HAMLET OF TUKTOYAKTUK, TOWN OF INUVIK
GOVERNMENT OF NORTHWEST TERRITORIES

ENVIRONMENTAL IMPACT STATEMENT FOR CONSTRUCTION OF THE INUVIK TO TUKTOYAKTUK HIGHWAY, NWT





REPORT

MAY 2011
ISSUED FOR USE
EIRB FILE NO.: 02/10-05
EBA FILE: V23201322.006

KIGGIAK - EBA

Hamlet of Tuktoyaktuk, Town of Inuvik,
Government of Northwest Territories

ISSUED FOR USE

ENVIRONMENTAL IMPACT STATEMENT FOR CONSTRUCTION OF THE INUVIK TO TUKTOYAKTUK HIGHWAY, NWT

EIRB FILE NO. 02/10-05

May 2011

EIS Inuvik to Tuktoyaktuk Highway.doc

KIGGIAK - EBA

Kiggiak - EBA Consulting Ltd.
p. 867.777.2026 • f. 867.777.2027 • kiggiak@eba.ca
75 Industrial Road • Box 2418 • Inuvik, Northwest Territories X0E 0T0 • CANADA

EXECUTIVE SUMMARY

INTRODUCTION

Since the 1960s, the completion of the Inuvik to Tuktoyaktuk Highway (the Highway) has been a long standing goal of the Town of Inuvik, the Hamlet of Tuktoyaktuk and the residents of the Inuvialuit Settlement Region. The first initiative to construct the Highway Project took place in 1974 when Public Works Canada (PWC) identified and surveyed a 140 km land route between Inuvik and Tuktoyaktuk. Preliminary engineering studies were undertaken on this route at that time. Quarry sources were identified and survey maps and design profiles were produced.

In the 1990s, the Government of the Northwest Territories (GNWT) reviewed earlier studies, collected additional environmental and socio-economic information, conducted community consultations, and re-examined the routing and the design. In 1998, the GNWT produced a comprehensive report entitled the "Proposed Inuvik to Tuktoyaktuk Road Environmental and Socio-Economic Baseline Report". Further studies, including a Cost Benefit Analysis, were completed in 1999. The October 1999 GNWT Department of Transportation Highway Strategy identified the completion of the Highway as one of the Strategy's goals.

Building upon the Highway Strategy, the GNWT included the Inuvik to Tuktoyaktuk Highway as a potential project in a number of strategic funding proposals to Canada for infrastructure development including "Investing in Roads For People and the Economy" (November 2000), "Corridors For Canada" (May 2002) and "Connecting Canada – Coast to Coast to Coast" (November 2005).

These funding proposals and other supportive actions have resulted in the federal government's renewed interest in developing road and other infrastructure in the arctic, through cost-shared funding including the current Building Canada Plan (BCP) program. BCP funding led directly to the development of the first new road project in the Northwest Territories, the 19 km all-weather access road from Tuktoyaktuk south to Granular Source 177. This stretch of road is located along the proposed alignment of the Inuvik to Tuktoyaktuk Highway. Construction on this road began in the winter of 2009 and was completed with the exception of a final surface topping in the summer of 2010.

PROJECT PARTNERSHIP (DEVELOPER)

The Project Partnership, generally referred to collectively as the Developer or Project Team, for the proposed Inuvik to Tuktoyaktuk Highway are the Hamlet of Tuktoyaktuk, the Town of Inuvik and the GNWT Department of Transportation (DOT). In September 2009, the three parties signed an MOU to see work on the Project Description Report (PDR) for the Inuvik-Tuktoyaktuk Road completed. Initial funding for this work was provided directly by the Canadian Northern Economic Development Agency (CanNor).

Two of the partners, DOT and the Hamlet of Tuktoyaktuk had previously collaborated to facilitate the development of the all-weather access road from Tuktoyaktuk to Granular Source 177. This project, which is generally considered to be a success, with only few and minor concerns arising (i.e. DFO concerns with culvert heights) has provided the current Project Partnership with much

experience and information on construction techniques and related environmental management that will be utilized for the current Project.

PROJECT RATIONALE

The Inuvik to Tuktoyaktuk Highway provides the opportunity for major potential benefits for the region, for the North, and for Canada as a nation.

Based on the most recent economic analysis presented in this EIS, the construction of the Inuvik to Tuktoyaktuk Highway is expected to cost about $230 million. However, the resulting direct, indirect and induced economic spin-offs over the lifespan of the Highway are expected to generate about $248 million in net purchases of goods and services (material inputs) in the NWT and an additional $97 million in the rest of Canada. Furthermore, the Highway is projected to contribute to a net increase in GDP to the NWT of about $186 million and an increase in GDP in the rest of Canada of $84 million. The four year main construction period is estimated to create about 1,086 one-time (construction-related) jobs in the NWT and another 860 one-time jobs in the rest of Canada, with a more limited number of long-term jobs and business opportunities related to the ongoing operation and maintenance of the Highway.

