Andrew Gamble & Associates
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Ms. Kimberley Cliffe-Phillips
Environmental assessment Officer
Mackenzie Valley Environmental Impact Review Board
Yellowknife, NT

April 7, 2004

Dear Ms. Cliffe-Phillips;

Deh Cho Bridge – Developer's Assessment Report

Enclosed are 35 copies of the Developer's Assessment Report, prepared on behalf of the proponent, the Deh Cho Bridge Corporation.

It is our hope that the information provides a full response to the Terms of Reference provided by the Mackenzie Valley Environmental Impact Review Board for the Environmental Assessment of this project.

Please do not hesitate to contact us for any further information that may assist in the process.

Yours truly,

Andrew Gamble

enclosures

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Deh Cho Bridge Corporation

Deh Cho Bridge

Developer's Assessment Report to the Mackenzie Valley Environmental Impact Review Board

Prepared by

Andrew Gamble & Associates

&

Jivko Engineering

April 6, 2004

Contents

Introduction

An all weather road extends 530 km from the Alberta border north, crossing the Deh Cho (Mackenzie River) at Fort Providence and continuing to Rae-Edzo and Yellowknife, the NWT capital city. Winter roads connect to other Tli Cho (Dogrib) communities and to gold and diamond mines in the Slave Geological Province. This route serves over half the NWT population. Yellowknife also serves as an important air hub for the rest of the NWT and western Nunavut.

Since the road to Yellowknife was completed in 1968, it has been steadily upgraded. As of this date, 460 km have been reconstructed to a 100-km/hr design standard and paved or surface treated. The remaining 70 km between Rae and Yellowknife are scheduled for completion over the next three years.

The River at Fort Providence is crossed by ferry from late spring to early winter and by an ice bridge in the winter and spring. Since 1987, the ferry has operated into January or February through a channel cut in the ice, until the ice bridge is strong enough for heavy trucks.

When operating normally, it is estimated that the crossing (ferry or ice bridge) adds at least 20-30 minutes to a trip. The crossing is closed for an average of 4 weeks during spring break-up. Service is also interrupted with little notice for 1 to 3 weeks in the fall and early winter, due to low water levels and ice jams and while the ice forms sufficiently to cut the ferry channel.

During these periods of isolation, there is no road connection between the region and southern Canada. Any passenger traffic must be by air. Freight traffic to the region is also interrupted, with some diverted to air cargo between Edmonton or Hay River and Yellowknife. Some freight is also trucked to the river, transferred onto slings and shuttled by helicopter across the river where it is loaded onto other trucks and transported onward by road.

A bridge crossing at Fort Providence has been considered since before the road was completed. A Public Works Canada conceptual design from 1975 estimated the cost in the range of $25 - 30 million (current dollars). Inflated to today's dollars, this would be about $70 - 80 million.

It is generally accepted that a bridge crossing of the River at Fort Providence would provide a net environmental benefit as well as considerable economic stimulus and long-term direct cost savings to the Community of Ft. Providence and to business, government and consumers in the North Slave Region. However, given the cost and competing priorities for government spending, the bridge has remained in federal and GNWT plans as a 'future' priority.

The Deh Gah Got'ie Dene Band and Fort Providence Métis council recognized a significant long-term business opportunity under a partnership arrangement with the territorial government. This would likely prove attractive to government and fast track the crossing construction under an ideal Private-Public Partnership agreement.

The general concept proposed is similar to that used successfully in other infrastructure projects in southern Canada - for example, the Confederation Bridge linking PEl and New Brunswick and Highway 407 in Toronto, as well as numerous other smaller scale projects.
The basic elements of the proposal are:

- The Deh Cho Bridge Corporation (DCBC) will raise sufficient equity and debt financing to design, finance and construct the bridge to agreed standards.
- The GNWT and DCBC will enter into an agreement for a 35 year *Concession Period*, during which the DCBC will own, operate and maintain the bridge.

- During this period, the GNWT will pay a contribution of approximately $1.5 million annually from ongoing ferry/ice bridge savings. The GNWT will also collect and pay a toll of $5 to $6 per tonne on commercial freight crossing the bridge, netting approximately $3 million annually.
- Total revenues (approximately $4.5 million in year 1) will be used to service and retire the debt, operate and maintain the bridge and provide a return on shareholder equity.
- Annual costs will include debt servicing (interest and principal) of approximately $3 million and O&M of approximately $0.5 million, for a total year 1 cost of approximately $3.5 million.
- Revenues will increase with traffic and inflation, while costs will increase with inflation only, resulting in an increasing return on equity.
- At the end of the Concession Period, ownership of the bridge will revert to the GNWT, free of debt. At this time, the GNWT could suspend its annual contribution and tolls. Both the government and users would continue to benefit from ongoing savings.

Since inception of the proposal in 2000, the proponents have established the Deh Cho Bridge Corporation Ltd. (DCBC). The GNWT and Federal DIAND and have provided funding and loan guarantees for feasibility studies, business planning, design and environmental assessment. TD Securities has been retained to provide construction and long-term debt financing. Designs are being reviewed by the GNWT and finalized. The DCBC has reached an agreement-in-principle with the GNWT on the Concession Agreement.

Following permit applications submitted for screening by the Mackenzie Valley Land and Water Board, the Department of Fisheries and Oceans and Coast Guard, the project was been referred for environmental assessment to the Mackenzie Valley Environmental Impact Review Board in February of 2004.

The Board subsequently finalized terms of reference for a Requirement for the Developer's Assessment Report.

Regulatory permits are the final key requirement for the project to proceed.

A Summary

A.1 Non-Technical Summary

Please provide a plain language, non-technical summary of the Developer's Assessment Report (DAR) to enable the public to follow the proceedings.

See A.2 - Executive Summary

A.2 Executive Summary

Please provide an executive summary of the DAR, containing the most relevant points for decision-makers.

The proponent, the Deh Cho Bridge Corporation Ltd., is a special purpose company with majority ownership and control held by Ft. Providence First Nations. This company will be responsible for the design, financing, construction, operations and maintenance of the Deh Cho (Mackenzie River bridge crossing on the Yellowknife Highway near Ft. Providence, under a Concession Agreement with the Government of the Northwest Territories (GNWT). The DCBC has retained a broad range of in management, technical, environmental, legal and financial expertise to assist in this major undertaking.

The bridge design and construction plan has been developed and optimized based on detailed investigation and analysis of:

- ✓ Topographic surveys
- ✓ Soils investigations
- ✓ River hydrology studies
- ✓ River ice studies
- ✓ Highway traffic studies
- ✓ River navigation requirements
- ✓ Wind effects on structure
- ✓ Environmental assessments
- ✓ Structural analysis
- ✓ Costs and benefits
- ✓ Climate
- ✓ Location and logistics
- ✓ Public concerns
- ✓ All applicable codes and standards

Alternative locations, designs and construction schedules have been examined to optimize the project. It has been subject to independent expert review on behalf of the GNWT.

The Deh Cho Bridge will be a two lane structure totaling 1,045 metres in length, constructed at the current ferry crossing site. The structure will consist of 9 spans with 8 piers. The main span will allow a clear navigational opening width of 185 metres and vertical clearance of 22.5 metres at high water level, meeting the requirements for navigation on the river.

The piers and abutments will be cast in place concrete, while the superstructure will consist of steel girders, with precast concrete deck panels. The longer main span will be supported by portals and stays to reduce.

Construction will take approximately 24 months, commencing in the fall of 2004. The total estimated construction contract value is $51 million. With project development, design, supervision and financing costs adding approximately $6 million, the total project cost is estimated at $57 million.

Table A1 – Key Socio-Economic Impacts

Stakeholder	Positive Impacts	Negative Impacts	Mitigation
Community of Ft. Providence	Construction phase training, employment, local business and joint venture opportunities. Operations phase employment. Income form equity in DCBC. Future opportunities from joint ventures and skills developed. Benefits from reinvestment of DCBC dividends.	Potential for negative social impacts during construction, due to non-resident workforce and increased community incomes. Loss of seasonal ferry employment and local contracts.	yes yes
Public and consumers	Net savings in consumer goods and services Improved access and reduced isolation Reduced risk of shortages		
Trucking Industry	Reduced travel time and distance. Improved scheduling and equipment utilization. Increased volumes	Toll payment and administration	yes
Business	Lower overall cost for goods. Reduced cost for alternative transport (air freight) Reduced risk of shortages Regional economic stimulus	Reduced business for air carriers	no
Mining Industry	More reliable link to Yellowknife	Higher net transportation cost	no
Government	Reduced costs for good and services Fiscal benefits Economic stimulus Supports Aboriginal objectives		
Overall	Net Increase in community and Northern Employment Net reduction in cost of living for region Net present value of benefits exceeds costs by $38 million at 5% discount rate. Overall Internal Rate of Return is 8.5% Economic stimulus during construction and operations		

The design and construction plan is further detailed in Section C and Appendix 1 of this report.

The project has been subject to considerable consultation and scrutiny by stakeholders and has gained and maintained broad support of the Community of Ft. Providence, Deh Cho leaders, government, business, the trucking industry and the general public. Only the mines have expressed serious reservations about the costs and benefits for their operations.

The project has been subject to independent environmental and economic assessment on behalf of the proponent and the GNWT. It has also been reviewed by other government and regulatory agencies during the preliminary screening of permit applications.

Table A1 summarizes the key positive and negative **socio-economic impacts** identified for various stakeholder groups. The overall assessment is positive, with net economic benefits quantified for every group except the mines. Some additional benefits have been identified but not quantified or included in the analyses.

Sections C, G and I and Appendices 2, 7, 8, 9 and 12 provide further detail on socio-economic considerations.

The potential **environmental impacts** occur in two distinct phases. During construction the disturbance and risk to the environment is higher. Once construction is complete, the new regime should result in a condition that is more stable. Table A2 summarizes the key environmental impacts, risks and benefits during and after construction.

The project design and implementation plan includes all reasonable measures to minimize risks and mitigate predicted impacts.

Over the long term, it is expected that the construction of a bridge to replace the current ferry and ice crossing will result in a net environmental benefit.

Sections C, G and J and Appendices 1 through 9 and 14 through 16 of this report provide further detail on the environmental concerns, impacts and mitigation plans.

A.3 Conformity Table

The DAR is requested to include a table cross-referencing the items in these Terms of Reference with relevant sections of the DAR.

This Development Assessment Report follows the format and tracks and highlights the requirements listed in the terms of reference provided by the Mackenzie Valley Environmental Impact Review Board.

This approach allows for ready checking of the Developer's response against each of the requirements, without the necessity of a conformity table.

Table A2 – Significant Environmental Impacts & Risks

Phase	Predicted Positive Impacts	Predicted Negative Impacts and Risks	Mitigation
2 year Construction Phase		Air quality – increase in dust and emissions.	Yes
		Disturbance to soils and vegetation.	Yes
		Release of sediments and/or chemicals into water.	Yes
		Disturbance to fish habitat	Yes
		Disturbance caused by construction noise.	Yes
		Risk of (fuel) spills	Yes
75 year + Operations Phase	Reduced consumption of fossil fuels by ferry and reduction in trip length and waiting times.	Disturbance to habitat from increase in traffic and noise on bridge and highway.	Yes
	Elimination of sediments from erosion of ferry landings and ice bridge approaches.	Increased mortality from increase in traffic and noise on bridge and highway.	Yes
	Elimination of noise, erosion and habitat disturbance from ferry propeller wash.	Effects of structure on birds.	Yes
	Eliminated risk of spill on ice crossing, ferry and ferry ramps.	Risk of spill (fuel or other) on bridge	Yes
	Reduction in disturbance due to noise from ferry operation, air shuttle and trucks on winter access detours		
	Net gain in fish habitat.		
Overall	Short term construction impacts not significant with proposed mitigation measures. Anticipate net long term benefit and reduction in risk to environment		

B Developer

B.1 Company Corporate History:

Summarize the company's corporate history in Canada and the Northwest Territories. Also, include the corporate histories of any partners.

The Deh Cho Bridge Corporation Limited (DCBC) was incorporated in Yellowknife on November 28th, 2002). It was incorporated for the sole purpose of building, owning and operating the Deh Cho (Mackenzie River) bridge crossing on the Yellowknife Highway at Fort Providence.

B.2 Proposed Development Ownership:

List all owners of the proposed developments and the portion each will own. Also, include details of financial securities for government liabilities in the event of bankruptcy or other unforeseen failure to complete the project.

