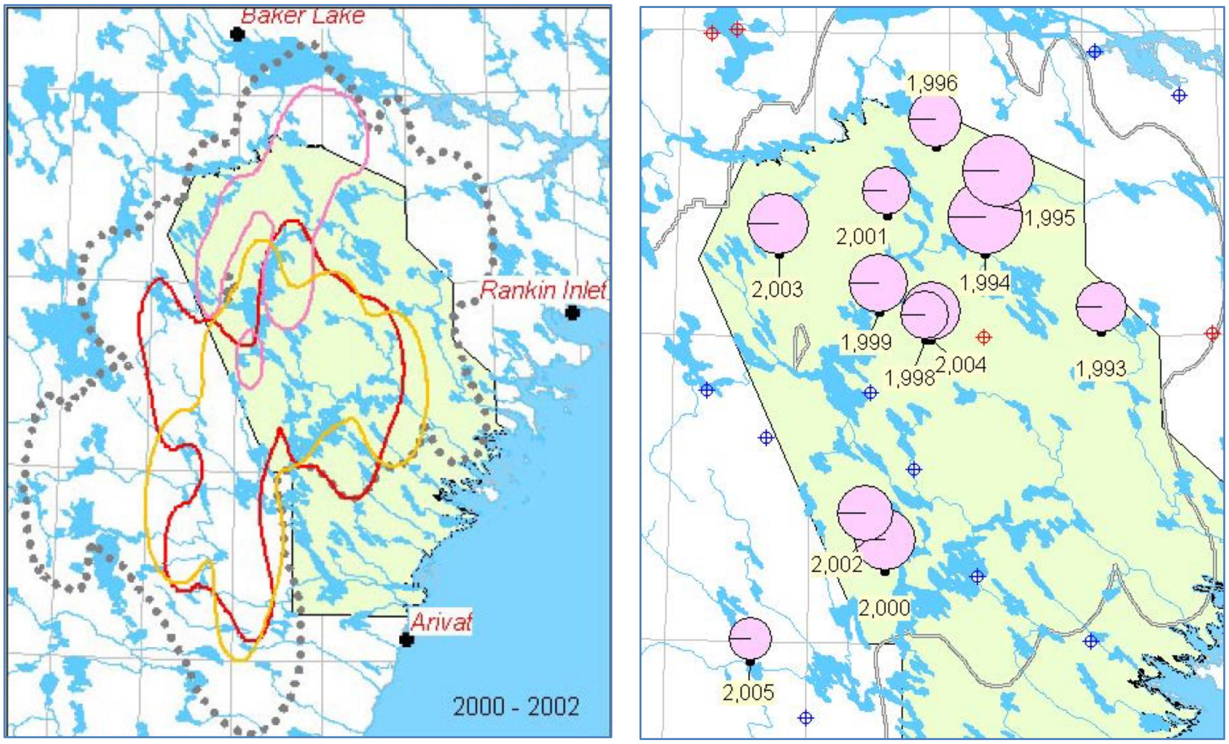

Figure 3. Left map: Qamanirjuaq annual calving grounds based on satellite collar locations, 2000-02. Right map: Distribution of annual Qamanirjuaq annual calving grounds as shown by the centroids (dark dots), 1993-2005. Source[5].

Figure 3 is for the Qamanirjuaq herd and shows (left panel) how calving distribution based on the collars overlaps the Caribou Protection Area (shaded green area) and the extent of calving (dashed line) for 2000-02. The right panel shows the relationship between the Caribou Protection Area (shaded green area), the extent of calving (double black line) the center of annual peak calving distribution (black dots), and the shape of the calving ground (pink circles).

3. Review caribou seasonal susceptibility/sensitivity to disturbance

KivIA has no additional comments to the review of information on caribou susceptibility/ sensitivity to disturbance from both an IQ and scientific perspective that was presented at the NWMB workshop in November 2015[6]. Acknowledging that caribou vulnerability to disturbance varies seasonally related to susceptibility of calves, degree of aggregation, and other factors, there is little point in protecting only the calving grounds without managing disturbance elsewhere within annual ranges. Caribou spend less than 10% of the year on calving and immediate post-calving habitat, thus their period of exposure is comparatively short. Management of land use planning activities has to be linked among seasonal ranges.

4. Position on protection strategies and what strategies could be applied to which seasonal ranges and categories of caribou herds

KivIA's protection strategy is that Mobile Caribou Conservation Measures[20] for caribou seasonal ranges should be implemented to support well-defined and regularly reviewed year-round Protected Areas for core calving areas and water-crossings:

1. KivIA supports identification of core calving areas using IQ, scientific data survey and collar data, and temporal trends to identify the core areas used by calving and immediately post-calving caribou (during extent of calving).
2. These core calving areas would be designated as Protected Areas and buffered by areas within which mobile protection measures (MCCM) would be in place to manage disturbance if caribou intersect with exploration and development activities during these critical periods outside of the protected core calving area; and
3. Mobile measures would be applied to other seasonal ranges as described in Table 2 and in the proposed draft MCCM document[20]. These proposed mobile protection measures consider flexibility to address differing vulnerability to disturbance among seasons.

KivIA's position is based on these principles:

1. To ensure that IQ information is mapped and integrated into describing seasonal ranges;
2. To be collaborative and transparent by sharing information and methods among the concerned groups working together on the NPC's draft NLUP – an example is working with GN on describing caribou seasonal ranges;
3. To build on what already has been done (DIAND's and KivIA's CPM) which used IQ and information additional to a reliance on satellite collars;
4. To achieve a balance between "*development*" and "*protection*" in caribou seasonal ranges by integrating Protected Areas and mobile protection measures applied to seasonal ranges. KivIA recognizes the complexity of caribou and how caribou adapt by changing their movements and use of seasonal ranges. KivIA also recognizes the need for adaptability and flexibility to accommodate boom/bust cycles driven by global economic trends as well as caribou cycles.
5. KivIA is also anxious to ensure that the land use plan is clearly integrated with herd management planning and the environmental assessment process.

Table 2. Season, risk category, and suggested zone sizes and thresholds of caribou numbers counted in the Early Warning Zone, Buffer Zone, and Zone of Influence (ZOI) to trigger corresponding mitigation actions. Analysis of movement rates and local input are needed to refine the dates and number of seasons. Modified from [20].

Season	Risk category	Timing[1]	Suggested zone radii (km)			Threshold number of adult caribou[2]			Mitigation actions if thresholds passed in ZOI[4]
			Early Warning Zone	Buffer Zone	ZOI	Early Warning Zone[3]	Buffer Zone	ZOI[4]	
Spring migration (pre-calving)	Cautionary	Apr - Jun	50	20	15	5/25	50	25/50	Suspend flights and ground operations within 36 hrs/ Close camp within 48 hrs
Calving (extent of calving)	Crucial	Jun	50	15	10	1/10	20	5/10	Suspend flights and ground operations within 24 hrs/ Close camp within 24 hrs
Post-calving/ summer (insect season)	Crucial	Late Jun - Aug	50	15	10	1/10	20	5/10	Suspend flights and ground operations within 24 hrs/ Close camp within 24 hrs
Late summer/ pre-rut	Cautionary	Aug - Oct	30	15	10	5/25	50	10/25	Suspend flights and ground operations within 36 hrs/ Close camp within 48 hrs
Fall migration/ rut	Low	Oct - Nov	50	15	10	5/50	100	25/50	Reduce above-ground operations within 48 hrs/ Suspend above-ground operations within 72 hrs
Winter	Low	Dec - Apr	30	10	5	5/50	100	25/50	Reduce above-ground operations within 48 hrs/ Suspend above-ground operations within 72 hrs

[1] The actual dates differ among herds.

[2] Proposed numbers based on differences in relative risk during each season. Caribou thresholds (generally collared individuals or incidental sightings) within the Early Warning Zone would trigger surveys within the Buffer Zone and Zone of Influence. Caribou thresholds (generally from aerial surveys) in the Buffer Zone would justify notice to the exploration manager and the land use inspector of a potential suspension should caribou enter the Zone of Influence.

[3] xx/yy represent number of collared/observed caribou within the Early Warning Zone.

[4] xx/yy represent thresholds of number of collared/observed caribou to trigger main sets of mitigation responses.

5. Position on how to integrate permanent, seasonal, and/or mobile restrictions or prohibitions to balance caribou conservation and economic development

The highest level in a hierarchy of integrated protection is applied to areas where caribou are vulnerable through congregating at predictable locations (fidelity) either through behaviour (calving grounds) or geographic constraints (water and ice crossings). KivIA makes the following recommendations:

1. **Core calving areas** (areas used by caribou from peak of calving through to about 3 weeks of age – extent of calving) mapped using IQ, aerial surveys and the most recent 10 years of satellite telemetry, will be closed to development (**year-round Protected Area status**).
2. **Core calving areas that overlap areas of High Mineral Potential** should be provided **seasonal Special Management Area status**, within which stringent measures (based on MCCM) will be applied for any exploration or development contemplated within those areas.
3. Develop a 25-km buffer around core calving areas and apply **mobile protection measures** as per MCCM.
4. The immediate area around **identified water crossings** should be within **year-round Protected Areas**, with the size of the area tailored to traditional caribou approach characteristics based on IQ. We anticipate these areas to have a radius of up to a maximum of several kilometres from the crossing site, and be not necessarily circular in shape. Around the water crossing we recommend a 10 km radius zone within which **mobile protection measures** would be applied (note this means larger monitoring zones – up to 25 km – to ensure adequate time for mitigation).
5. **For other seasonal ranges** (including as defined here post-calving/summer, late summer/pre-rut, fall migration and rut, winter and spring migration), apply **mobile protection measures** with different criteria and timing for different seasons within anticipated seasonal boundaries (Table 2) and types of exploration or development activities[20]. Mobile measure can be adapted to address potential disturbance issues wherever the caribou travel.
6. Major **transportation corridors and infrastructure** of significant economic important to the Kivalliq Region (e.g., the Nunavut-Manitoba Road) should be granted **Special Management Area** status with appropriate (and if required, stringent) mobile measures applied.
7. For industrial developments that are within different seasonal ranges (e.g., linear road corridors), develop packages of mitigation conditions for project certificate. We assume these would be addressed under the Nunavut Impact Review Board process.

Although KivIA cannot conduct the required analysis with the collar data, the extent of these proposed Protected Areas will likely be consistent with those proposed by GN in their June 2015 submission to NPC[14]. However, GN uses longer-term data, often back to 1993. Given possible changes in caribou distribution over time we recommend using the previous 10 years of data with 5-year updates. For example, use of the most recent 10 years of data of the

Qamanirjuaq herd will likely reduce the core calving area to the more northern portion of the current CPM Caribou Protection Area (Fig. 3).

Having two differing management zones (Protected Areas and Special Management Areas) will fragment management within some calving areas, which could increase the vulnerability of the calving caribou; this scenario is not desirable but may be necessary to balance caribou protection and economic development opportunities. We propose that mobile protection measures would be imposed within any Special Management Area within a calving area, with a range of measures including complete closure of areas and no activity during June and July. This does not preclude exploration activity (with appropriate mobile protection measures) during other times of the year, but permit conditions will clearly specify that mine activity could be suspended.

6. Additional recommendations related to caribou

KivIA has additional recommendations for NPC:

1. NPC should ask all parties to provide clear (biological and if necessary statistical) definitions of all terminology, and that NPC then provide direction on preferred and alternative terminology;
2. NPC should ensure an updated list of 'designated' water crossings is developed.

As noted, many of the measures recommended are derived from the proposed draft MCCM document prepared for the Kivalliq Region, and we refer the reader to that document for further details[20].

Schedule D. General Considerations, Heritage River Conservation and Water Protection

Hutchinson

Environmental Sciences Ltd.

2014 Draft
Nunavut Land Use Plan
Review

Prepared for: GeoVector Management Inc. and the Kivalliq Inuit Association
Job #: J150050

March, 2016

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March, 2016 HESL Job #: J150050

Alan Sexton, P.Geo.
GeoVector Management Inc.
10 Green Street Suite 312
Nepean ON K2J 3Z6

Dear Mr. Sexton:

Re: 2014 Draft Nunavut Land Use Plan Review

I am pleased to submit to you our review of the 2014 Draft Nunavut Land Use Plan (NLUP) as input into the Kivalliq Inuit Association's (KIA) technical submission to the Nunavut Planning Commission (NPC). This technical report focuses on a review of:

- the NLUP's freshwater environment interactions, ensuring they are sufficiently protective of Inuit freshwater resources (with a focus on drinking water supply);
- whether the Plan reaches beyond what is scientifically defensible at the cost of potential resource development and subsequent economic benefits;
- the plan's coverage of marine areas and migratory birds, and
- general overarching concerns with approach taken in the NLUP.

This report is intended as an appendix to the KIA's submission to NPC along with separate appendices contributed by GeoVector Management Inc. regarding mineral potential concerns, and Aurora Wildlife Research on specific caribou considerations.

Our review of the NLUP has identified 13 separate concerns. These are summarized in our executive summary and in a PowerPoint presentation that HESL will contribute to, intended for the KIA to present at a series of proposed technical meetings hosted by the NPC to discuss the draft NLUP.

We look forward to our continued participation in the NLUP Review process to ensure the development of a Land Use Plan that protects the environmental, economic and social interests of the Kivalliq Inuit, Nunavummiut and Canadians overall.

Sincerely,
per: Hutchinson Environmental Sciences Ltd.

Richard Nesbitt, M.Sc.
Richard.Nesbitt@environmentalsciences.ca

Signatures

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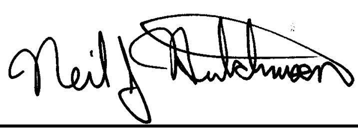
Report Reviewed by:



Neil J. Hutchinson, Ph.D.
Principal Scientist

Executive Summary

The Draft Nunavut Land Use Plan (NLUP) was developed by the Nunavut Planning Commission (NPC) as mandated for the Nunavut Settlement Area under Article 11 of the Nunavut Land Claims Agreement (NLCA). The Kivalliq Inuit Association (KIA) retained Hutchinson Environmental Sciences Ltd. (HESL) as part of a team also consisting of GeoVector Management (Geovector) and Aurora Wildlife Research to review the most recent draft NLUP and contribute to a KIA submission to the NPC.

Our review was intended to be high level at the request of the KIA and GeoVector, and identifies concerns that characterize shortcomings in the NLUP which would prevent it from being adopted as currently written. We were further requested to provide a specific focus on the Heritage River Land Use Designation. We have identified 13 separate concerns, summarized as follows:

Heritage River Land Use Designation

Nunavut contains three designated Heritage Rivers (the Kazan, Thelon and Soper rivers) and one nominated Heritage River (the Coppermine River). The Kazan and Thelon rivers are located within the Kivalliq Region. As per guidance provided by the Canadian Heritage Rivers Secretariat, these water resources should be protected from environmental degradation while still providing the opportunity for economic and social benefits to the Canadian population. The DNLUP as currently written does not provide adequate environmental protections to Nunavut’s Heritage River systems nor does it include sufficient rationale for the guidance that has been provided. This lack of rationale is particularly evident in the conflicting direction provided in the DNLUP for protection of the Kazan and Thelon rivers, and for potential energy development projects. The NPC should ensure that the NLUP has considered all available documentation and management plans applicable to the protection and responsible development of these Heritage Rivers.

It is recommended that the DNLUP apply the mixed land use designation to the Kazan and Thelon Heritage Rivers, and expand the scope of managing these river systems to their entire watersheds. These protections should be rooted in science and IQ-based decision making, include consideration of available and applicable management plans, and ongoing environmental monitoring.

Concerns with the Overall Approach taken in the NLUP

Several concerns were identified with the overall approach taken in the DNLUP. In particular, insufficient explanation is provided on the decision-making process guiding land use designations, and no framework exists for the periodic review and evaluation of how the DNLUP is performing over time nor the supporting information.

The DNLUP fails to explain the rationale used to establish the various land use designations throughout the territory. Furthermore, it is not clear whether land use designations can change with new information (e.g., an area currently designated as Protected Area might be identified in future as an Area of High Mineral Potential - would this alter the level of Protection?). In addition, there are land use designations that currently overlap in the DNLUP (e.g., High Mineral Potential and Community Area of Interest), but no clarification is provided on how potentially conflicting designations are balanced.

The DNLUP acknowledges that there are gaps in information, knowledge and expert advice that have restricted the consideration of land use options, but that this absence of information cannot impede the land use planning process. While it is recognized that the development of the DNLUP cannot wait until all information gaps have been filled, it should strive to incorporate the best available information on an ongoing basis. The DNLUP, however, does not explain how new information will be considered and integrated into the Plan in a timely and consistent manner. Furthermore, it is not clear whether the Precautionary Principle is used when making decisions in the absence of information under the DNLUP.

The lack of clarity on the decision-making process structuring the DNLUP, as well as the absence of any framework to ensure ongoing or periodic review and update of the Plan, creates considerable uncertainty with regard to land use planning options in the territory. It is recommended that the DNLUP:

- provide rationale and relevant background information used to establish the land use designations, including a discussion of the rules applied to categorize areas under different designations, and to delineate the size and shape of areas;
- clarify whether new information can change land use designations (and the process for doing so);
- explain how overlapping land use designations are currently managed and potential conflicts avoided;
- adopt the Precautionary Principle in all decision-making as it is currently enshrined in the 1999 Canadian Environmental Protection Act (CEPA 1999): *"Whereas the Government of Canada is committed to implementing the precautionary principle that, where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."*
- include a summary of data/knowledge gaps identified in its development, as well as a strategy for addressing them in future updates;
- establish a mandated and regular process for review and update to reflect the most recent information and current needs of the territory.

Freshwater Resource Potential Concerns

The review completed by HESL highlighted three overarching concerns with the protection of freshwater resources in the DNLUP.

First, the NPC has not included freshwater quality, quantity or flow as one of the areas and issues pertinent to the goal of supporting and sustaining the environment. There is also concern that this disregards Article 20 of the Nunavut Land Claims Agreement and diminishes consideration for changes to water quality, quantity and flow in their own right resulting from either development or proposed protection measures.

The KivIA is further concerned that the DNLUP as written does not provide adequate, science-based protections for the drinking water supply of all Nunavut communities. Not all communities have designated special management areas for "Community Water Source Watershed" to ensure that their local freshwater supply is sufficient in quantity and adequately protected from local and upstream influences. Where "Community Water Source Watershed" special management areas have been designated for communities, they have not been scientifically derived using documented criteria or rationale. Therefore, the DNLUP provides no assurance that the communities of Nunavut have been afforded adequate long-term drinking water supply security, an essential component of planning for population growth and development.

Finally, no consideration has been given in the DNLUP for drinking water sources while Nunavummiut are on the land. This disregards a necessary component of many traditional Inuit land uses that requires access to freshwater while away from community drinking water treatment and distribution infrastructure for an extended period.

It is recommended that:

- additional consideration be given throughout the DNLUP to freshwater quality, quantity and flow;
- scientifically defensible freshwater resource protections are designated for all of Nunavut's communities in future drafts as sufficient information becomes available and that the rationale and criteria for designating these source water protection areas be documented; and
- protection of freshwater sources while on the land is expressly considered by the NPC and includes documentation of consideration of Inuit Qaujimajatuqangit.

Protection of Marine Areas

The DNLUP recognizes that key marine features, such as caribou sea crossings, Ecologically and Biologically Significant Areas (EBSAs), and polynyas are important for Nunavut biodiversity. These features, however, are all assigned a Mixed Use Land Use Designation, which is the least protective land use category under the DNLUP. In addition, sea ice is identified as important for polar bears, and susceptible to climate change, yet it receives no land use designation under the DNLUP.

These key marine features are dynamic in their location and duration. Although identifying and monitoring these features may be challenging, protecting them is important for Nunavut biodiversity, especially in the face of climate change and increasing marine shipping activity.

It is recommended that the DNLUP should provide greater protection for these key marine features by defining them with recognition that they are dynamic features and designating them as Special Management Areas. As such, restrictions including clearly defined setbacks, should be considered on some access and uses in and around these features (e.g., relating to oil and gas exploration and production, commercial shipping). Furthermore, identification and monitoring of these features should be documented as a research priority in the DNLUP.

Protection of Migratory Birds

Key Migratory Bird Habitat Sites are assigned either Protected Area or Special Management Area Land Use Designations, while Migratory Bird Sanctuaries are assigned a Protected Area Land Use Designation under the DNLUP. National Wildlife Areas (designated as Protected Areas) also provide habitat for migratory birds. The Plan provides setback requirements that regulatory authorities must follow when issuing permits, licenses and authorizations for activity in, or in the vicinity of, these areas, in order to protect migratory birds during the breeding season.

The terrestrial setbacks established for all migratory birds, sea-level coastal nesting birds, all seabirds, Northern Fulmars, Ivory Gulls and coastal waterfowl and seaducks are seasonal, only applying when birds are present (i.e. in breeding bird colonies or moulting areas). Setbacks during only part of the year could lead to destruction or disturbance of breeding habitat when the birds are not present, resulting in loss or degradation of habitat necessary for birds when they return to breed.

Furthermore, the 300 m seasonal terrestrial setback from concentrations of birds may not be sufficient for all types of activities. The North Yukon Regional Land Use Plan (Vontut Gwitchin Government and Yukon Government, 2009) has adopted land use zoning based on intensity rather than type of use. In this approach, the direct surface disturbance and linear density of proposed human activities are used to determine the overall intensity of a proposed project. Similar metrics could be used to evaluate appropriate setback distances for different activities affecting migratory birds in the DNLUP.

It is recommended that the DNLUP require year-round terrestrial setbacks around migratory bird habitat to ensure breeding habitat is not lost or degraded during all periods of the year. It is also recommend that the intensity of proposed activities in, or in the vicinity of, migratory bird habitat be factored into the calculation of setback distance (e.g. consider the amount of area physically disturbed and the total length of linear features such as roads, access trails etc.).

Table of Contents

1. Introduction

The Draft Nunavut Land Use Plan (NLUP) was developed by the Nunavut Planning Commission (NPC) as mandated for the Nunavut Settlement Area under Article 11 of the Nunavut Land Claims Agreement (NLCA). The Kivalliq Inuit Association (KIA) retained Hutchinson Environmental Sciences Ltd. (HESL) as part of a team also consisting of GeoVector Management (Geovector) and Aurora Wildlife Research to review the most recent NLUP and contribute to a submission to the NPC.