There are currently two shareholders in the Corporation – The Chief, in trust for the Deh Gah Got'ie Dene Band and the Fort Providence Métis Council. It is anticipated that additional equity partners will be identified before construction commences. However, the initial two shareholders will maintain at least 60% equity ownership.

The GNWT and federal DIAND have provided funding for feasibility studies and business planning. The GNWT has also provided a loan guarantee for DCBC investments in the pre-construction phase of the development, including design and environmental assessment.

As a public private partnership, the project includes a close contractual relationship between the GNWT and the DCBC.

Prior to commencement of construction, final agreements will be required between the DCBC, the GNWT and TD Securities. These agreements will also be subject to all parties approving the proposed construction contractor(s), contract securities and comprehensive insurance and risk management plans.

Under these agreements, the DCBC will provide $5 million in equity and TD Securities will arrange for approximately $50 million in debt financing. In the event of bankruptcy of the DCBC or unforeseen failure to complete the project, the parties will rely first on contract securities and insurance protection. TD Securities will have the right and considerable incentive to step in and complete the project to protect their investment. The GNWT will also have the right to acquire the assets of the DCBC.

Unlike some resource developments, this project does not require the production, accumulation, storage or disposal of potentially toxic waste products.

The proponent suggests that the combined equity and debt at risk from the DCBC, GNWT and TD Securities constitutes an adequate financial security for project completion.

B.3 Organizational Structure:

Identify corporate and individual responsibilities for the proposed development and associated operations.

B.3.1 The Deh Cho Bridge Corporation

The Deh Cho Bridge Corporation has a six member Board of Directors, consisting of three nominees of each of the two shareholders. All are Aboriginal residents of Ft. Providence. Current Board Members are:

- Michael Vandell - President
- Susan Christie – Secretary/ Treasurer
- Clifford McLeod - Director
- Wayne Vandell - Director
- Irene Lafferty - Director
- Berna Landry - Director

A Chief Operating Officer (COO) has been hired as the sole employee of the Corporation (on a one-year secondment from the Hamlet):

- Albert Lafferty

B.3.2 Project Support Team

The Corporation has retained the following consultants to provide expert advice and support to the Board:

- **Project Manager** - *Andrew Gamble, Andrew Gamble & Associates (Yellowknife)*
  Provides overall coordination for the project and supports Board and Chief Operating Officer through advice and recommendations planning, strategies, public relations, negotiations and financial analysis.
- **Design Engineers -** *Jivko Jivkov, Jivko Engineering (Yellowknife) and John Spronken, J.R. Spronken & Associates Ltd. (Calgary)*
  The design team provides designs, estimates, construction logistics and schedule, tender documents and advice on contractor selection.
- **Other Engineering Specialists -** *Trillium Engineering and Hydraulics Inc. (Edmonton), AMEC (Vancouver), EBA Engineering Consultants Ltd.* (Y*ellowknife), KJ Technical Services (Yellowknife), Dewinton Consulting Services (Okotoks AB), Davenport Wind Engineering group (London, Ontario)*
  Design work has been supported by specialist consultants in surveys, geotechnical investigations, hydrology, ice engineering, wind engineering and navigation.
- **Environmental Consultant -** *Golder Associates (Yellowknife)*
  Initial environmental scoping and studies required in support of the permit applications. Additional environmental support will be required for construction and post construction planning, monitoring and mitigation.
- **Financial Management & Audit -** *Dargo & Associates Ltd. (Yellowknife) and KPMG (Edmonton)*
  Provides the Deh Cho Bridge Corporation with professional advice and management assistance in the areas of financial administration, banking, board policies and audit.
- **Legal Counsel** – *Charles Thompson, Petersen Stang & Malakoe (Yellowknife) and Thomas Barlow, Fasken Martineau, Barristers and Solicitors (Toronto)*
  Provide general legal counsel and expert advice in structuring agreements.
- **Structuring and Finance** - *Michael Cautillo*, *Deloitte and Touche Structured Finance Inc. (Toronto)*
  To provide advice in overall project structuring, negotiating agreements, identifying and instructing the lead financial institution and construction contractor(s).
- **Economic Consultant** - *Nichols Applied Management (Edmonton)*
  To complete a study of benefits and costs including community and Aboriginal Benefits of the Deh Cho Bridge Project.

- **Traffic Analysis** - *PROLOG Canada Inc. (Calgary)*
  The GNWT retained consultant to undertake an analysis and forecast of commercial traffic, as the basis for agreements
- **Lead Financing Agency** – *TD Securities (Toronto)*
  To provide recommendations on and arrange for debt placement.
- **Insurance/Risk Management** - *INTECH Risk Management Inc. (Toronto)*
  To provide advice in all areas of insurance and risk management.

B.4 Operational Structure

Describe the relationship between the parent company, its' contractors, and subcontractors. Also, detail how the company will ensure the contractors and subcontractors utilized will be responsible for, and honour commitments made by the parent company.

The 2-year construction phase and 35-year plus operating phase are described separately.

B.4.1 Construction Phase

The DCBC Directors are appointed by and responsible to shareholders. The DCBC office in Ft. Providence is currently staffed by a Chief Operating Officer, responsible to the Board. During construction, office staff will include a community employment co-ordination and clerical staff.

Figure B1 shows the overall operational structure during the construction phase.

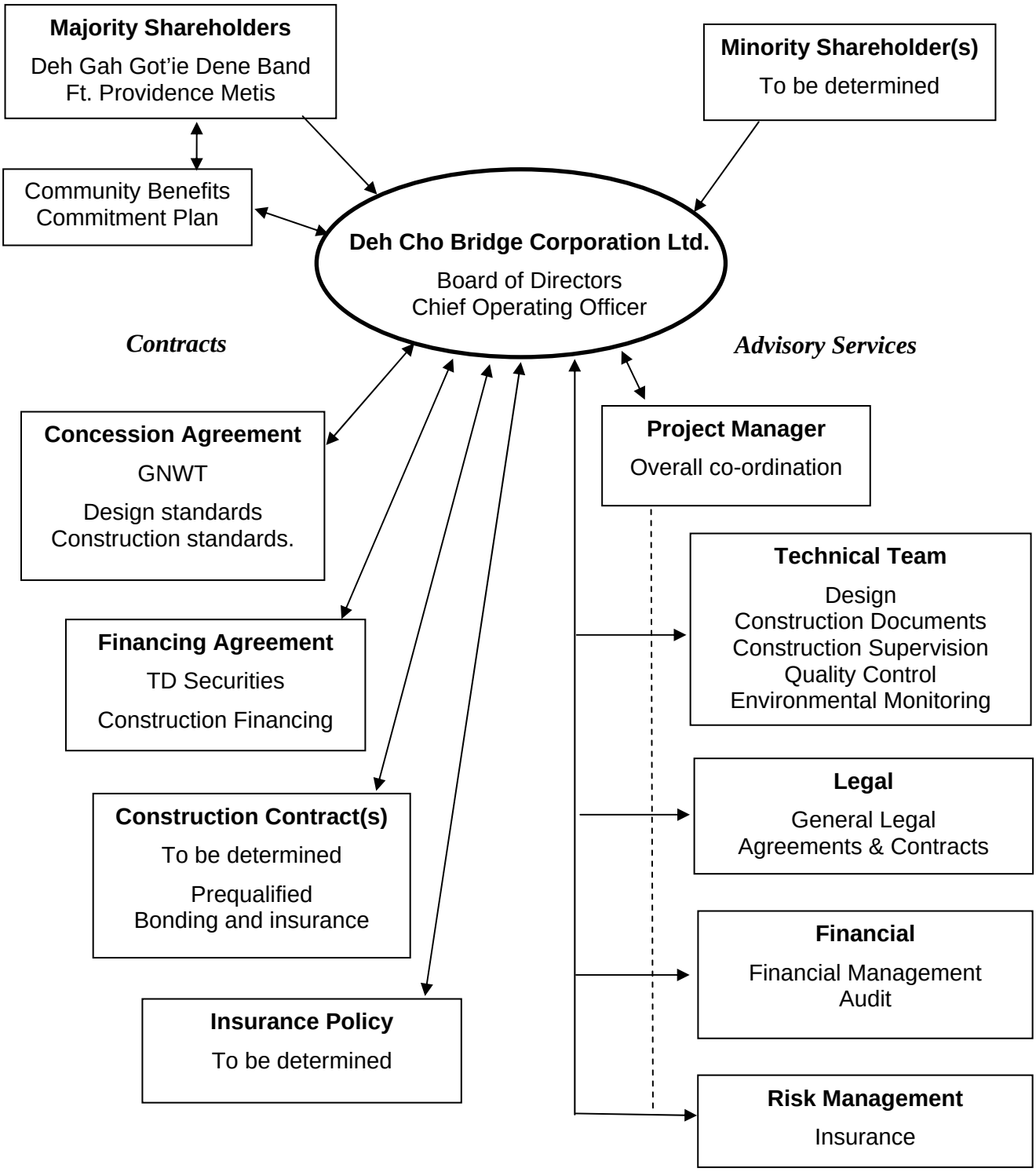
The DCBC has developed a Community Benefits Commitment Plan (Appendix 7), in consultation with community shareholder organizations. This plan outlines commitments of the corporation to ensure business, training and employment opportunities for residents during the construction phase.

Key contracts and agreements during this phase are:

- Concession Agreement – with GNWT. This agreement outlines the developer's responsibility and GNWT approvals for design and construction standards and includes due diligence review of all DCBC contact arrangements.
- Financing agreement – with TD securities. This agreement outlines the commitment to construction financing and includes due diligence by TD Securities.
- Construction Contracts – Contractor(s) to be determined. Potential contractors will be pre-qualified and approved by DCBC, GNWT and TD Securities, based on relevant experience, past performance and financial capacity. Contacts will include commitments to environmental performance, community benefits, bonding and insurance. All contracts will include clear requirements to meet environmental and safety standards and community benefits commitments. Quality control procedures will ensure adherence to these commitments.
- Insurance Policy – Insurer to be determined. During this phase, insurance coverage will include builder's all-risk, wrap up liability and errors and omissions insurance. Policies and coverage will be reviewed by the DCBC, TD Securities, the GNWT and contactor(s), to ensure that they meet the needs all parties.

The DCBC has retained consultant expertise required to support the development and construction phase, including technical team (project management, engineering and environmental), legal, financial and risk management.

Figure B1 - Operational Structure
Construction Phase

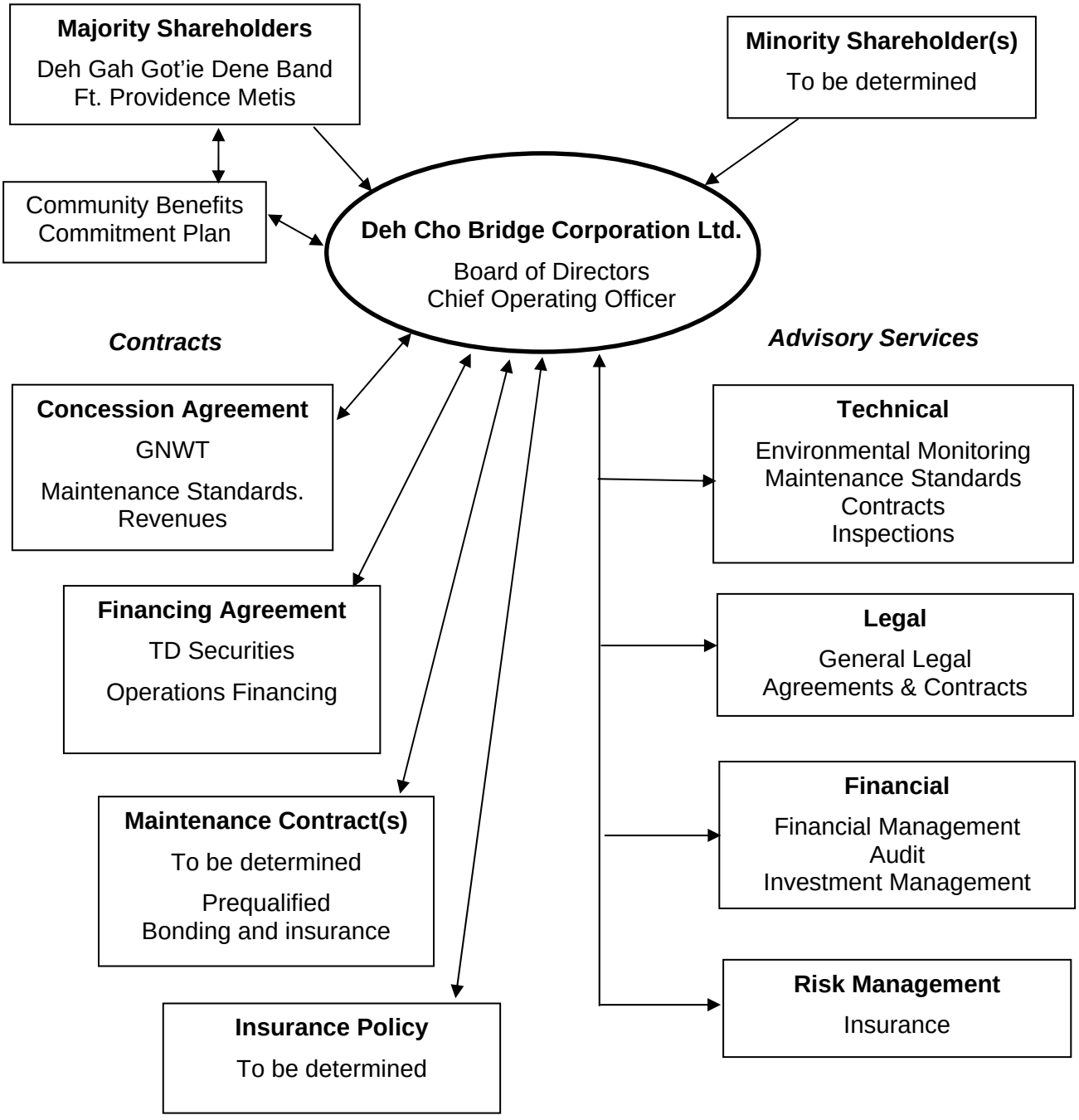


B.4.2 Operations Phase

Figure B2 illustrate the operational structure anticipated during the 35-year concession period.

The Community Benefits Commitment Plan outlines the DCBC commitment to the community for ongoing training and employment and investment of earnings.

Figure B2 - Operational Structure
Operations Phase



Key contracts and agreements during this phase are:

- Concession Agreement – with GNWT. This agreement outlines the developer's responsibility and GNWT approvals for inspection and maintenance standards and includes due diligence review of all DCBC contact arrangements.
- Financing agreement – with TD Securities. This agreement outlines the commitment to long-term bond financing and includes due diligence by TD Securities.
- Maintenance Contracts – Contractor(s) to be determined. Potential maintenance contractors will be pre-qualified and approved by DCBC, GNWT and TD securities, based on relevant experience, past performance and financial capacity. Contacts will include commitments to environmental performance, community benefits, bonding and insurance.
- Insurance Policy – Insurer to be determined. Coverage in the operations phase will include wrap up liability and accidental losses, as approved by the DCBC, GNWT and lenders.

During the operations phase, the DCBC will continue to require technical expertise in environmental monitoring, bridge inspection and setting and monitoring maintenance contracts. There will also be an ongoing requirement for legal, financial and risk management advice.

B.5 Environmental Performance Record*:*

Provide a record of environmental performance of the company and its contractors in conducting this type of development.

As a new company, the Deh Cho Bridge Corporation has no record of environmental performance. However, it is noted that the shareholders and directors are all Aboriginal residents of Ft. Providence and have made environmental responsibility a key requirement for the project.

The general contractor and subcontractors have not yet been selected. However, environmental performance will be a key factor in selection of all contractors. All contracts will include strict requirements for adherence to environmental standards and permits.

C Development Description

The developer is only asked to provide details on the development itself, not on impacts from the development.

During the construction phase of the project, activity will focus on the 2,720m x 60m construction corridor. However, there will also be ancillary activity in other areas adjacent to the site (camp, concrete plants, materials lay down and storage) and at 7 separate quarries and pits in various locations. As a major 2-year construction project, the work will be undertaken in several distinct phases or components.

Appendix 1 provides a detailed project description, schedule and construction methods, describing activity proposed at each location and stage of the work. This largely applies to Sections C.1, 2, 3, 4, 6, 8, and 9 below.

The general contractor has yet to be selected. It is anticipated that general contractors will examine a range of alternatives to optimize the construction approach. For example, it is considered technically feasible to construct the pier foundations in the open water season, using barges or a temporary bridge for access or in the winter from the ice surface. The project description makes assumptions about the most probable alternative approaches to be taken, while allowing some flexibility.

Once construction is complete, the operation of the bridge will be more stable and less disruptive, with routine maintenance and repairs to the structure and approaches. The operations phase applies primarily to Sections C.4, 5 and 7 below.

C.1 Timing*:*

Provide the proposed schedule for the project, and identify any time constraints.

Figure C1 provides the proposed overall construction schedule, with granular materials preparation commencing in September of 2004 and construction of the bridge commencing in the spring of 2005. The bridge would be ready for use before Christmas 2006, while final cleanup would be done in the spring of 2007. This schedule assumes all permits and agreements will be in place by August of 2004 and a contract is tendered an awarded shortly after.

Appendix 1 provides additional detail on each component of the work.

C.2 Access Route*:*

Describe the access route for all building materials required for the proposed development. Also, describe the detour access route proposed for ferry traffic and bridge traffic during the various phases of construction, including any highway realignment activities.

Access for building materials would largely be by existing transportation corridors.

- Supplies (steel, concrete, equipment) would likely be mobilized from the south by Highways 1 and 3 to the site. Alternatively, materials supplied from the south may be transported via rail to Enterprise and truck to the site, or by rail to Hay River and by truck or barge to the site. Materials would cross the river via the ice crossing or ferry.
- Bulk granular material would be transported by truck from identified pits and quarries. Granular material required to cross the river would be moved in the winter, via the ice crossing, not the ferry.
- Summer access to in-river works for constructing the piers and erecting the superstructure may employ floating barges or temporary bridges supported on the river

bottom. Winter access could use the ice or temporary bridges. Any temporary fixed or floating bridges or barges would be removed before spring and fall ice traffic on the river. At no time would these temporary works be allowed to interfere with ferry operations or with marine traffic on the Mackenzie River.

- As shown in Appendix 1, the permanent road approach to the bridge will utilize the existing highway/ferry right-of-way.
- Appendix 1 also provides further details on construction and removal of proposed temporary construction site access and detours.

C.3 Construction Methods*:*

Describe the methods used to build the bridge, abutments and detour access roads.

Appendix 1 describes the planned sequence and methods for construction of the bridge and approaches and for the construction of temporary facilities...

C.4 Operations*:*

Describe the operations in terms of timing, traffic volumes on the river and on the Highway. Also, describe the operations in terms of employees, contractors, schedules and worker accommodations.

Appendix 1 describes the timing of operations during the construction phase.

Appendix 4 outlines the estimated local and outside employment during and after construction. The number of workers on site during construction will vary with the time of year and the stage of construction. The construction workforce is expected to peak at 40 non-resident workers at the construction camp and 20 local workers. There will also be staff involved in contract supervision, quality control and environmental monitoring. During the operations phase it is estimated that the DCBC will employ directly or through contact 2-3 persons in bridge maintenance and company operations.

C.5 Maintenance Requirements:

Describe the projected maintenance requirements for the bridge, both short and long term. Include the physical nature of predicted maintenance activities as well as their frequency and potential environmental impacts. (For example, will icing on the bridge result in the requirement for chemical control measures?)

The structure is designed for a long life with minimal maintenance and rehabilitation required. Major components are reinforced concrete piers and abutments, high strength precast and pre-stressed concrete deck and an unpainted weathering steel superstructure. The substructure and superstructure components have a design life of 75 years and a practical life that should be longer.

The design also incorporates features allowing for quick repair/replacement of components, such as curbs, railings and lights that may fail prematurely or be damaged by collision.

Routine maintenance activities include regular inspection of all superstructure and substructure components for signs of wear, damage and erosion, and repair, if required. Special attention will be paid to any signs of erosion near the pier-footings or abutments and to the cleaning of bearings and expansion joints.

The bridge deck will require snow removal and the use of sand or fine gravel when icing is present. The deck would be cleaned and broomed in the spring to remove accumulated sand and other debris. There are no plans to use chemical de-icers or cleaning agents, as these may

accelerate bridge deterioration as well as raising environmental concerns.

Some of the sand or gravel for ice control and materials tracked onto the bridge. This as well as any fluids or deposited by vehicles may be washed by rain or melt water into the river or blown or the air. However, the quantities should be small and less than that the amount now deposited from the ferry and ice bridge.

C.6 Waste Management*:*

Give a description of the proposed waste management plans and sites.

These are fully described in Appendix 1 for each of the sites.

C.7 Accidents and Malfunctions*:*

List any possible accidents or malfunctions that may occur and describe the procedures to be followed in such instances (include the probability, potential magnitude and potential environmental impacts of any such accidents or malfunctions). Do proposed contingency plans include an alternative system of transport in the event that the bridge is closed to traffic for a long period of time due to structural damage?

Possible accidents would include but not necessarily be limited to the following:

i. Ship/barge collision with piers – Low probability
ii. Vehicle collision on bridge – high probability
iii. Loss of control of vehicle on bridge – high probability
iv. Collision with stay cable – Low probability
v. Fire from combustible material being transported – Low probability
vi. Ship/barge collision with superstructure – Low probability
vii. Major spill on bridge deck – Low probability

Possible malfunction would include but not necessarily be limited to the following:

viii. Deterioration of bearings – Low probability
ix. Defects in stay cables – Low probability
x. Defects in structural steel member(s) – Low probability
xi. Deterioration of expansion joints – Low probability

The following steps have been taken to reduce the probability and reduce or eliminate any inconvenience or disruption to traffic from possible accidents:

i. The main span opening provides a significant clearance for the largest vessels using the river. The piers have been designed to resists the impact from a 2500 ton barge plus tug traveling at a speed of 11 knots coming into direct contact with the piers. In the event of collision, there would be damage, possibly severe, to the vessel. This may include the spill of refined petroleum products.

ii. A vehicle collision on the bridge between two passenger cars would probably not result in any significant damage to the deck railing. Collision between two trucks may cause significant damage to the railing. It is proposed that a reasonable supply of replacements be stockpiled to the north of the bridge to permit timely repairs to be effected. A collision may result in a spill of refined petroleum products.

iii. Loss of vehicle control of a loaded truck may well result in the loss of guard rail section depending on the conditions under which this loss of control occurred. The guardrail is designed to limit damage to the superstructure while providing the restraint required by the relevant Codes governing this aspect. A single vehicle accident would be less likely to result in a spill.

iv. While this is highly improbable, the design of the bridge allows for the complete severance of stay cables. The loss of one (1) cable would not affect normal traffic, while the loss of two (2) cables of the same set would require a speed reduction. The complete loss of an entire set of cables would require both a speed reduction and flagging of traffic until repairs could be made. No environmental impact is anticipated.

v. A fire may result in a spill of products of combustion as well as refined petroleum products. The location of the fire, the type of material being transported, the time of year all are relevant in this scenario. It is anticipated that because of the bridge slope that any volatile fluid would be dispersed over a large area thus reducing the fuel mass necessary to cause damage from overheating. Local damaged areas that may be subject to heat concentration are not anticipated to be extensive and could be easily repaired.

vi. The only case where this could be of any significance is in the first or second approach spans, where the superstructure is low enough. Only the upper portion of the vessel would impact the lower chord of the truss. This portion of the vessel is not generally constructed to resist the impact of the vessel and therefore it is unlikely that significant damage would be caused to the truss. In any event, the damage would have to be assessed at the time and repairs, if required, effected as necessary.

vii. A major spill on the bridge deck is possible (refined petroleum products being the most likely). However, it is no more likely than on any other bridge in this drainage system and probably less likely than on the ice bridge or ferry ramps. Existing regulations for transportation of dangerous goods and spill contingency planning would apply.

In terms of possible malfunctions, which normally fall under the aegis of maintenance, the remedies are addressed below. Many of these fall under the same procedure as those described for Accidents. None should pose environmental concerns.

viii. Deterioration of bearings. The bearings are of two types: elastomeric pads and sliding pot-bearings. The elastomeric pads are virtually maintenance free. The details allow for quick replacement (should this ever be necessary) with the minimum degree of labour. The sliding pot bearings require occasional cleaning (every 2 to 5 years) to remove dirt and grit from the sliding surfaces. No other maintenance should be required. Similarly, details provide for quick changeover. The life expectancy of all bearings is 75 to 100 years.

ix. Defects in stay cables. Refer to item iv above.

x. As in any other structure, regular structural inspection is required as part of the due diligence. Space does not permit to examine every possible scenario and timely assessment would be required. The design of this structure has been purposely maintained as a robust structure to eliminate any such occurrence.

xi. Expansion joints require regular cleaning and maintenance. The greater attention paid to keeping these clean will result in longevity of the joint components. Normal repairs are limited to replacement of the rubber bladders.