HESL's review mandate was predominantly high level; our mandate was to identify shortcomings in the NLUP that may deter its implementation without further revision. Specifically, HESL was tasked with:

- assessing the NLUP's freshwater environment interactions, to ensure they are sufficiently protective of Inuit freshwater resources (with a focus on drinking water supply);
- ensuring that the Plan not reach beyond what is scientifically defensible at the cost of potential resource development and subsequent economic benefits;
- evaluating coverage of marine areas and migratory birds to ensure they were adequately considered, and
- providing general comments on the overall approach of the NLUP.

Our review was limited to specific issues pertaining to the Kivalliq Region, but also included a general assessment of the overall approach taken in the NLUP that may affect how it is applied in the Kivalliq Region and in other areas of Nunavut. The KIA has also requested that HESL provide a more in-depth review of the NPC's Heritage River Land Use Designations and include references that may assist the NPC as it refines its guidance for those designations.

Land Use Planning, as addressed by the DNLUP and the NPC, is only one step of the permitting process for a proposed project in the Kivalliq. Permits for activities on Inuit Owned Land are also reviewed by the KivIA, and projects which may have larger scale or residual environmental impacts are subject to the Environmental Assessment process through the Nunavut Impact Review Board. This consideration has, in part, informed our review of the DNLUP.

The Draft NLUP contains several sections specific to freshwater resource protection or potential freshwater use, marine areas and migratory bird protection that may be applied within the Kivalliq Region. They are:

Freshwater Resource Protection/Use

- **3.1.2.1: Thelon Wildlife Sanctuary.** This section includes the Thelon River valley running through the sanctuary as a *"unique extension of boreal forest habitat"*.
- **3.1.2.5: Heritage Rivers.** The NLUP designates three heritage Rivers: the Thelon, Kazan and Soper. The Plan specifies a corridor extending 1 km from the bank of both the Thelon and Kazan rivers, which are located in the Kivalliq Region.
- **4.3: Alternative Energy Sources.** The NPC summarizes its objective to find alternatives to diesel fuel for electricity generation. This includes a statement that *"Hydro-electricity from water is currently the most viable option"*.
- **4.4.1: Community Drinking Water Supplies**. This section is specifically broken down into:

- **4.4.1.1: Community Drinking Water Supplies within Municipal Boundaries**. This outlines protection for freshwater quality and quantity for the municipalities of Nunavut.
- **4.4.1.2: Community Drinking Water Supplies outside of Municipal Boundaries**. This outlines protection for drinking water supplies outside municipal boundaries. While not stated in this section, protection may be applied to waterbodies used by Inuit when on the Land in line with Section 1.4.2: Consultation, which states *"The Commission also learned of the importance of access to safe drinking waters both within municipalities and while traveling on the land. Preservation of water quality is also an underlying theme for protecting the environmental integrity of the NSA, which in turn is tied to food security."*

Marine Areas Protection

- **2.1.2.2: Caribou Sea Ice Crossings.** Migratory routes that cross frozen sea ice are recognized as susceptible to changing environmental conditions and ice breaker activity.
- **2.1.5: Marine Areas of Importance**. This section is divided into:
  - **2.1.5.1: Ecologically and Biologically Significant Areas (EBSAs).** These have been identified at large spatial scales in marine areas.
  - **2.1.5.2: Polynyas.** These dynamic marine features are considered important for marine wildlife, as a link between the ocean and atmosphere, and as nutrient rich, biologically productive areas.
- **5. 1. 3: Commercial Fisheries.** This industry is expected to grow in the NSA. The NLUP identifies areas of char and turbot abundance.

Migratory Bird Protection

- **2.1.1: Key Migratory Bird Habitat Sites**. These areas have been identified for migratory bird species known to breed in the NSA and include both terrestrial and marine habitat necessary to sustain and support their populations. The sites are classified into two categories, based on their overall importance to a particular species nationally and their sensitivity to disturbance.
- **3.1.2.2: Migratory Bird Sanctuaries (MBS).** These areas are established and managed under federal legislation to protect migratory birds and their nests, eggs and habitat. Eight MBS currently exist in Nunavut.

Section 2 of our report outlines our comments specific to the Heritage River Land Use Designations. Section 3 of our report outlines our additional technical comments on the 2014 Draft Nunavut Land Use Plan, relating to overall approach, freshwater resources, marine areas, and migratory birds.

2. Heritage River Land Use Designation

Nunavut currently has three designated Heritage Rivers – the Thelon, the Kazan and the Soper rivers. The Coppermine River has been nominated but has not yet been designated. These four rivers join the Canadian Heritage Rivers System, *"a valued nation-wide program, which is recognized around the world as a model for river conservation and community engagement. Canadian Heritage Rivers include a myriad of renowned national waterscapes, magnificent cultural treasures, and deeply entrenched societal icons"* (Parks Canada, 2007).

Protection of the Canadian Heritage River Systems are based on eight key principles as laid out in the 2008-2018 Strategic Plan (Parks Canada, 2007). Three of these principles can be used to provide the NPC with guidance as it finalizes the NLUP, and include appropriate, scientifically based protection for the two designated Heritage Rivers within the Kivalliq Region (the Thelon and Kazan Rivers):

> *"**Leadership:** The federal, provincial, and territorial governments are strongly committed to the CHRS. The partners support the promotion of the CHRS and ongoing monitoring of designated rivers, and the long-term operation and management of heritage rivers within their jurisdictions.*
>
> ***Integrity:** Rivers in the system are designated and managed to meet the heritage values and guidelines set out by the Canadian Heritage Rivers Board. The CHRS values scientific and traditional knowledge.*
>
> ***Sustainability:** The CHRS recognizes that healthy rivers are essential to life on earth. Successful river management must protect river health in order to deliver the full range of ecological, economic, and social benefits for present and future generations."*

These three guiding principles of the Canadian Heritage River Systems are in line with the DNLUP's overall goals (highlighted in section 1.3):

*"**Goal 1** - Strengthening Partnership and Institutions A Nunavut-Specific Land Use Planning Process*
***Goal 2** - Protecting and Sustaining the Environment Protecting Wildlife, Air, Land and Water*
***Goal 3** - Encouraging Conservation Planning*
***Goal 4** - Building Healthier Communities Strengthening Culture, Heritage and Well-being*
***Goal 5** - Encouraging Sustainable Economic Development".*

Together, the principles of the Canadian Heritage River Systems and the goals of the NLUP indicate that protection should be afforded to Canada's Heritage Rivers for a variety of uses including ecological, economic and social benefits, and that conservation decisions should be made with the best available scientific and traditional knowledge. Protections afforded to the two Kivalliq Region designated Heritage Rivers should be updated based on the results of ongoing monitoring and should account for the developing needs of the territory.

Recommendation: Heritage Rivers in the Kivalliq Region should be afforded a mixed land use designation in section 3.1.2.5 of the Draft NLUP. This will help ensure that these rivers are protected from ecological degradation while still promoting economic and social benefits within the Kivalliq from their use.

Regular and ongoing monitoring of water quality, quantity, flow and biological baseline conditions along these heritage rivers should be conducted with particular emphasis on locations that may become stressed with future development, such as potential hydropower generating locations. Information gained through monitoring should be expressly considered in the NLUP, during updates to it, and in any management plans that may be developed for the Thelon and Kazan Heritage Rivers.

Guidance on how this recommendation can be functionally applied in the NLUP to support a variety of land uses can be taken from management of the Grand River in Southern Ontario, a designated Heritage River as of 1994. The Grand River drains to Lake Erie, one of Canada's Great Lakes, and contains three distinct areas – till plains, moraines and clay plains. The river supplies drinking water to several major municipalities and provides recreational benefits to the region while still supporting economic and agricultural development. Protection and management of all these overlapping services provided by the Grand River can be found in the Grand River Watershed Water Management Plan (Project Team, Water Management Plan. 2014). We have included the full reference in Section 2.3 of this report.

The remainder of Section 2 identifies specific concerns regarding the guidance and designations outlined in the current Draft NLUP for the Kivalliq's Heritage Rivers.

2.1 KIA-HESL-1: Adequate Protection of Heritage Rivers

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-1
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Richard Nesbitt, Hutchinson Environmental Sciences Ltd.
Subject:	**Adequate Protection of Heritage Rivers**
References:	NLUP Sections 3.1.2.5, Section 7.7, Schedule A Site # 88-89.
Issue / Concern or Information Deficiency and Rationale:	Three Heritage Rivers are identified in the NLUP: the Thelon, Kazan and Soper. Two of these (the Kazan and Thelon) are located in the Kivalliq Region. The plan specifies protections for these two rivers as SMAs with a corridor extending 1 km from their banks. This is less than the recommended 2 km corridor as per the Canadian Heritage River Management Plan for the Kazan River. The following land uses are restricted in each area: **88 89 Kazan Heritage River / Thelon Heritage River [Special Management Area]** **Terms:** The NPC may refer a project proposal falling within Schedule 12-1 to NIRB for screening, where the NPC has concerns respecting the cumulative impact of that project proposal in relation to other development activities in the planning region. **Direction:** The NWB, where appropriate, needs to mitigate the impacts of the following project proposals on the waters flowing into the heritage river to ensure that the integrity of the river system is maintained: • Mineral exploration and production; • Oil and gas exploration and production; • Quarries; • Hydro development; • All-weather roads; and • Related research The NLUP should provide broader protection to the Thelon and Kazan Rivers beyond what is recommended in the Heritage Rivers program. GeoVector (2008) summarizes the rationale for protecting the entire watershed for Heritage Rivers in Nunavut as: 1) *"A narrow corridor makes sense in more southern areas where there is often a natural riparian zone along the rivers with areas with agricultural and residential uses further from the river. For the Thelon and Kazan rivers, there is no such distinction.* 2) *A narrow corridor may also make sense when the riparian trees screen the river from activities and developments further from the river. For the Thelon and Kazan, there are very few trees tall enough to provide a screening function.* 3) *Through most of the Thelon and Kazan watersheds the drainage is deranged and extremely complex, with many large lakes and many streams. Thus, a riparian zone limited to the mainriver and selected lakes is hard to justify from a natural environment aspect.* 4) *There is considerable planning work being done on the watershed level in other jurisdictions and watersheds have merit as natural functional units."* Application of a narrow band of protection is concerning as the Thelon, for example, is bordered by the Special Management Area (SMA) site number 113 (Community Water Source Watershed – Baker Lake) and site number 167 (High Mineral Potential):

<table>
<tr>
<td></td>
<td>
103 Community Water Source Watershed - Pangnirtung
104 Community Water Source Watershed - Grise Fiord
105 Community Water Source Watershed - Coral Harbour
106 Community Water Source Watershed - Arviat
107 Community Water Source Watershed - Repulse Bay
108 Community Water Source Watershed - Chesterfield Inlet
109 Community Water Source Watershed - Kugaaruk
110 Community Water Source Watershed - Arctic Bay
111 Community Water Source Watershed - Pond Inlet
112 Community Water Source Watershed - Kugluktuk
113 Community Water Source Watershed - Baker Lake
[Special Management Areas]

Terms: The NPC may refer a project proposal falling within Schedule 12-1 to NIRB for screening, where the NPC has concerns respecting the cumulative impact of that project proposal in relation to other development activities in the planning region.