In the very unlikely event that the bridge structure were damaged severely enough to cause a prolonged closure, the alternative would be to revert to an ice crossing and/or remobilize a ferry

for the crossing. On a temporary emergency basis, a tug and barge arrangement could be used.

C.8 Abandonment and Restoration

Describe the plans for abandonment and restoration, including the construction site, detour access roads, ferry landings and the river bottom. Include plans for long-term monitoring, maintenance and remediation.

See Appendix 1 for details on abandonment and restoration of temporary facilities. The existing ferry camp is not included in this application and will remain the responsibility of the department of Transportation.

The plan includes a program for post-construction monitoring of any changes to water quality or fish habitat. Particular attention will be paid to early detection and remediation of any signs of erosion around the pier foundations, abutments and road approaches. This will include underwater inspection of the river bottom at the pier footings.

C.9 Air photos and Drawings:

Include a plan view drawing, to scale, of the proposed development superimposed on an air photo or satellite image of the site. Also, include an elevation view drawing, to scale, of the proposed development.

See Appendix 1a for air photos and plans.

C.10 Other:

Describe any other relevant proposed activities or development components.

None identified.

C.11 Modifications:

Provide details of any changes or modifications to the development description as presented in the Preliminary Screening phase that may occur throughout the EA phase. This information should be provided on an ongoing basis.

There have been few conceptual modifications introduced in the bridge design since the submission of the Application for Water License of May 23, 2003:

- The pier foundations originally presented as predrilled concrete caisson have been replaced with cast in place concrete spread footing and pedestals. This modification was introduced to satisfy the actual geotechnical conditions defined by the geotechnical investigation report prepared by EBA Engineering in July 2003. Detailed description of the new pier design including geometry, materials and method of construction are presented in Appendix 1.
- The steel plate girders of the bridge superstructure have been replaced with steel trusses of same height width and position. This modification was introduced to achieve a better response of the bridge structure to the wind forces. Detailed description of the new superstructure, including geometry, materials and method of construction are presented in Appendix 1.
- The steel hanger suspenders installed on the piers on both sides of the main span has been replaced with vertical steel towers with stays. This modification was introduced to accommodate larger horizontal and vertical clearances for the traffic on the bridge deck. Details of this modification are presented in Appendix 1.

- Proposed sources for quarried rock, aggregates and granular materials have now been identified.
- The schedule has been revised to reflect the currently anticipated timing of approvals.

All remaining bridge parameters and components remain as per our original application and as described in Appendix 1.

Figure C1 – Construction Schedule

	2004					2005											2006												2007
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jul
i.) Construction Corridor																															
Pier Foundations																															
Constr of 4 piers (north)										xxxx	xxxx	xxxx	xxxx	xxxx																	
Constr of 4 piers (south)													xxxx	xxxx	xxxx	xxxx															
Pier Shafts- installation																							xxxx	xx							
Bridge Abutments										xxxx	xxxx	xxxx	xxxx	xxxx																	
Steel Superstructure																															
Fabrication								xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx										
Installation																				xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx					
Bridge Deck																															
Fabrication of pannels								xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx						
Shipping & Installation of Pannels																									xxxx	xxxx	xx				
Railing, Lights,																										xx	xxxx				
Earth works																															
Construction of Nort & South detours									xxxx																						
Placing in-stream rock on North approach									xx																						
Placing in-stream rock on South approach												xx																			
Embankments construction Phase One													xxxx	xxxx																	
Access road realignment																										xxxx					
Embankment Construction Phase Two																									xxxx	xxxx					
Riprap on embankment shoulders															xxxx												xxxx				
Texas barrier																										xx	xx				
Chip seal																															xxx
ii.) Construction Camp																															
Site Prep & Camp setup		xxxx	xxxx																												
Camp operation									xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx		
iii.) Concrte Plant									xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx		
Plant setup											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx		
Plant operation																															
iv.) Two Parking Areas										xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx			
v.) Two Reclamation Areas																												xxxx			xxx
vi.) Limestone Quarry, HYW 1, km 188.5			xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx		
vii.) Gravel Pit HWY 1, km 188.5											xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx		
viii.) South Borrow Area, HWY 3, km 23+270										xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx		
ix.) North Borrow Area, HWY 3, km 26+240										xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx		
x.) Concrete Agr. Quarry, HWY 3, km 87	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx							
xi.) Grey Lmstn Quarry, HWY 3, km 156	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx				
xii.) Granite Quarry, HYW 3, km 232	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx				

D Effects of the Physical Environment:

This section pertains to potential changes to the development, e.g. timing or alternative methods, caused by the environment.

D.1 Description of Effects

List and describe all effects that the environment may have on your development (e.g. effects of ice movements in the Mackenzie River)

Construction schedule and logistics at this location are subject to assumptions made about the weather, water and ice conditions.

Weather – The cold, dark winters and longer daylight in the summer are key considerations in the design and construction schedule and logistics. The weather conditions are reasonably predictable and variations from the norm in temperature and precipitation will not affect the project, except to the extent that the weather affects ice formation and breakup.

Ice formation at the winter road crossing – Ice formation upstream of the bridge site, affects the timing of vehicle crossing and ferry removal. This has proven to be consistent within a few weeks each year (figure D1). This will be important for hauling aggregates across the river in both directions and for the movement of heavier structural components and equipment. The proposed schedule can accommodate these variations.

Figure D1 – Ferry and Ice Road Seasons

	Ice Road			Ferry	
	Light Traffic < 5 Tonne	> 60 Tonne Capacity	Closed	First Trip	Last Trip
2000 / 2001	Dec 21/00	Jan 15/01	Apr 15/01	May 09/00	Jan 15/01
Earliest	Nov 28/90	Jan 07/92	Apr 12/96	May 06/93	Dec 27/86
Latest	Jan 09/98	Feb 16/88	May 05/66	May 31/62	Feb 10/88
Last 5 years avg.	Dec-26	Jan-19	Apr-18	May-12	Jan-18
Last 10 years avg.	Dec-19	Jan-15	Apr-19	May-12	Jan-16
Last 15 years avg.	Dec-18	Jan-19	Apr-18	May-13	Jan-16

Ice formation at the bridge site – because of the faster currents and the channel cut for the winter ferry operation, formation of ice at the bridge site is later and less predictable. Depending on the approach used, contactors may face additional risk in relying on this ice to support construction of piers and erection of the superstructure. For this reason, the schedule assumes that contractors will chose to construct in-river foundations in open water and will launch the superstructure from each shore out and/or from barges. Ice formation also causes varying degrees of ferry service interruptions in the fall.

Ice movement – During Spring breakup, access is interrupted for up to six weeks. Any temporary structures or partially completed pier footings (below high water) will not withstand the forces of heavy ice movement of Mackenzie River ice. Breakup is also predictable and is accommodated in the schedule.

Water levels – spring breakup is accompanied by higher water levels, due to runoff and ice

damming. However, this location is not downstream, in distance or elevation, from Beaver Lake and Great Slave Lake. These lakes provide a large reservoir and serve to dampen the severity of flooding at Ft. Providence. Fluctuations in water level have been accommodated in the design and construction plan.

D.2 Changes to Development

List and describe any changes or modifications to your proposed development that may be caused by the environment (e.g. late river ice break-up, flooding).

As noted above, it is technically feasible to undertake in-river construction of pier foundations in the winter, taking advantage of natural and man-made ice as a working platform. However, given the risk of inadequate ice thickness and strength, as well as the colder weather and darkness, it is expected that contractors will undertake this work in the open water, relying on barges and/or temporary bridges as working platforms.

The variability in ice formation and ice breakup are understood and can be accommodated in the proposed schedule.

E Alternatives

Provide an explanation of alternatives to the various parts of the development where appropriate alternatives are possible. This discussion shall include, but is not limited to, development timing and a description of potential environmental impacts that were considered when evaluating and selecting alternatives (e.g. why were certain types of equipment selected, why will the bridge spans be hauled by barge to the site etc.). Include consideration of environmental impacts from the current ferry system, and construction and operation of winter ice road crossing.

E.1 Alternative to Bridge

The only viable alternative to the proposed bridge is continuation of the current ferry and ice bridge operation. The bridge is being proposed based on the long term economic and environmental benefits, as outlined in Sections I and J of this report.

E.2 Alternative Location of Bridge

Several alternative crossing locations were examined.

The proposed site was first recommended in the study - *Preliminary Hydraulic Design, Mackenzie River Bridge, Liard River Bridge, Great Bear River Bridge* prepared for PWC by Northwest Hydraulic Consultants Ltd (NHCL) of Edmonton, AB in 1975. The Study establishes that the waterway could be constricted to 3,000 feet (915 m) or less without serious hydraulic effects, and concludes that a design value of less than 3,000 feet would be acceptable from a river engineering viewpoint. The Study evaluated three potential sites for a bridge crossing between Fort Providence Rapids and Beaver Lake, and recommended the site at the existing ferry crossing.

The proposed site was confirmed by PWC and it was the basis for their *Mackenzie River Bridge, Fort Providence, Yellowknife HWY #3, NT, Preliminary Design and Cost Estimate*, dated December 1975.

It is proposed to construct the bridge at the existing ferry crossing, for the following technical, economic and environmental reasons:

- ✓ It is the most economic location.
- ✓ The bed of the river at the proposed site is highly stable and scour resistant with changes occurring only in geologic time scale.
- ✓ The direction of flow does not vary markedly from point to point across the section
- ✓ The structure is not located in a curve of the navigation channel
- ✓ The depth of the river at the proposed site is fairly uniform. The maximum depth is substantially less than the other locations.
- ✓ The bridge would use the existing highway and will not require additional road construction, as would a new location.
- ✓ Maintaining the existing highway corridor will prevent disturbance to current land use along the shoreline.

At this site, the natural riverbed is approximately 1,560 m wide. For the purpose of the ferry operation, partial causeways were extended on the north and on the south shore, more than 30 years ago. The north causeway is projecting 430 m into the river, and the south one 165 m. Presently, the constricted river is 965 m wide at the ferry crossing. The proposed bridge is 1,045 m long and will allow an increase of the waterway to 995 m.

The banks of the Mackenzie River in the vicinity of the proposed site are stable with no appreciable changes having occurred during a 50-year interval based on inspection of aerial photographs. A distinctive feature of the banks is numerous spur-like projections, some of which exceed 300 m in length. Although portions of them are submerged during high open water or ice jam high water,

there is no sign of recent erosion.

The bed of Mackenzie River in the vicinity of the proposed crossing is comprised of hard dry clay-till overlain by 0.8 m to 1.2 m layer of alluvium. At the ferry crossing, divers have reported that the bed was clay scattered with large, partially embedded boulders. The riverbed is considered stable, and general scour is not anticipated.

E.3 Alternative Bridge Designs

There are almost unlimited variations and combinations possible in the conceptual design and choice of materials. The design concept proposed considers such issues as:

- Soils and the foundation conditions
- river flow
- ice characteristics and forces,
- climatic conditions
- transportation and logistical challenges
- river navigation requirements
- operational constraints during construction
- all relevant codes and standards
- traffic
- risks (environmental, safety, financial)
- durability
- aesthetics
- costs

The proposed design has been optimized to meet all operational, safety and environmental requirements at the lowest cost and risk. It is subject to detailed peer review and approval by the GNWT.

E.4 Alternative Construction Schedule

The proposed schedule assumes that all permits and approvals will be in place by early fall of 2004 and that granular production can commence shortly after. On-site construction would commence in the spring of 2005, with substantial completion by the winter of 2006.

Once construction starts, it is generally accepted that it should be completed in as short a time as practical, to reduce the length of time of disruptions, minimize the construction debt and begin to see the benefits.

For this project, the most critical component will be the construction of the pier foundations and pier shafts up to high water level. This phase requires work to be done on the riverbed, under water. Once the structure is above water, work becomes relatively more straightforward and less susceptible to water and ice forces.

It is technically feasible to utilize a natural or man-made winter ice cover as a working platform for installing cofferdams, excavation of foundations and construction of footings and pier shafts. In theory, the relatively low cost of construction of an ice bridge makes winter construction attractive. However, the ferry operates at this location until well into the winter, when the ice bridge is open to heavy traffic. There is a risk that it may be difficult to build sufficient ice at all pier locations and/or that piers cannot be constructed in the time available before spring breakup. Piers must be completed at least to the high water level and cofferdams removed before spring breakup, as partially complete foundations could be damaged by ice movement.