Direction: The NWB, where appropriate, needs to mitigate impacts on community water drinking supplies to ensure that the integrity of the drinking water is maintained.

167 High Mineral Potential
168 Oil and Gas Significant Discovery License
[Special Management Areas]

Prohibited Uses: The following uses are prohibited:
• the establishment of tourism facilities;
• the establishment of Conservation Areas and Parks;

SMA 113 offers the NLUP the opportunity to refer project proposals to the NIRB for screening, but does not provide this opportunity to projects in the SMA 167. The NLUP should provide an opportunity to refer all development projects within the Heritage River watersheds to the NIRB for screening. Although Section 7.7 provides NPC the opportunity to verify if a project conforming with the Plan is exempt from screening by the NIRB, the NIRB itself is the more appropriate agency for such a determination within the context of potential development of the Heritage Rivers of Nunavut.

In the Considerations for Potential Refinement document, the NPC provides an option to refine the NLUP stating that it will *“Consider developing NLUP Special Management Areas designations to support the Heritage River Management Plans. Given that the management plans generally do not provide specific land use recommendations, consider including setbacks from the rivers that would be eligible for minor variances”* (page 14). While we agree that setbacks may be a valuable addition to a management approach, this proposed option for refinement does not go far enough to protect the Heritage River watersheds.
</td>
</tr>
<tr>
<td>Technical Comment/ Information Request:</td>
<td>The NLUP should expand the Land Use Designation for the Kazan and Thelon Heritage Rivers to the entire watershed. These Land Use Designations should replace site number 167 within the Thelon and Kazan watershed boundaries. The Thelon and Kazan River watershed boundaries are displayed below and are available from the Government of Canada (Kokelj 2003).</td>
</tr>
</table>

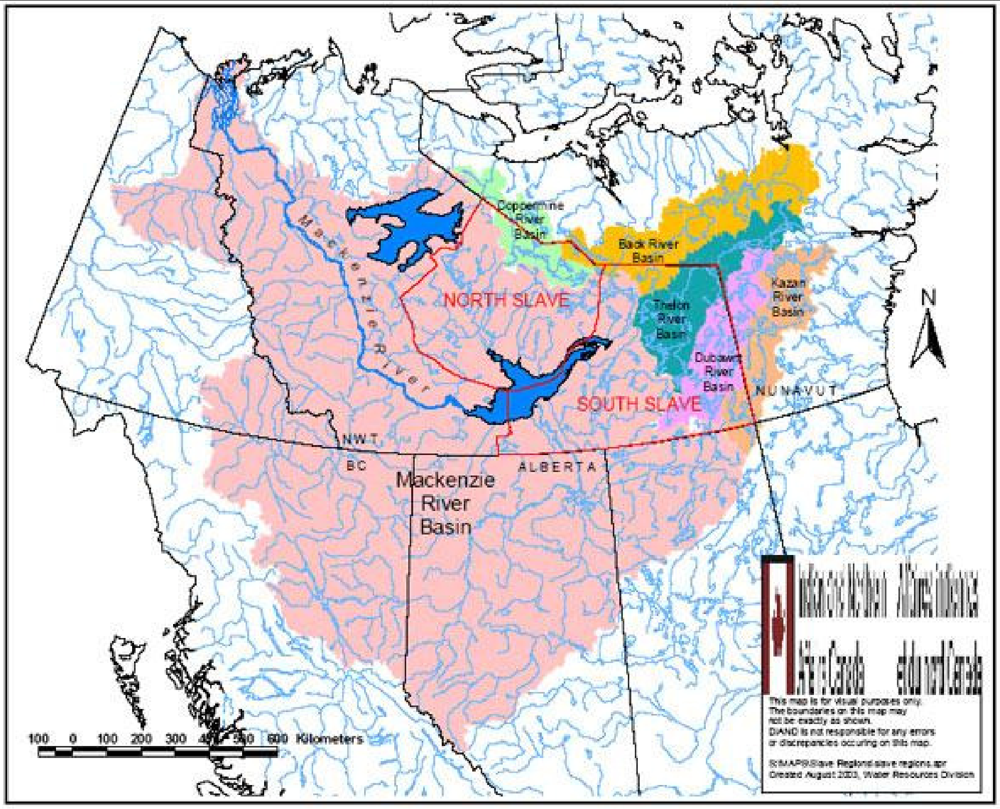


Figure Caption: River basins of the North and South Slave regions, NWT

We further recommend the following Terms and Direction to the NPC for guidance in protecting the Heritage River Watersheds:

> **Terms:** The NPC may refer a project proposal falling within Schedule 12-1 to NIRB for screening, where the NPC has concerns respecting the cumulative impact of that project proposal in relation to other development activities in the planning region.
>
> **Direction:** The NIRB and subsequently the NWB, where appropriate, needs to mitigate the impacts of the following project proposals on the waters flowing into the Heritage River to ensure that the integrity of the river system is maintained:

- Mineral exploration and production;
- Oil and gas exploration and production;
- Quarries;
- Hydro development;
- All-weather roads; and
- Related research (e.g. for exploration purposes).

Further non-exploration based research and consultation is required to determine if Nunavut and the rest of Canada would be best served by resource development or long-term preservation through established conservation efforts within the Heritage River Watersheds.

The NLUP should also consult the appropriate Heritage River Management Plans for the Kazan and Thelon rivers where they exist

2.2 KIA-HESL-2: Conflicting Direction in NLUP for Alternative Energy Generation

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-2
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Richard Nesbitt, Hutchinson Environmental Sciences Ltd.
Subject:	**Conflicting Direction in NLUP for Alternative Energy Generation**
References:	NLUP Sections 3.1.2.5 and 4.3. Schedule A Site #88, 89, 100-102, Table 6
Issue / Concern or Information Deficiency and Rationale:	Section 3.1.2.5 identifies the Thelon and Kazan as Heritage Rivers including a protection *"corridor extending 1 km from the river bank"*. Under site numbers 88 and 89, the Kazan and Thelon Heritage rivers are designated SMAs and are provided with some degree of protection from hydro-electric projects (among other developments) by referring project proposals to a NIRB screening for potential environmental impacts. This protection is counter to the direction in Section 4.3 which states *"High potential sites have been identified for hydro-electric generation opportunities for the Kivalliq Region along the Thelon and Quoiche Rivers…These sites are unique locations that would benefit from management to ensure that the potential of the sites is maintained"*. Site numbers 100-102 prohibit *"all uses within 100m of high potential alternative energy sites, except activities associated with hydro-electric generation"*. We are concerned by several issues raised by this inconsistency. They include: - The 100m perimeter around high potential hydro-electric sites may represent an a-priori assessment of the extent over which environmental impacts may occur (for instance, as the Local Study Area) for project areas. There is a need to provide a rationale for prescriptive protection measures or identify a process to do so; - The specific locations for the *"high potential alternative energy sites"* designated as SMAs are not identified in the map provided as Schedule A, precluding an assessment of the implications associated with conflicting guidance from the two sections of the NLUP; - Hydro-electric projects may hinder passage of the 15-16 freshwater fish species in the Thelon River, in addition to an anadromous subset of the approximately 35 marine fish species found in Hudson Bay (Coad and Reist, 2004); - The NLUP seems to provide conflicting guidance. This weakens the NLUP's capacity to encourage developers to pursue hydro-electric projects in the territory, as well as to ensure environmental protection of a Heritage River (Thelon) which also serves as a significant wildlife corridor in the River Valley. The Draft NLUP cites the Government of Nunavut (Table 6) as the source for information on Heritage Rivers used in the NLUP. This citation does not expressly reference the Canadian Heritage River Management Plans which aggregate a wealth of pertinent data directly applicable to the management of these water courses and their contributing watersheds (GNWT 1990; Parks Canada 2007). While the NLUP indicates it will be updated to reflect new information when it is generated through research programs and studies, it fails to incorporate applicable existing data.
Technical Comment/ Information Request:	The Draft NLUP should provide consistent direction for potential projects and review agencies (e.g., NIRB and NWB) between Land Use Designations outlined in Schedule A and the narrative within the body of the Draft Plan. This will prevent confusion when assessing proposed projects for conformity and better ensure the protection of environmentally sensitive areas outlined in the NLUP and by other key data sources.

	We recommend that the NLUP incorporate existing information contained in the Heritage River Management Plans where relevant. This should be used to provide projects and regulatory bodies with direction and ensure a level of protection consistent with the goals of the Canadian Heritage Rivers System conservation program.

2.3 Heritage River References

Canadian Heritage Rivers Board. 2012. Canadian Heritage Rivers System Annual Report 2010-2011. Retrieved from http://www.chrs.ca/en/publications.php on February 9, 2016.

Coad, B. W., and Reist, J. D. 2004. Annotated list of the Arctic marine fishes of Canada. Fisheries and Oceans Canada.

GeoVector Management Inc. 2008. Thelon and Kazan Rivers Background Study. Prepared for the Kivalliq Inuit Association.

Government of the Northwest Territories Department of Economic Development and Tourism. 1990. Canadian Heritage Rivers Management Plan. Retrieved from http://ftp.nirb.ca/02-REVIEWS/ACTIVE%20REVIEWS/12MN036-SABINA-BACK%20RIVER/02-REVIEW/06-COMMUNITY%20CONSULTATIONS/04-COMMENTS/140327-12MN036-Kazan%20HR%20Management%20Plan-IT6E.pdf on June 14, 2015.

Kokelj, S.A. 2003. Hydrologic Overview of the North and South Slave Regions. Prepared for Indian and Northern Affairs Canada Water Resources Division.

Project Team, Water Management Plan. 2014. Grand River Conservation Authority, Cambridge, ON. 137p. + appendices.

Parks Canada. 2007. Canadian Heritage Rivers System Strategic Plan 2008-2018.

Parks Canada, Canadian Heritage Rivers Board Secretariat. 2015. The Rivers. Retrieved June 12, 2015 from: http://www.chrs.ca/en/rivers.php.