The alternative is to construct the piers during the open water season. This would require the use of temporary bridges or barges as working platforms for construction. While this approach

may be more costly, it offers advantages of a longer season and better light and weather conditions. The proposed schedule assumes this approach will be preferred by the foundation contractor, and that most piers will be constructed during the open water season of 2005. Abutments and the piers close to each shore may be constructed in the winter or the summer.

The other critical component of the schedule is the transportation of rock and aggregates across the river. Material quarried from the south side will be required on the north side and vice versa. It will not be feasible to haul large quantities of granular material on the ferry. It will therefore be critical that granular material is hauled on the winter crossing during the previous winter. For example, concrete aggregates required in the summer of 2005 for the North piers and abutments must be hauled and stockpiled in the winter of 2004-05. Similarly, depending on the source, precast deck panels should be stockpiled during the winter.

Contractors must plan around the interruption of access during the spring breakup and possibly during the fall.

Other major components, including completion of the piers above water, erection of superstructure and installation of the deck are less critical in terms of schedule.

The proposed schedule anticipates the constraints and risks noted above. At the same time, the proponent wishes to remain open to alternatives proposed by the general contractor.

F Regulatory Regime:

Provide a table summarizing relevant licenses, permits or other authorizations required for the proposed development. Also, include a summary of land ownership and the present state of each license or authorization required.

F.1 Licenses and Permits

Agency	Authority	Requirement	Status
Mackenzie Valley Environmental Impact Review Board	Mackenzie Valley Resource Management Act	Water License	Environmental assessment In progress
Mackenzie Valley Land and Water Board	Mackenzie Valley Resource Management Act	Land Use Permit	Submitted – consideration pending approval by MVEIRB
Mackenzie Valley Land and Water Board	Mackenzie Valley Resource Management Act	Water License	Submitted for screening – referred to MVEIRB
Department of Fisheries and Oceans	Fisheries Act, s. 35(2)	Authorization for Works Affecting Fish Habitat	Screening complete – referred to MVEIRB for Assessment – consideration pending approval by MVEIRB
Department of Fisheries and Oceans – Canada Coast Guard	Navigable Waters Protection Act, s 5(1)(a)	Permit under Navigable Waters Protection Act	Submitted – consideration pending approval by MVEIRB

F.2 Land

Land use permits for all temporary and permanent works have been applied for through the Mackenzie Valley Land and Water Board.

The land to be occupied permanently for the bridge structure is within the current highway right-of-way. For legal reasons, it is intended that the title to this land will be vested in the Commissioner for the GNWT. The GNWT will lease the land to the DCBC, for the term of the concession. The DCBC will make the improvements (the bridge) and lease the land and improvements back to the GNWT.

This has been agreed by DCBC, GNWT and Canada and the necessary administrative arrangements are being made.

G Public Consultation

G.1 Records:

Provide minutes and a summary of consultation undertaken with the public, Aboriginal organizations, land owners, federal, territorial and municipal governments, industry, directly/indirectly affected communities of the North Slave Region and others. Include dates and participants. This should include clear evidence of, and details from, consultation directly with members of potentially affected communities (in addition to community-based corporations). It is particularly important to include details from consultation with community members from Fort Providence.

Consultation on stakeholder views and concerns relating to potential environmental, economic and social impacts of this project has been critical to developing and advancing the proposal.

Development of this proposal has included almost three years of ongoing efforts to consult with all affected parties, by providing information, seeking views of stakeholders and incorporating changes to respond to concerns

Table G1 lists the consultations undertaken, since inception of the proposal in July of 2000. This listing does not include:

- Numerous informal discussions and meetings with business owners, political leaders and members of the general public.
- Meetings and correspondence with officials of the federal and territorial governments and regulatory agencies.
- Numerous press interviews and resulting newspaper, radio and television reports.
- Consultation with engineering, financial and legal advisors.

Copies of letters and presentations are available for most sessions. For the most part, detailed minutes of meetings were not prepared. The focus was to identify and respond immediately to questions and concerns and, where necessary, to arrange follow up work or modifications to project plan. The proponent has also offered to provide additional information and detailed briefings to all affected parties.

The DCBC continues to seek and respond to requests for information, presentations and meetings with the media, business organizations, community and aboriginal leaders, government and regulatory agencies.

Following several meetings with the three Ft. Providence elected councils (Dene, Métis and Hamlet), various community agencies and groups and with the general public, The Board developed a draft *Community Benefits Commitment Plan* (Appendix 7). This plan was then explained to community groups and individuals by an independent consultant, Michael Nadli in a series of focus groups. Following this Mr. Nadli has prepared a report and recommendations (Appendix 8). The Board is in the process of incorporating these recommendations in a revised commitment plan. This will be presented for approval at a public meeting within the next few weeks.

The Board has also made a commitment to members that the final decision to proceed with the project will not be made without a final public review of the project agreements by the community.

In addition to the efforts of the DCBC, there were public hearings held by the NWT legislative committee considering the Deh Cho Bridge Act. This legislation was amended, recommended and passed into law by the NWT legislature in June of 2004.

Following submission of screening applications by the DCBC to the Mackenzie Valley Land and

Water Board (MVLWB) and the Department of Fisheries and Oceans, the MVLWB undertook distribution to affected communities and agencies listed in Table G1.

The DCBC has received formal support from NTCL, the major commercial user of the river for shipping and from Cooper Barging. DCBC is also seeking comments and support for the proposed bridge location and design from other users, including Gruben's Transport and the owners of the MS Norweta.

Key efforts planned in the upcoming months include:

1. Ongoing community consultation in Ft. Providence, including formal community endorsement of the Community Benefits Commitment Plan.
2. Briefings of media, business, community and other interested organizations throughout the project development and implementation phases (before, during and after construction).

Table G1

Listing of Consultation Efforts

DATE	ORGANIZATION	PURPOSE
July 2000	Ft. Providence Combined Council	Initial Meeting of Alliance leaders to consider proposal
Sept.18, 2000	Ft. Providence Public Meeting	Initial public meeting to seek community support.
Sept. 26, 2000	GNWT & Canada	Initial Proposal submitted to Ministers Nault & Handley. Contributions approved
Apr. 26, 2001	Ft. Providence Public Meeting	Community update on status of project
Apr. 27, 2001	Ft. Providence Resource Management Board and Elders Council	Consultation for environmental scoping (Golder Associates)
Nov. 27, 2001	Ft. Providence Public Meeting	Presentation of draft report, including environmental scoping, design and business case
Feb. 4, 2002	Yellowknife City Council	Presentation at public meeting of City Council
Feb.11, 2002	GNWT	Pre-Feasibility Study and formal proposal submitted to Minister Handley
Feb.12, 2002	Press	Press briefing at Legislative Assembly to explain proposal
Feb.12, 2002	RTL Robinson's Trucking	Meeting with Marvin Robinson to discuss trucking reaction
Feb.12, 2002	NWT Chamber of Mines	Meeting and presentation
Mar. 21, 2002	NTCL	Initial Meeting with NTCL in Hay River to discuss navigation requirements
Apr. 26, 2002	Yellowknife Chamber of Commerce	Chamber luncheon presentation

May 5, 2002	NWT Association of Communities	Resolution presented and passed at 2002 Annual general meeting.
June - Jan, 2002	NTCL	Meeting with NTCL in Hay River to discuss navigation requirements
Oct./Nov., 2002	Trucking, construction, engineering, mining, manufacturing and retail business	Consultation by Nichols Applied management for Aboriginal Benefits report
Nov. 13, 2002	Ft. Providence Public Meeting	Update community on status of Memorandum of Understanding (MOI)
Nov. 15, 2002	Public Event & celebration	MOI signed between GNWT & Ft. Providence Combined Council Alliance
Nov. 18, 2002	Press Briefing	Joint GNWT/Alliance Press Briefing and technical presentation at Legislative Assembly. Briefing, MOI and fact sheets posted on Department of Transportation web site
Nov. 19, 2003	NWT Motor Transport Association (NWTMTA)	Briefing of NWTMTA at AGM
Jan. 9, 2003	NTCL	NTCL agreement on navigation channel formalized
Feb. 20, 2003	NWT Chamber of Commerce	Meeting with President and Directors
Feb. 27, 2003	Ft. Providence Public Meeting	Community update and newsletter
Mar. 5, 2003	MLAs	Information package to all members of Legislative Assembly in support of Deh Cho Bridge Act
March 12, 2003	Ft. Providence Leaders	Letter in support of permit applications
April 25, 2003	Tli Cho (Dogrib) Chiefs	Meeting with Grand Chief and four community chiefs to confirm support
April 30, 2003	NWT Legislature Standing Committee	Presentation made at public hearings of Standing Committee on Governance and Economic Development (on Deh Cho Bridge Act)
May 13, 2003	Meet the North Conference - Edmonton	Presentation and panel discussion
May 1, 2003	Affected communities	Letter and information package sent to affected communities (MVLWB list)
May 1, 2003	Dene Leaders	Resolution presented and passed at annual Dene Leadership Meeting
June 4, 2003	Community of Ft. Providence	Public meeting, project update and discussion of community benefits
June 12, 2003	Chief Fred Norwegian, Jean Marie River First Nation	M. Vandell met in Jean Marie. Positive support and no concerns
May – June, 2003	NWT Public	Public Hearings undertaken by the NWT Legislature on the Deh Cho Bridge Act.

		(Appendix 10)
July – August, 2003	Affected communities and agencies: ▪ Deh Gah Got'ie Dene Council (Ft. Providence) ▪ Fort Providence Métis Council ▪ Liidli Kue First Nation (Fort Simpson) ▪ Metis Local #52 (Fort Simpson) ▪ Jean Marie River First Nation ▪ Ka'a'gee Tu First Nation (Kakisa) ▪ Pehdzeh Ki Dene Council (Wrigley) ▪ Northwest Territory Metis Nation ▪ Deh Cho First Nation ▪ Hamlet of Fort Providence ▪ Village of Fort Simpson, ▪ GNWT Health ▪ DIAND - South Mackenzie District ▪ Prince of Wales Heritage Mark Davy, ▪ GNWT –MACA, ▪ GNWT – RWED ▪ Environment Canada ▪ DFO ▪ MVEIRB ▪ GNWT DOT	Mackenzie Valley Land & Water Board screening distribution for comments (Appendix 2)
December, 2003 – February, 2004	Community of Ft. Providence	Community Benefits Plan and M. Nadli consultation and report. (Appendices 7 & 8)

G.2 Issues:

Identify the issues raised, how they were resolved and what issues remain unresolved.

Support to date has been very positive. In general, most stakeholders believe the bridge will have positive environmental and socio-economic impacts.

Key indicators of support from community, Aboriginal, territorial and federal leaders and industry include:

- Community of Fort Providence - Letter of support from elected leaders of Dene, Métis and Hamlet Councils and Resource Management Board.
- NWT Association of Communities - Resolution of 2002 Annual General Meeting.
- Dene Nation - Unanimous resolution of Dene Nation Leaders at May 2003 meeting.
- NWT Legislature and Government - GNWT Memorandum of Intent, project financial support and passage of the Deh Cho Bridge Act (Appendix K).
- Government of Canada - Financial support from federal DlAND.
- Northern Transportation Company Limited - letter of support regarding navigational clearances.
- NWT Motor Transport Association - Letter of support at NWT legislative Committee hearings

Evidence of support is included in Appendix 9.

Issues raised generally fall into two categories - environmental and economic.

G.2.1 Environmental

Community of Ft. Providence – as noted, environmental responsibility has been a pre-requisite to community support since the inception of the proposal. Concerns focus on water quality, potential disturbance of fish habitat and migratory birds, recreational use of the river and preventing bison from entering the bridge.

The community also recognizes that the replacement of the ice bridge and ferry operation will have long term positive impacts, by reducing disturbance and siltation of the river, reducing the risk of spills, reducing fuel consumption and reducing ongoing noise and activity at the crossing.

On balance, the community is satisfied that their concerns have been considered in the design and construction plan and that any short term disturbance and residual risks are outweighed by potential long-term benefits.

Government and Regulatory Agencies – Agencies, including Federal departments of Fisheries and Oceans (DFO), DIAND and Environment Canada submitted questions for clarification and additional information during the environmental screening through the MVLWB. These questions and responses form part of the public registry with MVEIRB and are included in Appendix 2.