3. Technical Comments

3.1 Overall Approach

3.1.1 KIA-HESL-3: Basis for NLUP Decision-Making

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-3
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Richard Nesbitt and Andrea Smith, Hutchinson Environmental Sciences Ltd.
Subject:	**Basis for NLUP Decision Making and Future Adaptation**
References:	NLUP Section 1.4.5 and 7.11, NLUP Table 6
Issue / Concern or Information Deficiency and Rationale:	Accurate and relevant data have not been properly incorporated into developing the NLUP. Our concern is founded in statements including *"…a lack of available data, information and expert advice limits the analysis of land use options"* (Section 1.4.1 p. 16) and *"Land use planning… will rely on the best available Inuit Qaujimajatuqangit and scientific information as a basis for decisions. The absence of information does not preclude the necessity to make land use planning decisions and to conclude the plan development process in a timely manner"* (Section 1.4.5 p. 18). Justification for how particular Land Use Designations were applied to freshwater resources, and terrestrial and marine wildlife and habitat features, is lacking in the Plan. For example, Table 6 states that the Community Drinking Water Supplies were *"Created at the NPC on 29/09/2009 by delineating from 1:250,000 Nunamap II data"*. This does not provide appropriate spatial resolution for consideration of required protection of drinking water intake protection zones, inputs within the subwatershed or from the broader watershed and does not describe how information was incorporated into the decision or classification. Similarly, no explanation is given for designating marine features such as caribou sea ice crossings, EBSAs and polynyas as mixed use (see technical comment 3.2). Finalizing the NLUP cannot be drawn out over a lengthy and unstructured process. The Draft NLUP, however, allows for decisions to be made in the absence of sufficient data. This could potentially lead to the NLUP, for example: • being overly or under protective;, • unnecessarily limiting resource development or permitting it in inadequately assessed sensitive areas (areas not identified as sensitive under the current Draft NLUP); or • restricting Inuit traditional land uses. The Draft NLUP does not propose a timeline for the Periodic Review and Monitoring of the Plan, nor a consistent process for updating information. The NLUP simply states that *"the Commission may review the Plan periodically to verify whether, and the extent to which, it continues to:* • *achieve the purpose of land use plans set out in the NLCA;* • *support the implementation of the Commission's Broad Planning Policies, Objectives and Goals, and* • *provide for the conservation and use of land and guide and direct resource use and development." (Section 7.11, p. 50)* It also states that *"A Periodic Review should occur every 5 years"* (Section 7.11 p.50) which again, is not prescriptive and does not provide a clear schedule for updating the

	plan. A mandated timeline for update and incorporation of new information should be included in the NLUP to ensure it is up to date and adequately protective and to provide stability to the planning process through a clear and documented process for review and update. In addition, methodology should be established to ensure that new information is collected and incorporated into the Plan in a consistent manner. Throughout the Plan it is acknowledged that more information is needed (e.g., Sections 1.4.5, 2.1.5, 4.4 etc.). It would be helpful to provide a summary of data/knowledge gaps identified in the process of developing the NLUP, as well as a strategy for addressing them in future on a routine and scheduled basis. Ad hoc updates do not provide for planning certainty or stability.
Technical Comment/ Information Request:	Proponents cannot be expected to commit exploration resources in a territory that has an uncertain land use plan that may not reflect current scientific understanding and that lacks a defined process for review and update. While science-based decision-making is based on updating our understanding to align with more recent findings and the weight of evidence associated with new discoveries, it is also based on acknowledging when insufficient information exists to make a decision. The Draft NLUP has not provided rationale nor the relevant background information used to establish the various Land Use Designations throughout the territory. Please provide a discussion on the nature of the data used to establish the Land Use Designations and the rationale / decision making rules for each. Decision rules should include discussion for the size/shape of each management area and the rationale for categorizing each Land Use Designation as a Special Management Area (SMA), Mixed Use, etc. It is not clear whether the Precautionary Principle is used when making decisions in the absence of data in the Plan. The Nunavut Impact Review Board (NIRB) requires that a precautionary approach be applied to all project undertakings under its jurisdiction. We recommend that this approach be adopted in all NLUP decision-making as well. We recommend that a summary of data/knowledge gaps identified in developing the NLUP be provided in the Plan, as well as a strategy for addressing them in future updates. The NLUP should also include mandated periodic updates to ensure it reflects the most recent information and current needs of the territory. Water licenses issued by the Nunavut Water Board are issued for specific durations at which point they must be renewed; renewal often occurs every 5 to 10 years. We recommend the NLUP include a requirement for review and update by the NPC at least every 10 years. Updates and objective decision rules based on sound data will ensure that the NLUP governs appropriate management decisions for the protection of Nunavut's natural resources ensuring long-term benefit to all Nunavummiut.

3.1.2 KIA-HESL-4: Missing Definition of Terms

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-4
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Andrea Smith, Hutchinson Environmental Sciences Ltd.
Subject:	**Missing Definition of Terms**
References:	Throughout the NLUP, e.g., Sections 1.4.3, 2.1, 2.1.5.1 etc.
Issue / Concern or Information Deficiency and Rationale:	A number of terms are used throughout the NLUP without defining them (e.g., 'environmental integrity', 'environmental quality', 'Ecologically and Biologically Significant Areas'). Including definitions of these terms would provide greater clarity on their role in contributing to the Plan's objectives and goals, and would strengthen its scientific defensibility. The term 'Accessory Use' is defined ("a use of land that is temporary or seasonal and is both incidental to and customarily found in connection with a principal land use", p.8), but no example is provided. In the Considerations for Potential Refinement document, several options are presented for addressing 'Accessory Use'. Option 1 states: *"Refine definition of 'Accessory Use' and frame scenarios and examples of accessory uses in order to prevent project splitting" (p. 40). We agree with the first part of option 1, but request clarification on the second part: "in order to prevent project splitting".* We do not agree with Option 2*: "Consider accessory uses to be those that do not create a 'significant modification' to a project or project proposal"* (p. 40). This definition is not consistent with the original definition focusing on principal land use. We do not agree with Option 3: *"Eliminate accessory uses from NLUP"* (p. 40).
Technical Comment/ Information Request:	Please provide definitions to the terms listed above, as well as an example(s) of what constitutes an 'Accessory Use". We recommend refining the definition to "a use of land that is incidental to and not a significant influence on, a principal land use".

3.1.3 KIA-HESL-5: Identification of Research Priorities

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-5
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Andrea Smith, Hutchinson Environmental Sciences Ltd.
Subject:	**Identification of Research Priorities**
References:	Section 1.4.5
Issue / Concern or Information Deficiency and Rationale:	A number of research priorities are identified, including caribou, cumulative impacts and oil exploration, development and transportation. Invasive alien species (IAS) are a major environmental and socio-economic threat globally, and pose an emerging risk to Arctic regions such as Nunavut, given climate change and increasing human activity. Yet, biological invasions are not mentioned in the NLUP.
Technical Comment/ Information Request:	We believe IAS should be one of the research priorities identified in the NLUP. In particular, the following aspects of IAS should be considered in future research: • the impacts of climate change on the threat of the introduction and spread of IAS; • the impacts of increased shipping activity to the region on the risk of biological invasions (and pollution); • the identification of major pathways and vectors for the introduction and spread of IAS into and within Nunavut (e.g., proposed transportation corridors such as the Kivalliq to Manitoba connection); • evaluation of best management strategies to prevent and manage IAS in Nunavut.

3.1.4 KIA-HESL-6: Balancing Land Use Designations

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-6
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Andrea Smith, Hutchinson Environmental Sciences Ltd.
Subject:	**Balancing Land Use Designations**
References:	Chapter 7 Plan Implementation
Issue / Concern or Information Deficiency and Rationale:	It is not clear whether Land Use Designations can change with new information, or how overlapping designations are managed. This creates uncertainty and confusion. For example, if future information is collected indicating that an area with a less protective Land Use Designation should be assigned a greater protective designation, will the area's designation be modified? A possible scenario, for instance, might be that an Area of High Mineral Potential (in which one of the prohibited uses is the establishment of conservation areas and parks) turns out to also be a biodiversity hotspot that might require designation as a Protected Area. How would this be managed? Conversely, a Protected Area might be identified in the future as an Area of High Mineral Potential. Where different land use designations currently overlap (e.g., High Mineral Potential and Community Area of Interest), how are the two potentially conflicting designations addressed? The Considerations for Potential Refinement document presents the option of considering the creation of new land use designations where they intersect, or considering whether both designations can simultaneously apply (p. 39). We are concerned that this option does not explicitly address the issue of how to resolve potentially conflicting requirements of different land use designations where they overlap (e.g., environmental protection vs. economic development).
Technical Comment/ Information Request:	Please include discussion in the NLUP explaining whether new information can change land use designations (and the process for doing so- see also technical comment 3.1.1 above on the need for defined periods for review and update of the NLUP). Please also explain how overlapping land use designations are currently managed and identify a process for resolving conflicts or remove overlapping designations where they currently exist in the NLUP.

3.1.5 KIA-HESL-7: Use of Discretionary Language

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-7
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Andrea Smith, Hutchinson Environmental Sciences Ltd.
Subject:	**Use of Discretionary Language**
References:	Section 1.5.3
Issue / Concern or Information Deficiency and Rationale:	Although Land Use Designations and their respective terms are legally binding under the NLUP the use of discretionary language throughout the Plan weakens its impact. For example: "The NPC *may* refer a project proposal…to NIRB for screening" (Table 1) "Regulatory Authorities, *where appropriate*, must incorporate the setbacks in Table 2 for all migratory birds…" (Table 1). The discretionary wording appears to give proponents the option of taking environmentally protective measures, but not requiring it.
Technical Comment/ Information Request:	Please clarify in the NLUP under what circumstances the enabling language must be followed, and under what circumstances it is optional, with justification, to ensure the NLUP's goal of protecting and sustaining the environment is achieved.

3.2 Freshwater Resource Protection/Use

3.2.1 KIA-HESL-8: Sustaining Freshwater Quality and Quantity

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-8
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Richard Nesbitt, Hutchinson Environmental Sciences Ltd.
Subject:	**Sustaining Freshwater Quality and Quantity**
References:	NLUP Section 2.0 and 7.12
Issue / Concern or Information Deficiency and Rationale:	The NLUP states in Chapter 2 (Protecting and Sustaining the Environment) that *“The following areas and issues have been identified to support the NPC Goal of protecting and sustaining the environment:* • *Key migratory bird habitat sites;* • *Caribou habitat;* • *Polar bear denning areas;* • *Walrus haul-outs;* • *Marine areas of importance;* • *Transboundary considerations; and* • *Climate change.” (p. 23)* The list does not consider freshwater quality and quantity, ecosystem components which are specifically protected under Article 20 of the NLCA, although some Land Use Designations provide direction to the Nunavut Water Board pursuant to Article 13 of the NLCA. Article 20.3.1 of the NLCA provides protection for water *“quality, quantity or flow”* from substantial alteration by projects or activities within the Nunavut Settlement Area. The Draft NLUP provides specific protection for terrestrial and marine areas for wildlife and acknowledges transboundary considerations and climate change, but provides no specific protection for water beyond Heritage Rivers and drinking water supply for the communities. This shortcoming is carried forward into Section 7.12 which includes recognition that studies and research are required to *“further the policies and objectives of the Plan”.* There is no requirement for additional research to ensure the protection of freshwater quality, quantity or flow.
Technical Comment/ Information Request:	The NLUP should include freshwater quality, quantity and flow in its list of goals for protecting and sustaining the environment and this should include a discussion in Chapter 2 regarding how this goal is being addressed and direction for Land Use Designations that may result in alteration to these ecosystem components. This direction should go beyond simply referring projects to the Nunavut Water Board. The NLUP should take its own position with respect to protecting water quality, quantity and flow and expand its mandate to require *“initiation and completion”* of additional research and studies into this important ecosystem component in support of Article 20 of the NLCA .