G.2.2 Economic

The proposed Concession Agreement includes a commercial vehicle toll in the range of $5-$6 per tonne of freight. This would not apply to light, non-commercial vehicles. Much of the business and public reaction has been based on individual assessment of the potential benefits of the bridge and costs of the toll.

Community of Ft. Providence – This project is expected to have positive and negative socio-economic impacts, during and after construction. On the positive side, the construction phase will create community business, training and employment opportunities. During operations, there will be continued employment in maintenance and operations, while the projected return on equity will provide a sustainable source of income to the community to invest in local social and economic priorities.

On the negative side, concerns have been expressed about the social impacts of a large non-resident workforce during construction and the potential negative side effects of increased community incomes. Over the long term, there will be a loss of seasonal jobs on the ferry and ice bridge.

The Community Benefits commitment Plan is being developed by the Board of the DCBC, in consultation with the community. This plan has focused on accommodating community concerns to optimize the benefits and mitigate the potential negative impacts. The DCBC is committed to having this plan endorsed by the community and has committed to ensuring community support for a final decision to proceed with the project.

On balance, the consensus view of residents is the benefits exceed the costs and are greatest if the community participates in the project.

Trucking Industry – The proponent and the GNWT Department of Transportation has met with NWT Motor Transport Association and individual trucking companies. The industry sought and received assurances that the maximum toll would not exceed the proposed $5-$6 maximum. There was also concern about toll collection procedures and enforcement. Industry prefers a simple configuration based toll with limited administration burden. Both the DCBC and GNWT (who will administer toll collections) support this. Based on these understandings, the NWTMTA

supported the bridge proposal at hearings on the Deh Cho Bridge Act.

Business – There has been a generally positive reaction from retail and other business in the region. Most see the potential benefits of a bridge crossing. Many feel that this infrastructure should be provided without tolls, while recognizing that government would be unlikely to make the investment in the near term. Some have undertaken the analysis on the economic benefits and costs. The key concern is that tolls remain within the range proposed and that they do not result in an increase in the cost of doing business.

Mining Industry – the mining industry has expressed concern through the NWT and Nunavut Chamber of Mines to the Minister of Transportation and through correspondence with the MVLWB. This industry relies on seasonal winter road resupply of mines north of Yellowknife and believes that the costs of tolls would exceed potential benefits of more reliable year round access to Yellowknife. It was this concern that resulted in a referral of the project by DFO to the MVEIRB. The Chamber has subsequently withdrawn its intervention.

Public – The general reaction has been positive. There is to be no toll on private vehicles. The key concern is that tolls do not result in an increase in the cost of living.

Barging Companies – NTCL is the major user of the Mackenzie River for commercial shipping. In March of 2002, NTCL advised that the main channel clearances were not adequate for their operations. In ensuing discussions, the DCBC and NTCL agreed on the lateral and vertical clearances and the positioning of the main span piers and the design was subject to significant modifications and a cost increase. NTCL provided a formal agreement in January of 2003. Cooper Barging provided a letter of support in March of 2004. Other users are being canvassed and are expected to support the current proposal.

Government – Both the GNWT and federal DIAND have been strong supporters. GNWT has provided $230,000 in contributions and a loan guarantee of $2 million for project development. The GNWT has enacted enabling legislation, signed into an Agreement-in-Principle and are actively negotiating a Concession Agreement with the DCBC. DIAND has provided $292,000 in contributions and committed to a $3 million equity contribution to the project.

H Assessment Boundaries:

H.1 Spatial

Provide a rationale for setting the spatial boundaries for the impacts described below.

The spatial boundaries for the environmental and socio-economic are different. Both are far-reaching but more pronounced locally.

H.1.1 Environmental

The key focus of environmental concern, both positive and negative, is in the immediate vicinity of the bridge itself. This is largely focused on the fish habitat and water quality of the river and on the terrestrial environment in the immediate area. However, consideration must include impacts on downstream water quality for the entire Mackenzie River. Potential also exists for impacts in the quarry and pit locations. Consideration has also been given to potential impacts on air quality.

Spatial boundaries for environmental impacts therefore include all land included and adjacent to the areas identified for construction activity and quarries and all watercourses draining from these areas, including the Mackenzie River and the air in the immediate vicinity of the project.

H.1.2 Socio-economic

The project will have local and regional socio-economic impacts, particularly north of the Mackenzie River and in proportion to proximity to the project. Spatial boundaries for socio-economic impacts include, in order of relative degree of impact:

1. The community of Ft. Providence.
2. The North Slave Region of the NWT (Yellowknife, Detah, Tli Cho communities, Slave Province mineral region)
3. South Slave communities (Kakisa, Enterprise, Hay River)
4. The Western Arctic Region Communities relying on air supply from Yellowknife (NWT and Nunavut)
5. The NWT

H.2 Temporal

Provide a rationale for setting the temporal boundaries for the impacts described below.

From both an environment and economic view, the short-term construction phase impacts are expected to be more pronounced and variable, while the long-term operations phase impacts are expected to be more stable.

The 2-year construction phase will continue to receive the greatest attention in maximizing positive benefits and in minimizing and mitigating potential negative impacts.

During operations, the concession agreement and revenues to the community will continue for 35 years. The bridge has a 75-year design life. However, in practice, once constructed this bridge is expected to be in place for the foreseeable future. During this phase, the environmental impacts are expected to be relatively stable, while the socio-economic impacts will vary somewhat, in proportion to population and traffic.

The temporal boundary for assessment is the foreseeable future, with particular attention to the construction phase and early operations years.

I *Human Environment:*

Socio-Cultural and Economic Matters

I.1 Direct Economic Impacts

Describe potential direct economic impacts on the community of Fort Providence in particular, and on the other communities affected by all weather access across the Mackenzie River (e.g. employment, tolls, cost of local supplies and services).

Benefit-cost analysis prepared by Nichols Applied Management for the GNWT in September of 2002 (Appendix 4b) estimated economic and employment impacts and the costs and benefits from the bridge. Follow up studies, completed for the GNWT and DCBC in February of 2003, updated the original study to reflect new information (Appendix 4a) and identified the costs and benefits specifically to Aboriginal residents (Appendix 4c).

The Nichols studies estimates the benefits resulting from:

- Reduced travel time and vehicle operation costs for commercial transportation companies;
- Avoided cost of running the ferry and building the ice bridge for the GNWT;
- Avoided cost of extra warehousing, inventory, shrinkage, and labour, for retail and other businesses in the bridge service area; and
- Reduced travel time and vehicle costs for non-commercial travelers.
- Employment benefits from construction and operation of the bridge

It also estimates the costs from:

- The proposed toll of up to $6 per tonne
- The loss of jobs from suspension of the ferry and ice bridge

Nichols concludes that the project will provide an overall net benefit of $38.6 million over 35 years, resulting in an internal rate of return (IRR) of 8.5% and notes that this is well above the normally accepted benchmark of 5.0% for Canadian public sector projects. This estimate does not quantify the benefits of regional economic stimulus, reduced sense of isolation, or the residual value of the bridge at the end of the concession. Nor does it attempt to quantify benefits to the environment. It also excludes indirect government fiscal benefits.

Nichols estimates 250 person years of direct employment during construction and an average of about 2 – 10 person years for each year of operation (depending on the toll collection system), not including indirect employment. There is a loss of 8 person years in seasonal employment from suspension of the ferry.

Nichols also allocates the costs and benefits to various user groups. Significant net economic benefits accrue to the community, businesses, the general public and the government, while there is a marginal cost increase to mining companies.

I.1.1 Community of Ft. Providence

Construction Phase

The construction activity itself will bring direct economic impacts to the community including training and employment, opportunities for local business and opportunities for joint ventures.

Opportunities for local businesses include:

- Joint venture(s) in general contract or major subcontracts (foundation, concrete panels, superstructure components)
- Camp and catering for foundation crew, erection crew, concrete crew
- Earthworks/granular/rock

- Concrete production
- Transportation (concrete, aggregate, superstructure, deck panels)
- Concrete panel production
- Finishing work

Opportunities for local employment include:

- Bridge Corporation staff,
- Employment with general contractor and/or foundation, concrete, erection, deck production, deck installation, earthworks contractors, surveying, traffic control.
- Heavy equipment, light equipment, trucking
- Camp and catering
- Project management, financial and clerical
- Environmental monitoring
- Quality control

According to Nichols, the bridge is expected to provide about 11 person years of direct local employment during construction.

There have been some concerns and questions about potential negative impacts on the community during construction. These include:

- Social impacts on community of non-resident workforce during construction.
- Impacts of increased wages during construction and loss of employment after construction.

Minimizing and mitigating these negative impacts is a key objective of the Community Benefits Commitment Plan (Appendix 7).

Operations Phase

Once construction is complete and the bridge is opened, the level of community activity will reduce significantly. The corporation will need to operate and maintain the bridge and manage finances (revenues, expenditures and profits). There will also be a requirement for environmental monitoring for the first several years.

Although a toll collection system has not yet been decided upon, any employment opportunities created will be available to the people of Fort Providence.

Opportunities for local business:

- Bridge maintenance
- Provision of Corporation office.
- Environmental monitoring
- Toll collection
- Other opportunities generated by investment of profits

Opportunities for local employment:

- Bridge Corporation staff,
- Bridge maintenance
- Environmental monitoring
- Toll collection
- Other opportunities generated by investment of profits

Operations are expected to result in 2 – 10 person years for each year of operation to community residents (depending on the toll collection system).

This phase holds fewer direct business and employment opportunities, but promises substantial

profits for 35 years. The Concession Agreement guarantees a minimum return (after costs) of $225,000 per year. Current projections suggest that this will be significantly higher and rise steadily over the concession period. This will be shared with any equity partners and will be subject to taxes. The current plan suggests a target minimum of 70% community equity, but this could be as high as 100%.

Once the bridge is open, potential negative impacts include:

- Loss of ferry and ice crossing contracts and jobs.
- Social, cultural and safety effects of year round 24-hour access on community.

There will be a loss of 8 person years of seasonal employment in the current crossing operations.

Minimizing and mitigating the negative impacts is a key objective of the Community Benefits Commitment Plan.

I.1.2 The Public and Consumers of the Region

For the construction phase, Nichols estimates that about 50% of the employment, or 125 person years, will accrue to NWT-based workers.

During operations, there will be no tolls for non-commercial traffic. The Nichols study estimates the savings to non-commercial traffic over the 35-year concession period to be valued at $80.1 million. Discounted at 5%, these savings have a present value of $15.7 million.

Commercial transportation savings, coupled with savings from the reduction of storage will reduce overall retail prices benefiting to the average North Slave Region consumer. The Nichols Applied Management study estimates this benefit to be an average of $7.17 per tonne. The difference between this benefit and the toll of $5-6 per tonne should flow through retailers to consumers.

Employment gains and losses during operations will largely be local, as noted above.

The Nichols study highlighted but did not quantify a range of other public benefits. These include improved connections between communities, reduced the isolation, more reliable supply of goods and services and improved access to government services, employment and business opportunities.

I.1.3 Trucking Industry

RTL - Robinson Enterprises provides trucking services including major freight and fuel re-supply contracts, LTL (less than truckload) service, equipment mobilization and specialized and oversize loads for business, mines and individual customers. In 1997 this company moved over 100 million litres of fuel and 45,000 tonnes of freight in the N.W.T.

RTL notes several costs of the current ferry/ice bridge crossing:

- ✓ During 'normal' ferry/ice bridge operations, there is a delay/detour adding of 20-30 minutes at the crossing. This can extend to several hours during peak times, when trucks are forced to line up at the ferry.
- ✓ In the worst case, trucks can encounter unscheduled interruptions in service during freeze-up and wait several days for service to resume.
- ✓ Some oversized loads cannot be accommodated on the ferry and must wait for the ice bridge to reach full capacity.
- ✓ During periods of extended service interruption, the RTL fleet is idle. There is usually a rush just before spring break-up to get ahead and after break-up to catch up on demand. This results in less than optimum fleet utilization.

Nichols estimates the bridge would result in direct savings (time and distance savings) to trucking companies in the range of $2 to $3.83 per tonne, including only the first two of the above noted benefits. The per-tonne savings is higher for traffic diverted from the ferry than it is for traffic diverted from the winter crossing.

I.1.4 NWT Businesses

The construction phase is expected to result in $24 million (44% of the $55 million) construction expenditures going to NWT business.

Currently, suppliers must provide storage and finance the cost of 6-8 weeks of inventory or fly supplies in or risk depletion of inventory. The Deh Cho Bridge will provide savings to businesses in the form of reduced disruptions and costs in financing, transporting and storing inventory. The savings in transportation costs include those noted under trucking companies above, as well as the cost for air transportation.