3.2.2 KIA-HESL-9: Adequate Long-term Supply for Community Source Water

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-9
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Richard Nesbitt, Hutchinson Environmental Sciences Ltd.
Subject:	**Adequate Long-term Supply for Community Source Water**
References:	NLUP Sections 4.4.1, 4.4.1.1, 4.4.1.2
Issue / Concern or Information Deficiency and Rationale:	The NLUP seeks to protect drinking water supplies both within and outside municipal boundaries. The NLUP states that *"municipal land use plans are able to provide direction on how land should be used to maintain the quality and quantity of drinking water"* for *"drinking water [sources] from small lakes and catchment areas where the entire watershed is within the municipal boundary"*. (Section 4.4.1.1, p. 35) We note that the municipal boundaries in Nunavut do not encompass the entire watershed supplying or indirectly contributing to the communities' drinking water supply. The Draft NLUP has therefore established several land use designations intended to protect the community drinking water supply. SMAs 103-113 provide the following direction for several communities in all three regions of Nunavut: 103 Community Water Source Watershed - Pangnirtung [Special Management Areas] 104 Community Water Source Watershed - Grise Fiord 105 Community Water Source Watershed - Coral Harbour 106 Community Water Source Watershed - Arviat 107 Community Water Source Watershed - Repulse Bay 108 Community Water Source Watershed - Chesterfield Inlet 109 Community Water Source Watershed - Kugaaruk 110 Community Water Source Watershed - Arctic Bay 111 Community Water Source Watershed - Pond Inlet 112 Community Water Source Watershed - Kugluktuk 113 Community Water Source Watershed - Baker Lake **Terms:** The NPC may refer a project proposal falling within Schedule 12-1 to NIRB for screening, where the NPC has concerns respecting the cumulative impact of that project proposal in relation to other development activities in the planning region. **Direction:** The NWB, where appropriate, needs to mitigate impacts on community water drinking supplies to ensure that the integrity of the drinking water is maintained. As per our review mandate, our comments focus on SMAs 135, 106, 107, 108 and 113 which apply to Kivalliq communities – Coral Harbour, Arviat, Repulse Bay (now Naujaat), Chesterfield Inlet and Baker Lake. Some communities in the Kivalliq, specifically Baker Lake as outlined in the figure below, have been afforded greater protection under the Draft NLUP, as the Community Water Source Watershed SMA encompasses a major portion of the watershed. While the Community Water Source Watershed for Baker Lake does overlap with a land use designation denoting High Mineral Potential (i.e. SMA 48), the NLUP includes guidance to the NWB that impacts to community water drinking supply should be mitigated.

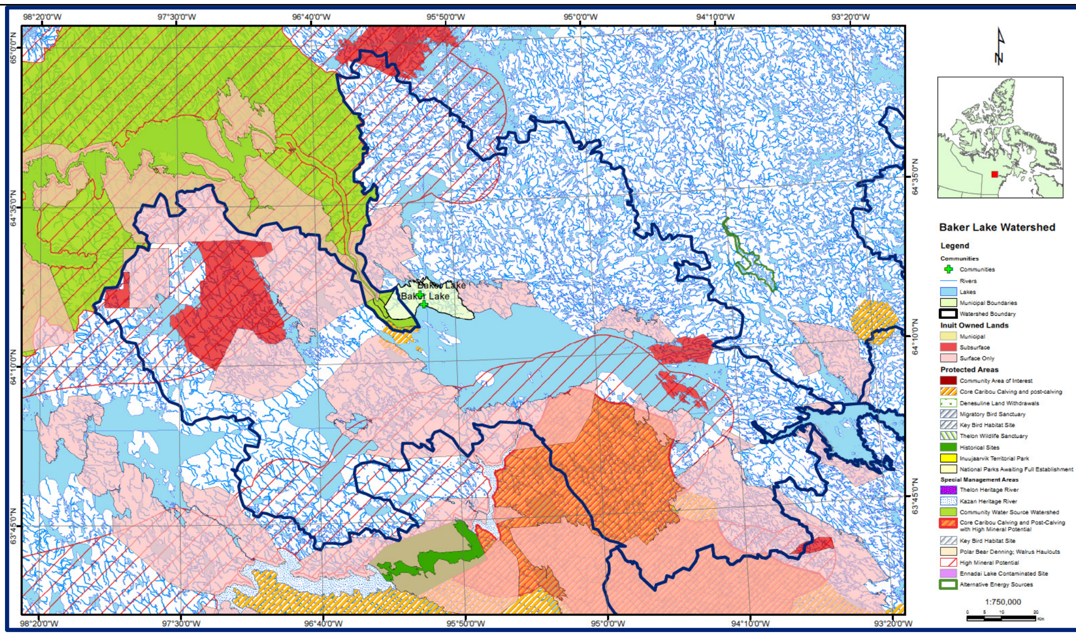


Figure Caption. Baker Lake and Community Water Source Watershed (green)

The drinking water supplies of communities like Arviat have geographically smaller Community Water Source Watersheds, and include Areas of High Mineral Potential within their broader subwatershed and in adjacent subwatersheds. The proximity of resource potential to the community's drinking water supply is demonstrated in the figure below.

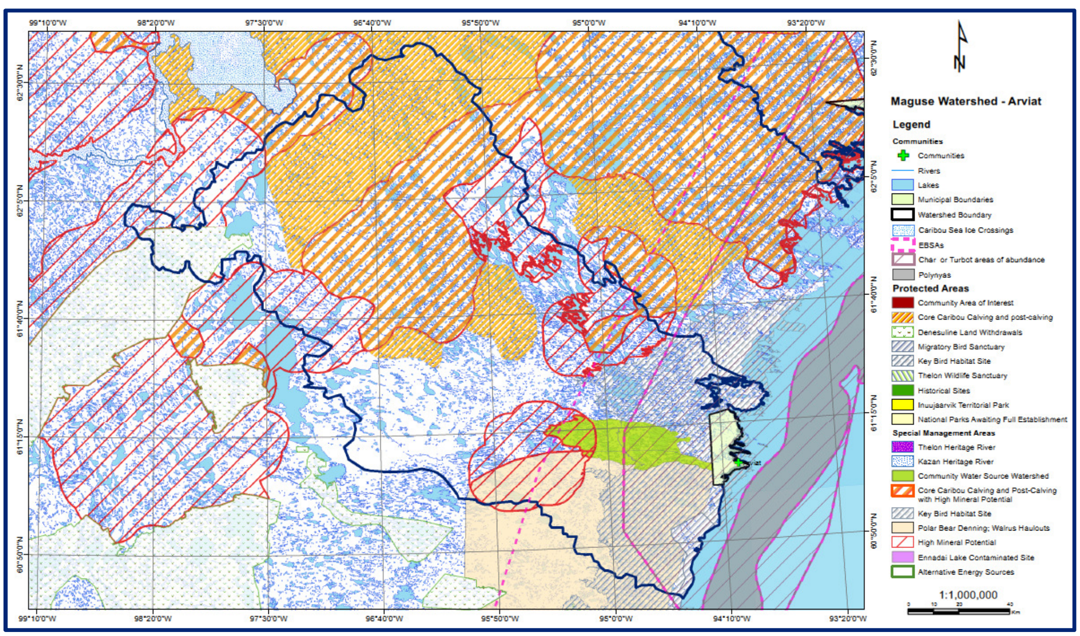


Figure Caption. Arviat and Community Water Source Watershed (green)

Exploration of adjacent areas of high mineral potential does not include direction to mitigate

<table>
<tr><td></td><td>impacts to community drinking water supplies under the proposed NLUP.

Several communities in the Kivalliq (Rankin Inlet and Whale Cove) are not afforded a SMA land use designation to protect their Community Water Source Watershed. These communities include Coral Harbour, Repulse Bay, and Whale Cove. We note that exploration and development has not been prohibited nor has guidance been provided to protect the community's drinking water supply within the subwatersheds

While these communities may not currently be at risk of having their drinking water supply compromised, the Draft NLUP includes no scheduled mechanism for update to incorporate new data (also see KIA-HESL-3: Basis for NLUP Decision Making and Future Adaptation).

Mineral and oil and gas potential may be identified in these watersheds at some point in the future, and a mechanism to adapt the NLUP accordingly is required.

The NPC has presented two options to refine the NLUP intended to address our concerns:

“Option 2: Consider developing general conditions that would provide protection for community drinking water supplies. Would need to identify appropriate conditions for land uses, and/or identify incompatible uses that should be prohibited.

Option 3: Planning partners may consider committing to a process to develop specific, potentially quantitative water quality/quantity conditions for community watersheds, for inclusion in the NLUP in the future through plan amendment.”

These options for refinement do not go far enough to alleviate our concerns for the long-term freshwater supply security of communities within the Kivalliq. Option 2 should be further refined to require inclusion of scientifically defensible data even when developing “general conditions”. The commitment proposed in option 3 is an acceptable component of a resolution, but is insufficient, as the NPC has not outlined a schedule for future amendments to the NLUP (also see KIA-HESL-3: Basis for NLUP Decision Making and Future Adaptation).</td></tr>
<tr><td>Technical Comment/ Information Request:</td><td>The NLUP does not consider all inputs into watersheds providing the communities with freshwater. No scientific basis is provided in the NLUP to indicate if the community source water watershed land use designations are sufficient to ensure community drinking water supplies are adequately protected. The NLUP should consider and include discussion on:

appropriate intake protection zones for each community;
minimum water quality standards for water entering Community Source Water Watersheds

This should include guidance to the NWB similar to that used for Land Use Designations 88 and 89. This could read: The NWB, where appropriate, needs to mitigate the impacts of the following project proposals on waters flowing into the Community Source Water Watersheds to ensure the integrity of the drinking water supply is maintained:

Mineral exploration and production;
Oil and gas exploration and production;
Quarries;
Hydro development;
All-weather roads; and
Related research;

rationale for why some communities have Community Source Water Watershed Special Management Areas while others do not,

If this discussion does not alleviate concern for communities currently not specifically protected under the Draft NLUP, Community Source Water Watershed Special Management Areas should be established to ensure long term protection of the drinking water supply from exploration activities and development within the subwatershed.

We acknowledge that the data required to create scientifically defensible “Community Water Source Watersheds” is not currently available for all communities in Nunavut. The</td></tr>
</table>

	NPC should therefore summarize the data gaps that must be addressed prior to including defensible polygons within the NLUP for the protection of the community drinking water supply and provide a schedule to do so. .

3.2.3 KIA-HESL-10: Protection of Drinking Water Supply While on the Land

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-10
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Richard Nesbitt, Hutchinson Environmental Sciences Ltd.
Subject:	**Protection of Drinking Water Supply While on the Land**
References:	NLUP Section 1.3 Goal 1, 1.4.2, 1.4.3
Issue / Concern or Information Deficiency and Rationale:	The NLUP states within the description of the NPC's Planning Approach that *"The [NPC]… learned of the importance of access to safe drinking waters both within municipalities and while traveling on the land. Preservation of water quality is also an underlying theme for protecting the environmental integrity of the NSA…"*.(Section 1.4.2, p.16), during a series of community consultations undertaken by the NPC as part of the NLUP development. Traditional land uses are an important part of Inuit culture and heritage, and we applaud the NPC for this upfront consideration of drinking water supply while on the land. However, this understanding of the need for safe drinking water beyond the boundaries of a municipality was not carried through to the rest of the NLUP; drinking water supplies are only expressly protected through Land Uses 103-113 covering Community Source Water Watersheds. We note that no options to refine the NLUP were proposed by the NPC to address this concern in their Considerations for Potential Refinements to the 2014 Draft NLUP.
Technical Comment/ Information Request:	The NLUP should provide discussion of how drinking water resources will be protected for Nunavummiut use while on the land. We recommend that this be provided both as a narrative in the body of the NLUP as well as throughout the Land Use Designations. Areas used by Nunavummiut for traditional land uses should be specifically indicated and referenced in the plan pursuant to Section 1.3 of the NLUP "Broad Planning Policies, Objectives and Goals" Goal 1, which states it will work to integrate and apply the principles of IQ. At present, there is no indication that the NLUP has directly incorporated IQ; no references are directly made to IQ maps or consultation for drinking water protection while on the land.