The Yellowknife Direct Charge Co-op provides groceries, dry goods and gasoline to over 2,800 member families, representing approximately 9,000 people.

In 2001, the Co-op sold about 10,000 tonnes of goods and 4.3 million litres of fuel. The total Co-op tonnage, including fuel, was about 14,000 tonnes. The Co-op spent about $2.5 million on transportation, paying an average of 22 cents per kg for general freight and about 7 cents per litre for fuel. The bridge toll on all Co-op freight would amount to about $70,000 – $85,000.

The General Manager identified potential savings in airfreight, inventory financing, the cost of renting and storing extra fuel tankers, the cost of renting and heating extra trailers and the losses due to handling and spoilage. He estimated that a bridge would result in savings to the Co-op of about $300,000 per year.

Even if the full toll costs were passed on, Co-op net costs would decrease by about $230,000/year, or over $16/tonne. This represents a net annual savings of at least $80 per member family.

Nichols notes that the benefit to businesses will vary depending on individual circumstances and estimates a weighted average benefit for community resupply of about $7.17/tonne.

It is noted that a bridge crossing of the Deh Cho at Fort Providence would provide economic stimulus, benefiting businesses in the North Slave Region.

I.1.5 Mines

The mines north of Yellowknife rely on annual winter resupply via winter road. The benefit is therefore less than for communities, since most mine traffic is on the ice bridge, rather than the ferry and there is no year round road access to these mines.

The Nichols study estimated only the transportation cost savings of a bridge over the ice crossing at $2.18 per tonne. This represents an increase in net cost after including the proposed toll.

However, there are some additional benefits to the mines that were not quantified:

- With a bridge, materials may be shipped to Yellowknife at a lower cost and on a more reliable basis, for air freighting to the mines.
- Some oversize loads cannot be accommodated on the ferry and must wait until the ice bridge is up to full capacity before shipping.
- Materials are marshaled in Yellowknife in preparation for the short winter road season. The bridge will eliminate the potential for disrupting schedules caused by delays in ice bridge construction and/or interruptions in ferry service.

I.1.6 Government

As individual consumers, government will benefit from the improved level of access to cheaper and more consistently delivered goods.

Government will gain direct and indirect corporate and personal income taxes, during and after construction.

The GNWT will benefit from direct savings from ceasing the operations and maintenance of ferry, shore infrastructure, ice bridge and ice bridge access roads. Once the bridge is built there will no requirement for capital upgrading or replacement ferry, ice crossing access and support infrastructure. The GNWT will also benefit from the salvage value of the ferry and infrastructure.

At the end of the concession period, the GNWT will acquire this major infrastructure asset at no cost, with a remaining useful life of at least 40 years. After that time, the GNWT can suspend its annual contribution and continue to benefit from substantial annual savings.

Should traffic meet or exceed forecasts, the GNWT will 'profit share' in the toll revenues.

The Deh Cho Bridge project supports government objectives to foster regional economic development and to secure First Nations participation in, and expand economic benefits from, major regional development initiatives. The Deh Cho Bridge project will also support Aboriginal training, employment, and business development and equity investment opportunities.

I.2 Indirect Economic Impacts

Describe potential indirect economic impacts and their significance on the Northwest Territories (e.g. cost of living).

I.2.1 Community of Ft. Providence

The reinvestment of the net income from equity participation in the project, estimated at $35 million, is expected to provide considerable indirect economic benefits to the community.

The Community Benefits Commitment Plan outlines areas of planned investment, including Investments in other for-profit ventures, community economic development initiatives and community social development. The plan also contemplates a trust fund to ensure that these investments can be sustained after the concession period has ended.

Nichols states that a conservative estimate of the employment benefit from reinvestment would be an average of 9.1 jobs, or 318 person years over 35 years.

Other indirect impacts would accrue from the spending of incomes generated, the opportunities created by the skills and experience gained by the community and from the development of joint ventures that continue beyond the construction phase.

I.2.2 Other

A range of indirect impacts on other groups have been identified, but not quantified:

- Reduced cost of living in the region.
- Better scheduling and equipment utilization for all businesses relying on this route for transportation.
- Fiscal benefits to governments.
- Potential use of highway corridor and bridge for utilities (e.g. communications and power transmission)

I.3 Direct Socio-Cultural Impact

Describe potential direct impacts on the social and cultural environment of NWT communities affected by all weather access across the Mackenzie River (e.g. changes in traffic volume and results on other community attributes, effects on river users and river traffic).

The key impact will be the reduced sense of isolation and increased convenience from year round 24-hour access. There is some concern in the community of Ft. Providence that this will eliminate the annual imposed 'quiet time' when the crossing is shut down.

Total traffic volumes are expected to increase only marginally and there should be no appreciable impact on river users or river traffic.

Success in the project will be a considerable source of pride for the community.

I.4 Indirect Socio-Cultural Impacts

Describe potential indirect impacts on the social and cultural environment of NWT communities affected by all weather access across the Mackenzie River. Describe other indirect socio-cultural impacts (including impacts to current employees working on the Mackenzie River Ferry).

None identified. The impact on current seasonal employees is noted in Section I.1.1.

Cultural and Heritage Resources

I.5 Local Cultural and Heritage Resources

Identify archeological and other heritage resources as well as sites or areas of cultural significance in or near the project area.

None identified.

I.6 Direct Cultural Impacts

Describe potential direct impacts on sites or areas identified in I-5.

None identified.

I.7 Indirect Cultural Impacts

Describe potential indirect impacts on any of the sites or areas identified in I-5 (e.g., through increased access by different user groups).

None identified.

I.8 Cumulative Effects

Describe the impacts on any of the sites or areas identified in I-5 that this development may have in conjunction with previous, present, and reasonably foreseeable future developments in this area.

None identified.

Land and Resource Use

I.9 Traditional Land Use

Discuss the potential impacts of the proposed development on traditional land use and occupation.

None identified.

I.10 Existing land use

Discuss the potential impacts of the proposed project on existing land use and occupation.

The area between the North winter crossing access road and the river has many cabins used

for recreation and harvesting by community residents. The bridge will have the positive effect of eliminating the heavy commercial traffic and noise in this area during the ice bridge season.

I.11 Recreational Activities

Discuss the potential impacts of the proposed development on recreational activities.

None identified.

Visual and Aesthetic Resources

I.12 Visual and aesthetic resources

Discuss the potential impacts of the proposed permanent structure on the visual and aesthetic resources of the area.

The bridge will be a highly visible local attraction. Although highly subjective, most people will regard the structure as aesthetically pleasing compared to the existing ferry, camp and landings.

At 90 feet above the water, the view from the bridge will be impressive.

J Physical and Biological Environment:

J.1 Air Quality and Climate

Discuss the potential impacts of the proposed development on the local and regional air quality and climate.

The key potential impacts to the air environment include dust and emissions from heavy equipment during construction. These effects can be controlled to some level during construction but would be higher than current dust and emission levels in the areas around the bridge. Following construction, these effects would return to normal (existing) conditions in the region.

Dust and emissions from heavy equipment may cause animals and birds to move to avoid the area around the proposed bridge. This potential impact would be limited to the construction phase of the proposed bridge project when heavy equipment is on site. Mitigating, or limiting, the effect of dust and emissions during construction activities is possible by limiting the size of the construction footprint and implementing a dust control program.

Over the long term, the bridge might result in an increase in traffic volumes on the highway that would lead to an increase in vehicle emissions in the area. This impact would occur for the life of the bridge but is related to traffic volume rather actual bridge itself. There would be no mitigating measures for this concern.

However, the Prolog report (Appendix 13), noted that the 'uplift' or traffic increase due to the bridge would be small (about 2%) and much of the increase would be diversion of freight and passengers that would otherwise use aircraft.

Other factors affecting air quality include potential chemical spills, which may release air contaminants and could affect the people and wildlife in the surrounding area. During construction, this would be mitigated by proper storage and handling practices, sufficient spill response equipment and proper spill contingency planning and training.

Based on the above, and the nature of the project (e.g., effects mainly restricted to the construction phase of the project, implementation of best management practices/mitigation), potential long-term net effects to air quality and climate are expected to be low and not significant.

On the positive side, the long-term consumption of fossil fuels and resulting emissions will be reduced in several ways:

- Elimination of the ferry operation will reduce fuel consumption by over 400,000 litres per year.
- Reduction in fuel consumption by eliminating the winter detour and shortening the trip distance for all vehicles using the ice crossing. This 15 km short-cut will save approximately 300,000 kilometers per year for commercial vehicles alone.
- Elimination of fuel consumed by equipment in the construction and maintenance of the ice crossing and approach roads.
- Reduction in fuel consumed by idling vehicles, waiting to cross via ferry.
- Reduction in fuel consumed by aircraft in air shuttle.

J.2 Terrain and Soils

Discuss the potential impacts of the proposed development on the local terrain and soils.

The following potential impacts to terrain and soil capability were identified for activities associated with the project (right-of-way clearing, lay-down area clearing, topsoil salvage and

grading):

- permanent loss of soil;
- lowering of soil capability through water/wind erosion, especially on soil with shallow bedrock;
- lowering of soil capability through admixing of topsoil/subsoil; and
- lowering of soil capability through compaction and rutting.

Road construction near the Mackenzie River may cause slope instability, depending on the slope of the terrain, texture and moisture content of the material, and vegetative cover.

The coarse texture of the fluvial deposits of the Mackenzie River valley makes this area sensitive to erosion. Erosion from roadways can cause an alteration of terrain along the road length.

Mitigation Measures -Disturbances to Vegetation from Clearing

The mitigation measures for reducing/eliminating disturbances to vegetation resources within the project area include:

- minimizing right-of-way width and the extent of new clearing where possible;
- maximizing construction during the winter months; and
- salvaging and replacing the surface soil to support successful revegetation.

Mitigation Measures - Disturbances to Soil

Wind/Water Erosion

The overall impact of soil erosion on soil capability during the construction phase will be minimized by the following mitigation measures:

- working surfaces and slopes will be graded to minimize run-off erosion;
- progressive reclamation during operations will minimize slope erosion;
- the road right-of-way will be seeded with an erosion controlling plant cover as soon as practical following access road construction;
- where required, diversion berms can be placed and designed to minimize erosion and sedimentation; and
- topsoil stripping will be discontinued during periods of high winds.

Where necessary, surface diversion berms will be installed to control surface and subsurface (groundwater seepage) flows and bring them to the surface. Berms will be constructed at the crests and breaks in slope, as well as where groundwater is encountered. Locations will be selected in detail at the time of construction. Special consideration should be made in areas with shallow bedrock.

Soil Compaction and Rutting

Any off road surfaces that have been compacted can be deep ripped and cultivated to prepare the surface for re-vegetation. Any soils that are rutted will be flattened with a blade prior to topsoil re-vegetation.

Stability at the river crossings will be ensured by implementing the following recommendations:

- control surface runoff to minimize water erosion during construction (use berms, dams, or erosion control blankets); and
- re-establish vegetation as soon as possible following construction.

Mitigation along the right-of-way will focus on minimizing erosion. Grading during construction should be minimized or avoided, as much as practicable. Areas where the surface vegetation is disturbed should be re-vegetated as soon as possible, and water breaks should be installed to interrupt flow paths along ditches on steep slopes.

Based on the above, and the nature of the project (e.g., small areas of vegetation to be affected, road construction limited to existing causeway approaches, impacts primarily limited to period of construction), potential effects to terrain, soils, and vegetation are expected to be minimal and not significant.

J.3 Vegetation and Plant Communities

Discuss the potential impacts of the proposed development on the local vegetation and plant communities.

Potential impacts to vegetation could be either direct through clearing or indirect through the alteration from clearing and alteration of drainage patterns by grading. Areas most likely affected due to recommended highway improvements may include natural vegetation communities in proposed laydown areas used for staging equipment during construction (short-term effect). During construction spoil materials will be deposited in old abandoned pits, thus, natural vegetation communities will not be affected by this aspect of the project. The bridge approaches will be widened and the present ferry causeways will be shortened on the north side of the river and lengthened on the south side (net effect of shortening overall causeway lengths). As such, vegetation communities presently along the ferry causeways will be affected. However, these areas are small, sparsely vegetated, and vegetation communities will be re-established following completion of the project.