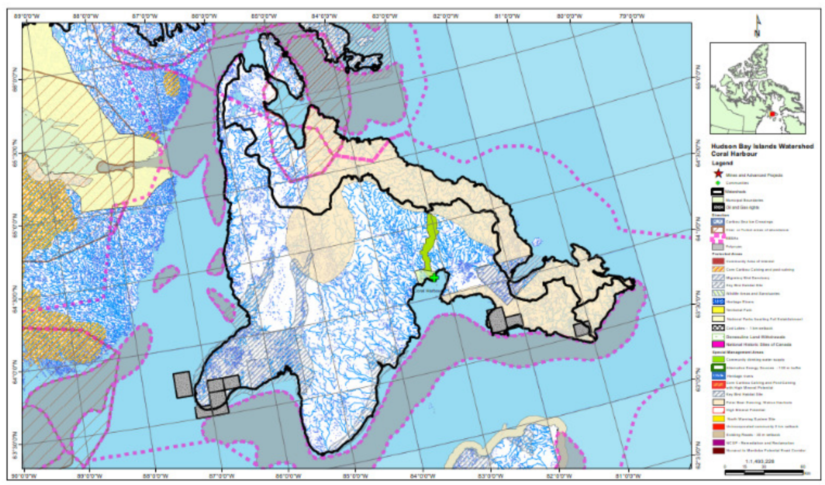
3.3 Marine Areas Protection

3.3.1 KIA-HESL-11: Adequate Protection of Key Marine Features

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-11
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Andrea Smith, Hutchinson Environmental Sciences Ltd.
Subject:	**Adequate Protection of Key Marine Features**
References:	NLUP Sections 2.1, 2.1.2.2, 2.1.3, 2.1.5.1, 2.1.5.2
Issue / Concern or Information Deficiency and Rationale:	The Draft NLUP states in 2.1 that its objectives include to *"protect, enhance and restore environmental quality", "identify and provide protection for the natural environment, [and] areas of biological importance", "address the requirements for conservation, management and protection of aquatic resources, their habitats and ecosystems", and "protect the integrity of ecosystem…and wildlife habitats"* (Section 2.1, p. 23). Under sections 2.1.2.2, 2.1.5.1 and 2.1.5.2, the NLUP recognizes that caribou sea ice crossings, EBSAs, and polynyas are all important marine features for Nunavut biodiversity. These features, however, are all assigned a Mixed Use Land Use Designation, which is the least protective land use category under the NLUP. While direction is given to regulatory authorities to mitigate impact on these areas, under the Mixed Use Designation, "all uses are considered to conform to the Plan, including mineral exploration and production, commercial fisheries, oil and gas activities…[and] shipping" (Chapter 6, p. 41). In addition, under Section 2.1.3, sea ice is identified as *"the primary influence on habitat use"* for polar bears, and susceptible to climate change. Furthermore, multi-year ice is identified as important habitat for the species during winter months. Despite its important role, however, sea ice used by polar bears is not given a land use designation under the Plan. We agree with the option presented in the Considerations for Potential Refinement document to designate caribou sea ice crossings as Special Management Areas (Option 5, p. 8). We agree with options presented in the Considerations for Potential Refinement document to *"consider setbacks, subject to safe navigation, from sensitive areas"* for marine ice-free shipping corridors, marine on-ice transportation corridors, and marine utility corridors (p. 32) if these sensitive areas include Marine Areas of Importance. No definition of sensitive areas is given, however, nor details on proposed distance or time of year of setbacks. Caribou sea ice crossings, polynyas and sea ice used by polar bears are dynamic in their location and duration. Although identifying and monitoring these features may be challenging, protecting them is important for Nunavut biodiversity, especially in the face of climate change and increasing marine shipping activity. It is difficult to assess the adequacy of protection given to EBSAs in the Draft NLUP, since they are not defined, and currently are only identified at large spatial scales.
Technical Comment/ Information Request:	The NLUP should provide greater protection to key marine features (i.e., caribou sea ice crossings, EBSAs, polynyas, polar bear use of sea ice) by designating them as Special Management Areas. As such, restrictions should be considered on some access and uses for these features (e.g., oil and gas exploration and production, commercial

	shipping), such as clearly defined setbacks. Identification and monitoring of these dynamic key marine features and a schedule to do so, should be identified as a research priority in the NLUP, as sea conditions in Nunavut continue to change due to climate change and human activity in future. We also request that EBSAs be defined in the NLUP to provide greater clarity and justification regarding why they are important components of the Plan.

3.3.2 KIA-HESL-12: Overlap between Oil and Gas Development and Key Marine Features

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-12
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Andrea Smith, Hutchinson Environmental Sciences Ltd.
Subject:	**Overlap between Oil and Gas Development and Key Marine Features**
References:	NLUP Table 1
Issue / Concern or Information Deficiency and Rationale:	Oil and Gas Significant Discovery Licenses (site number 168) exist in an area that overlaps with an EBSA (polynya), as well as a Key Bird Habitat Site – Boas River (site number 2), which has been assigned a SMA Land Use Designation (Figure 4). Oil and gas activity in this area could prove detrimental to both the EBSA and bird habitat area.  **Figure 4. Potential oil and gas development off Southhampton Island.**
Technical Comment/ Information Request:	The NLUP should provide greater protection to the EBSA and Key Bird Habitat Site potentially affected by the proposed oil and gas development off Southampton Island. This could include prohibition on oil and gas development within the polynya, and setbacks from it, as well as increased terrestrial and marine setbacks from the Boas River Key Bird Habitat Site.

3.4 Migratory Bird Protection

3.4.1 KIA-HESL-13: Requirements for Migratory Bird Setbacks

Technical Comment Source:	Kivalliq Inuit Association
Number:	KIA-HESL-13
Project:	Nunavut Land Use Plan – Draft 2014
Information Request For:	Nunavut Planning Commission
Reviewer:	Andrea Smith, Hutchinson Environmental Sciences Ltd.
Subject:	**Requirements for Migratory Bird Setbacks**
References:	NLUP Sections 2.1.1, 3.1.2.2, Table 1 and Table 2
Issue / Concern or Information Deficiency and Rationale:	Key Migratory Bird Habitat Sites are assigned either Protected Area or Special Management Area Land Use Designations, while Migratory Bird Sanctuaries are assigned a Protected Area Land Use Designation. National Wildlife Areas (designated as Protected Areas) also provide habitat for migratory birds. Table 2 outlines the aerial, marine and terrestrial setback requirements that regulatory authorities must follow when issuing permits, licences and authorizations for activity in, or in the vicinity of, these areas, in order to protect migratory birds during the breeding season. In Table 2, the terrestrial setbacks for all migratory birds, sea-level coastal nesting birds, all seabirds, Northern Fulmars, Ivory Gulls and coastal waterfowl and seaducks are seasonal, applying only when birds are present (i.e., in breeding bird colonies or moulting areas). Setbacks during only part of the year could lead to destruction or disturbance of breeding habitat when the birds are not present, resulting in decreased or degraded habitat when birds return to breed. A 300m terrestrial setback distance may not be sufficient for all types of activities. The North Yukon Regional Land Use Plan (Vontut Gwitchin Government and Yukon Government, 2009) has adopted land use zoning based on intensity rather than type of use. In this approach, the direct surface disturbance and linear density of proposed human activities are used to determine the overall intensity of a proposed project. Similar metrics could be used to evaluate appropriate setback distances for different activities affecting migratory birds in the NLUP.
Technical Comment/ Information Request:	The NLUP should require terrestrial setbacks around migratory bird habitat year-round, to ensure breeding habitat is not lost or degraded during the non-breeding period. The intensity of proposed activities should be factored into the consideration of potential impacts on migratory bird populations and their habitat when calculating setback distance. For example, following the North Yukon Regional Land Use Plan approach, we recommend that the amount of area physically disturbed and the total length of all linear features created (such as roads, access trails etc.) be incorporated into determination of setback distance.

3.4.2 Migratory Bird References

Vuntut Gwitchin Government and Yukon Government. 2009. North Yukon Regional Land Use Plan, Nichik Gwanał'in. Looking Forward, 143 pp.

4. Closing

Our review of the Draft Nunavut Land Use Plan highlighted several shortcomings with respect to the protection of freshwater resources, drinking water, marine areas and migratory birds. The key conclusion of our review is that the decision-making process for establishing Land Use Designations has not been provided, supporting data are not consistently included or referenced in the Draft NLUP and there is no clear requirement for systematic review and update to incorporate new findings into the NLUP. There is not, therefore, sufficient information to determine the appropriateness of the Land Use Designations to meet the various goals for environmental protection and encouragement of development and growth outlined in the NLUP. A clear requirement and schedule for systematic review and update of the NLUP and supporting information would represent a significant and beneficial means of addressing the other concerns that we have identified.

Conclusion: Our review has revealed sufficient shortcomings in supporting information that advise against undertaking a complete review of the NLUP until such time as the identified information needs and rationale have been incorporated into the Draft NLUP.

Recommendation: We therefore recommend that the Draft NLUP not be adopted in its current form and that the recommendations provided herein be addressed to provide sufficient information and rationale, and that the NPC allow for a complete and thorough review of a subsequent Draft.

Schedule E. Mineral Potential

REPORT ON

2014 DRAFT NUNAVUT LAND USE PLAN
(DNLUP)
FOR
KIVALLIQ INUIT ASSOCIATION
(KivIA)

Alan Sexton, MSc, PGeo

GeoVector Management Inc.

February 22, 2016

GeoVector Management Inc.

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1.0 INTRODUCTION

At the request of the Kivalliq Inuit Association (KivIA) a technical review of the 2014 Draft Nunavut Land Use Plan (DNLUP) was completed by GeoVector Management Inc. (GeoVector).

The Draft Nunavut Land Use Plan (DNLUP) was developed by the Nunavut Planning Commission (NPC) as mandated for the Nunavut Settlement Area under Article 11 of the Nunavut Land Claims Agreement (NLCA).

The review mandate was high level with the mandate to identify shortcomings in the DNLUP that might deter its implementation without further revision. This mandate was meant to ensure that the scope of the proposed DNLUP was compatible with the KIVIA's mandate and responsibilities to the Inuit beneficiaries of the Kivalliq Region.

The specific area reviewed under the KivIA's mandate was mineral potential.

2.0 Mineral Potential (Figures 1 and 2)

The KivIA concerns are related mainly to the lack of consensus on what uses should be prohibited or restricted within areas of High Mineral Potential. This reflects the minimal use of existing public domain geoscience data, which limited the areas that were defined as having high mineral potential. In addition, input from professional geoscientists with the expertise in using this data to define areas of high mineral potential that occur outside the currently identified areas on IOL's and Crown land is required. The recent new discoveries of the Amaruk gold deposit north of Baker Lake and the North Quest gold project west of Whale Cove are very good examples of how the effective use of public geoscience data can help outline areas of high mineral potential.

The KivIA proposes that the following options for refinement to the DNLUP be implemented:

1. The mineral potential outside areas of existing rights on Crown Lands and all IOL's should have more research to better categorize the location of low to high mineral potential corridors (See all references in section 6).

2. The DNLUP should be revised to recognize that surface IOLs were selected predominantly for their sub-surface mineral potential and the surface IOLs as access corridors to the sub-surface IOLs (McPherson, 2003).

3. All IOL parcels of High Mineral Potential should designated "Mixed Use".

4. A clearly defined process that outlines how flexible the DNLUP will be in changing land use designation boundaries and definitions as new information becomes available going forward.

5. Evaluation of the future mineral potential must be viewed through both the "mineral exploration and mining industry lens" and a "government lens." This is best achieved by compiling all the current public geoscience into a single database. Once in place a systematic review of this data using existing mineral deposit and mineral potential models should be completed.

6. The geoscience data in the public domain must be given much more consideration when defining areas of low to high mineral potential. Tourism facilities and mineral exploration / mining infrastructure are often beneficial to each other so excluding tourism facilities that do not interfere with the development of the mineral potential should be re-considered

3.0 Existing Rights

The KivIa agrees with the Government of Canada position of a broad exemption for activities where there are any existing sub-surface rights. In addition, these existing sub-surface rights should have access routes that allow for future development. Therefore, the KivIA supports the federal position on grandfathering existing rights to the extent that the federal system is legally viable.

4.0 Transboundary Considerations (Figure 3)

The KivIA concerns relate to the potential negative economic and social impacts of Protected and Special Management Areas that share a common boundary between Nunavut and the adjoining jurisdictions of Manitoba, the NWT and Saskatchewan in areas of high mineral potential corridors on both IOLs and Crown Land.

The current options for refinement in the DNLUP do not appear to address these concerns because there is no clear process as to how "general guidance" or "retaining references to identify priorities" would be done or even what these terms mean.

The KivIA proposes that the following options for refinement to the DNLUP be implemented:

1. More research to better define the potential negative economic and social impacts associated with Protected and Special Management Areas in the adjoining jurisdictions.

2. More research to better determine if *Mixed Use* and *High Mineral Potential* designations should be expanded while *Protected* and *Special Management Area* designations are contracted along the common boundaries between Nunavut and the adjoining jurisdictions.

3. More inclusive data from all public sources of geoscientific information.

4. Interpretation and a larger scale view of the geoscience data once it is captured.

5. Consultation with all transboundary jurisdictions on the potential negative economic and social impacts that could arise in these jurisdictions from the DNLUP.

5.0 Linear Infrastructure Corridors (Figures 1, 2 and 3)

Transportation is key to accessing resources and building healthier communities. The KivIA recommends that transportation corridors related to existing, planned and potential development projects should be included on the land use base of the DNLUP. This would add certainty to future plans. In addition, these corridors should be exempted from the prohibition on all-weather roads. The transportation corridors to consider within the Kivalliq are:

- Manitoba to Kivalliq Corridor
- Baker Lake to Meadowbank Corridor
- Meadowbank to Amaruk Corridor

6.0 References

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Figure 1: High Mineral Potential Corridors – Kivalliq Region

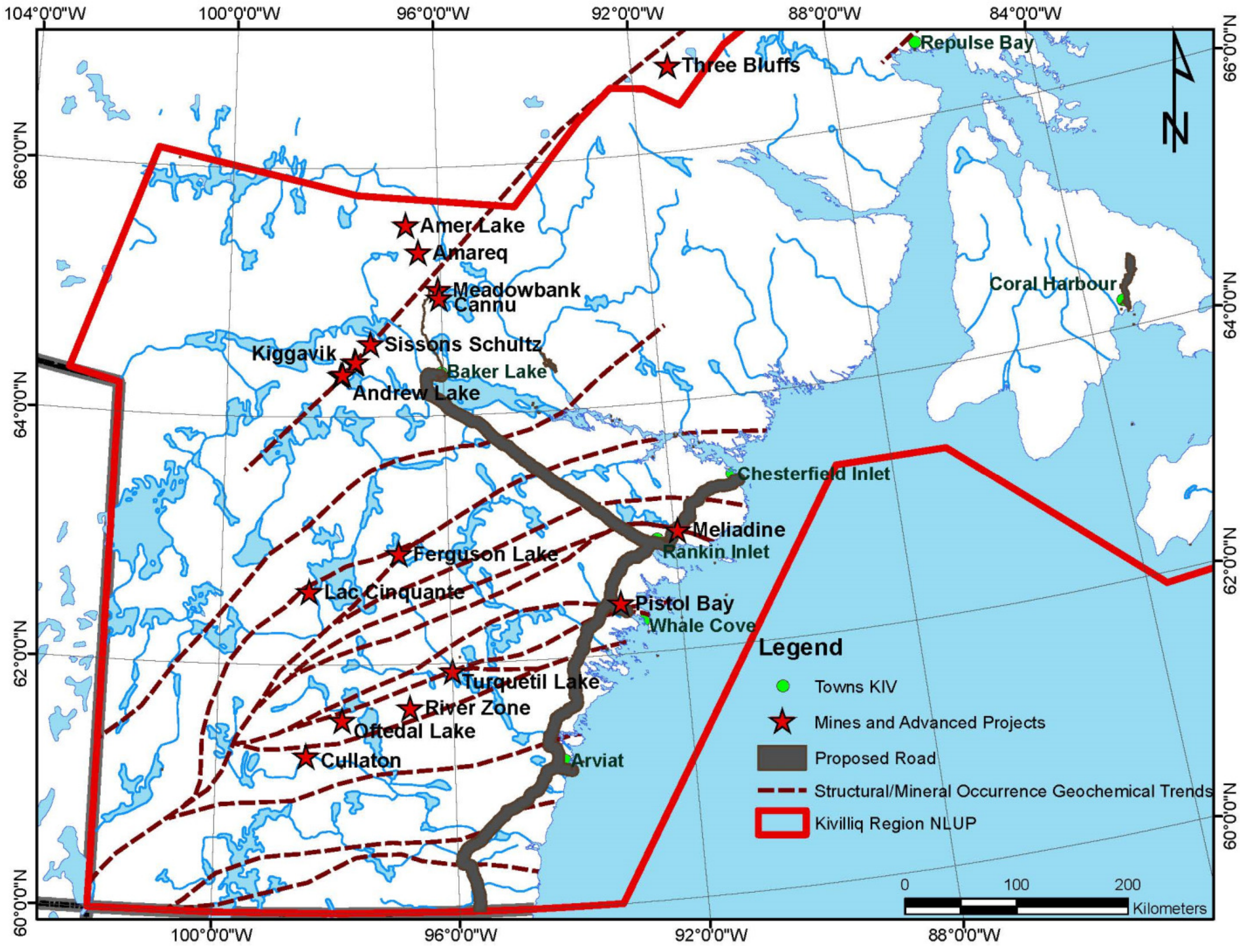

Figure 2: High Mineral Potential Corridors and IOLs – Kivalliq Region

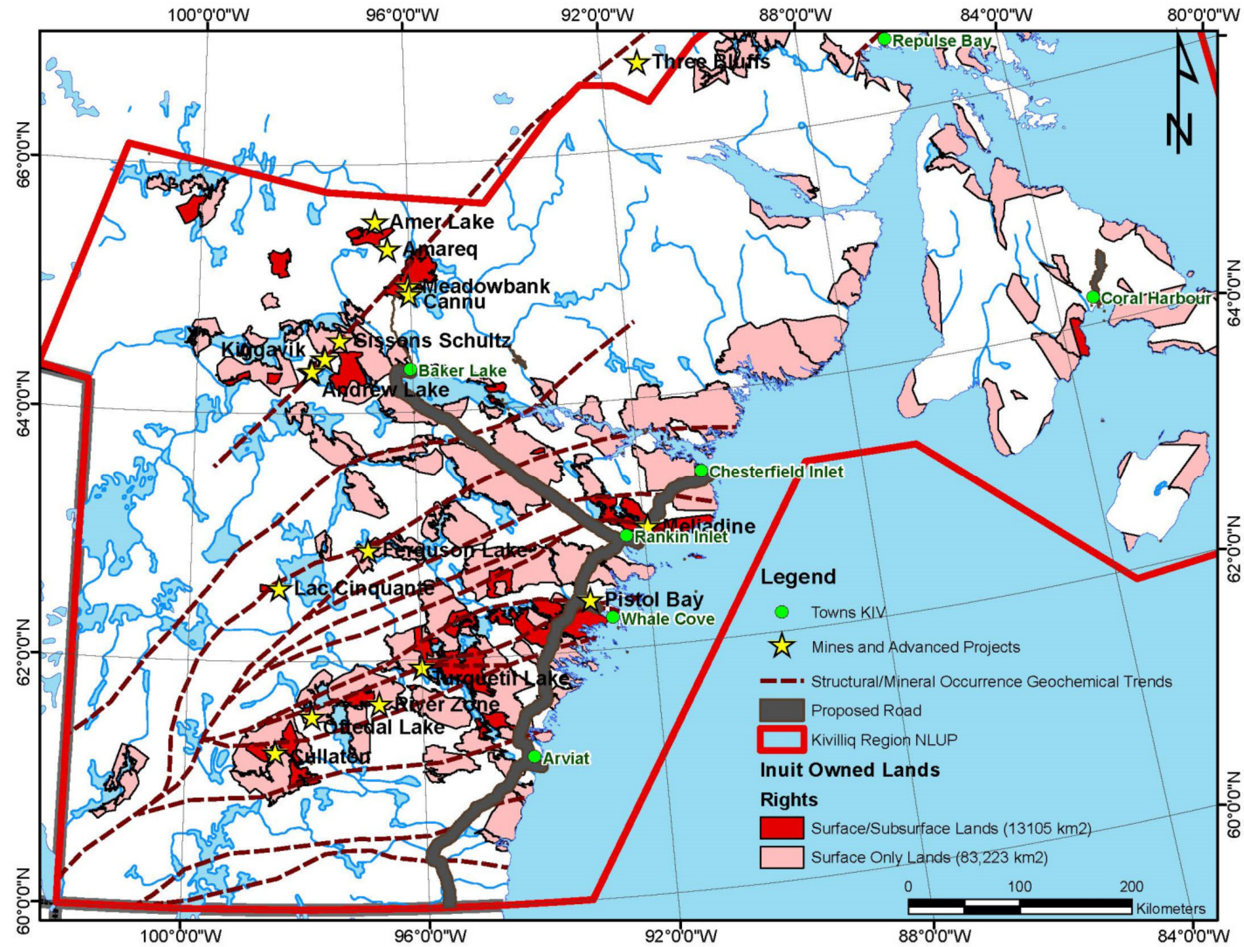

Figure 3: High Mineral Potential Corridors – Transboundary Considerations