As vegetation is closely tied with terrain and soils, further interactions (impacts, mitigation, net effects, etc.) of the project with vegetation communities is provided above in the response to J.2. Overall, the potential effects are rated as low and temporary (primarily restricted to the construction period) and not significant.

J.4 Water Quality and Quantity

Discuss the potential impacts of the proposed development on the Mackenzie River's water quality and quantity in the immediate project area, downstream and upstream (e.g. substrate disturbance, increased suspended sediments, substrate type, water flow, water depth, channel width, ice flow, ice jamming, damming effects, and any other impacts related to spring ice breakup).

Golder (2004) discussed potential impacts of the proposed project on water quality and quantity in the immediate project area, downstream and upstream. Short-term impacts on background water quality during the construction phase are anticipated (e.g., release of sediments and/or chemicals into the water channel); mitigation measures are provided (e.g., on site monitoring and feedback to construction personnel). Significant long-term negative effects on water quality are not expected.

Sediment loading resulting from bridge construction would be short-term; a variety of construction techniques could be used to minimize or eliminate the possibility of large sediment releases. Mitigation measures could include:

- building coffer dams to isolate abutments during construction;
- maximizing construction during frozen river conditions; locating drill rigs on barges during open water conditions; and
- implement a feedback water quality monitoring program to regulate the release of sediments and/or chemicals during construction (see Appendix D in Golder 2004).

Trillium (2002) discussed potential impacts of the proposed project on hydrotechnical issues (e.g., water flow, water depth, scour, ice flows, ice jams). With proposed mitigation measures, the project is not anticipated to significantly affect open water hydraulic characteristics, ice characteristics, and scour (see pages 29 through 31 of Trillium 2002).

A positive long-term aspect of the bridge will result from the elimination of the ferry and ice bridge. Both activities contribute to release of sediments and chemicals into the water through:

- Debris and soils tracked onto the ferry and ice road or chemicals spilled from vehicles.
- Ongoing erosion and repair of ferry landings and ice bridge approaches.
- Erosion from ferry prop-wash.

Finally, the risk of a major spill on the ice crossing or ferry will be eliminated.

J.5 Aquatic Resources and Habitat

Discuss the potential impacts of the proposed project on the aquatic resources and habitat in the immediate project area and downstream (discuss the current habitat characteristics and range of species present, any potential impacts to fish and invertebrates, as well as any proposed monitoring plans).

Golder (2004) discussed all potential impacts of the proposed project on aquatic resources and habitat in the immediate project area and downstream (e.g., habitat changes due to footprint of the project structure, sediment loading, scouring, fish passage, local fish harvest). Short-term impacts during construction are anticipated; no significant long-term (operational scale) effects are anticipated. Mitigation plans are discussed and compensation alternatives are forwarded (if needed).

Mitigation measures include the following:

- limit the amount of in-stream construction activity and limit the footprint of the bridge;
- avoid construction during critical fish activity periods (e.g., spring spawning period for northern pike);
- incorporate design features into the bridge that will reduce adverse effects and enhance habitat value around the bridge (e.g., select clean rock fill for abutment and bank riprap, and size the material to provide high quality fish habitat);
- ensure "best practices" are followed for construction to limit sediment release and prevent water contamination; and
- implement a feedback water quality monitoring program to regulate the release of sediments and/or chemicals during construction (see Appendix D in Golder 2004).

As outlined by Golder (2004), the project will have some measurable impacts on aquatic resources and habitat in the vicinity of the proposed bridge site. However, the areas affected are small relative to the availability of similar habitats in the area and will be short-term (i.e., limited mainly to construction phase of the project). In addition, construction plans will result in a net gain in aquatic habitat areas, which will benefit fish populations in the area of the project.

The domestic fishery in the vicinity of Ft. Providence will not be affected over the long-term; the potential for short-term disturbance will be reduced through construction scheduling and timely communication with the local fishers.

Overall, the potential short-term effects on aquatic resources are of low magnitude, of short term duration and low significance, while the long-term impacts should be positive.

J.6 Wildlife and Wildlife Habitat

Discuss the potential impacts of the proposed project on the wildlife and wildlife habitat in the

project area. Specifically, examine the effects of the proposed development on wildlife movement along the riverbank as well as up and down the river itself (e.g. what is the likelihood for collisions of migratory birds with the bridge structure under conditions of low visibility?).

All Wildlife

Primary impacts on wildlife associated with bridge/road construction and operation include reduction/alteration in habitat and interference in nesting, breeding, migrating and over wintering activities. Potential impacts to wildlife include:

Habitat

- reduction in habitat effectiveness along the river due to increased noise from bridge crossings; and
- reduction in wildlife habitat directly through site clearing or indirectly through sensory disturbance and barriers to movement;

Movement

- sensory disturbance from road traffic along bridges may obstruct daily or seasonal wildlife movements;

Abundance/Biodiversity

- interference in nesting activity;
- disturbance to wildlife during construction; and
- increased mortality risks from changes in vehicular access and increased vehicle use.

The potential impacts on reduced habitat effectiveness due to sensory disturbance and on wildlife movement within riparian areas due to bridge traffic would be the greatest potential impact on wildlife.

Mitigation Measures

The route will to avoid key moose/ungulate habitat and other important wildlife areas (wetlands, marshes and fens). Specifically, the proposed bridge will be constructed on existing road and ferry infrastructure. Mitigation of potential impacts includes the following measures:

- installation of a "Texas barrier" will prevent undesired movement of wildlife across the bridge (i.e., primarily to prevent mixing of the bison populations on the north and south sides of the Mackenzie River);
- noise reduction (decreased speed limit, wooded or vegetated buffers) near the bridge would reduce noise levels, thus may potentially have less of an impact on wildlife;
- avoid raptor nests and bear dens by conducting pre-construction surveys;
- prompt reclamation of habitat where possible; or re-vegetation with non palatable species using native seed mixes;
- open span bridge to allow for wildlife movement underneath;
- low-impact construction techniques;
- reduction in speed limits and adherence to posted limits and avoid usage at night;
- maintain maximum line of sight along road to reduce collisions;
- all wildlife collisions will be reported to responsible authorities;
- properly dispose of garbage in bear-proof containers to avoid attracting nuisance wildlife such as bears; and
- educate workers with regards to garbage cleanup, speeding and documenting and reporting incidents/collisions.

With the implementation of these mitigation measures impacts of the project on wildlife are anticipated to be low and not significant.

Aerial Wildlife

Primary interactions of aerial wildlife (e.g., waterfowl, raptors, songbirds, and bats) with proposed infrastructure are addressed in Appendix F of Golder (2004); mitigation strategies are also provided. Effects of the project on aerial wildlife are anticipated to be low and not significant.

J.7 SARA

Pursuant to section 79 of the Species at Risk Act, conduct an assessment of the potential effects of the project on species at risk. This assessment should include: identification of species at risk that may be affected by the project, identification of measures to avoid, minimize, and mitigate potential effects on these species or their habitat, and a proposed approach to monitoring of these effects.

There are over 400 species listed at risk in Canada encompassing all major groups of animals (wildlife, birds, fishes, plants, amphibians, and lizards).

Potentially affected SARA (COSEWIC-listed; not provincially listed) species as per Schedules I-III (SARA) are provided below. Comments regarding interactions with the project are also given. Significant long-term effects are not expected.

Measures to avoid, minimize, and mitigate potential effects on these species or their habitat, and a proposed approach to monitoring of these effects is discussed in the response to J.6 above.

Endangered

- whooping crane - not in the project area (i.e., out of range); and
- Eskimo curlew - not likely affected, however, migration patterns may be within the project area.

Threatened

- wood bison - potentially affected by increased traffic which may lead to more vehicle collisions - installation of a Texas gate will prevent bison movement on the bridge as well as unnatural mixing of population on the north and south sides of the Mackenzie (i.e., separate southern population that is known to have exposure to tuberculosis);
- woodland caribou - potentially affected by increased traffic which may lead to more vehicle collisions;
- peregrine falcon - disturbance to potential nesting areas; and
- Ross's gull - likely no effect.

Special Concern

- grizzly bear - potentially affected by increased traffic which may lead to more vehicle collisions;
- wolverine - potentially affected by increased traffic which may lead to more vehicle collisions;
- ivory gull - likely no effect;
- short-eared owl - likely no effect due to this species being a ground-nester
- yellow rail - potential sensory disturbance effects

- northern leopard frog – potentially affects, however, unknown distribution in project area; and
- western toad - potential habitat loss, disturbance effects, but unknown distribution in this area.

J.8 Noise

Discuss the potential impacts of the proposed project on the noise levels within the project area and surrounds.

Project Area and Surrounds

Increased noise levels in the area are to be expected if the bridge is constructed. Noise due to construction would cause animals and birds to avoid the area around the bridge and their community. Noise is an issue that is present at all phases of the project but would likely be greatest during construction, which is a relatively short-duration activity. Noise during this period would be related to the amount of heavy equipment operating during construction. Mitigation measures would include:

- limiting activities to non-sensitive time periods (i.e., during peak waterfowl migration times);
- limiting extent of heavy equipment operations; and
- ensuring all equipment is installed with appropriate noise reduction devices.

Noise levels during the operational phase of the project would be related to traffic volume and maintenance operations. There are no mitigation measures to address an increase in noise as a result of traffic volumes. Reduction of noise as a result of maintenance activities can include limiting activities to non-sensitive time periods, limiting extent of heavy equipment operations, and ensuring all equipment is installed with appropriate noise reduction devices.

Fish and Wildlife

Issues related to noise and wildlife interactions are provided in our response to J.6 above. Noise impacts and mitigation to fisheries resources is addressed in Golder (2004). Short-term, minimal effects are anticipated during construction. Positive effects due to discontinuation of ferry operations will result (i.e., noise from engine revving, dropping of bow ramp). Significant long-term effects of noise on wildlife and fish are not expected.

K Cumulative Impacts:

K.1 Cumulative Impacts

Predict the cumulative impacts that might result from the proposed development impacts in combination with other past, present or reasonably foreseeable future developments and activities.

As noted above, the construction phase of this project will necessarily cause some environmental disturbance.

In the longer term, the bridge should result in a net environmental benefit, due to reductions in siltation and disturbance of the river, reduced noise and fuel consumption and increased fish habitat.

Accessibility to the region and highway corridor was greatly increased with the original highway construction. Highway upgrading and paving have incrementally improved access. The bridge will provide a further marginal increase in access and is expected to result in a small increase in traffic volume.

L Appendices

1. Updated Project Description – Jivko Engineering (April, 2004)

2. Key correspondence relating to permit applications (May 1, 2003 to date)

3. Mackenzie Valley Land and Water Board (MVLWB): Application for a Water License under Mackenzie Valley Resource Management Act (submitted May 2003).

4. Canadian Coast Guard (CCG): Application under Navigable Waters Protection Act, s 5(1)(a) (submitted March 2003).

5. Department of Fisheries and Oceans (DFO): Application for Authorization for Works Affecting Fish Habitat under Fisheries Act, s. 35(2) (submitted January 2003).

6. Mackenzie Valley Land and Water Board (MVLWB): Land Use Permit Application under Mackenzie Valley Resource Management Act (submitted April 2004).

7. Draft Community Benefits Commitment Plan (November 2003)

8. Report to the DCBC on Community Benefits Commitment Plan – Michael M. Nadli (Feb., 2004)

9. Motions and Letters of support

10. Deh Cho Bridge Act (Assent, June 13, 2003)

11. Memorandum of Intent between the Community (Bridge Corporation) and the GNWT (November 2002)

12. Benefit-Cost Analyses of the Deh Cho Bridge – Nichols Applied Management (September, 2002 & February, 2003)

13. Commercial vehicle Traffic Forecast, Mackenzie River Crossing – PROLOG Canada Inc. (September, 2002)

14. Golder Associates Ltd. 2004. Fisheries assessment of the Mackenzie River at Ft. Providence, NT – Proposed Deh Cho Bridge. Prepared for Jivko Engineering, Yellowknife, NT. Golder Report No. 03-1370-021: 89 p. + 6 app.

15. Trillium (Trillium Engineering and Hydrographics Inc.). 2002. Updated Hydrotechnical Information for Mackenzie River Bridge at Ft. Providence. Prepared for Jivko Engineering Ltd., 25 November 2002. 33 p. + ADDENDUM, Ice Load Analysis for New Pier Geometry, Jan 08, 2004, 14 p.

16. EBA Engineering Consultants Ltd. 2004. Geotechnical/Materials Evaluation, Proposed Deh Cho Bridge Fort Providence, NT. Prepared for Jivko Engineering, February 2004. 25 p.+ 7 app