The construction of the proposed Highway will achieve the following goals:

- Complete the Highway to the arctic coast and provide year-round overland access to Tuktoyaktuk;
- Reduce the cost of living in Tuktoyaktuk by enabling goods to be shipped year-round;
- Provide Tuktoyaktuk residents with cheaper, easier and safer access to regional services including:
  - Health care;
  - Educational opportunities; and
  - Recreational opportunities.
- Enhance opportunities for family, social, recreational and sporting interactions by providing year-round access between communities;
- Promote the tourism and hospitality industry in Inuvik and Tuktoyaktuk;
- Strengthen Inuvik's role as the regional commercial hub;
- Provide more opportunities for business expansion;
- Reduce costs of future oil and gas exploration and development and encourage new activities;
- Reduce the cost of government services delivered to Tuktoyaktuk and the Region;
- Support national security and northern sovereignty objectives; and
- Deliver on current governmental policies to stimulate the economy in response to the recent economic downturn.

In summary, the construction of the Highway Project will help to address the goals of bolstering Northern economic development; enabling future natural resource exploration, development and production; and reinforcing Canadian sovereignty objectives.

CONSULTATIONS

Meetings and consultation sessions for the proposed Highway were held in Inuvik and Tuktoyaktuk in October 2009 and January 2010. These meetings were an important opportunity to share information about the Project with the communities and to hear directly from residents about their interests, questions and concerns.

The first round of meetings and consultations in October, 2009 served to provide the communities, organizations, and regulatory agencies with an introduction to the proposed Inuvik to Tuktoyaktuk Highway Project (see Figure 1); to identify the Project Partnership, Project status, anticipated study and review schedule; to answer preliminary questions; and to receive advice, input and recommendations. Key messages from the October consultations highlighted the importance of the Husky Lakes area to the communities. Some residents of Tuktoyaktuk and Inuvik requested an examination of other possible alignments, in particular, Alternative 2 (also known as the Upland Route). There was a distinct interest in receiving engineering and preliminary design detail that would be comparable to the Primary 2009 Route.

The second round of meetings and consultations, held in January, 2010, allowed the Project Team to respond to questions and issues raised during the October 2009 consultations; to solicit community feedback on the updated Project information; and to gauge the perceived acceptability of the Primary 2009 Route for submission to the EISC screening process that was ongoing at that time. The two community meetings, held concurrently in Inuvik and Tuktoyaktuk on January 14, 2010, were well attended and the overall response arising from both meetings was that there was a high level of support for the Highway.

A number of community members indicated their general confidence in the ability of the Inuvialuit co-management bodies and other regulatory agencies to protect their environmental, cultural, and socio-economic interests in relation to the Highway Project.

Following referral of the Project by the EISC to the EIRB for further assessment and review in April 2010, community scoping sessions were held by the EIRB in Tuktoyaktuk and Inuvik. Prior to participating in those sessions, the Project Team had received some additional input from Inuvialuit interests on a possible further refinement of one of the alternative minor realignments being considered by the Project Team in the vicinity of the Husky Lakes area.

This refinement, referred to as Alternative 3 (2010 Minor Realignment) recommended by Inuvialuit interests, was presented during the scoping sessions by the Project Team as another potential alignment that warranted further consideration. This alignment not only preserves and increases the setback of the Highway from Husky Lakes but it would also shorten the overall length of the Highway by about 2 km.

Following the EIRB scoping sessions, the Inuvialuit Land Administration arranged an additional but complementary series of consultation meetings on the Highway Project in Tuktoyaktuk and Inuvik in November of 2010. The meetings were attended by 30 people in Inuvik and 98 people in

Tuktoyaktuk. While some were concerned with the routing, environmental, and wildlife effects, the beneficiaries supported the concept of a highway between Inuvik and Tuktoyaktuk.

Regarding the proposed alignment of the Highway in the vicinity of the Husky Lakes, the participants in the Tuktoyaktuk meeting expressed particular support for Alternative 2 (Upland Route) because this route is furthest from the Husky Lakes. The Inuvik participants voiced less concern about the realignment options under consideration, but some indicated that the Alternative 3 (2010 Minor Realignment) recommended by Inuvialuit interests was a good compromise between the Alternative 2 (Upland Route) and the Primary 2009 Route (proposed route).

ROUTE ALIGNMENT ALTERNATIVES

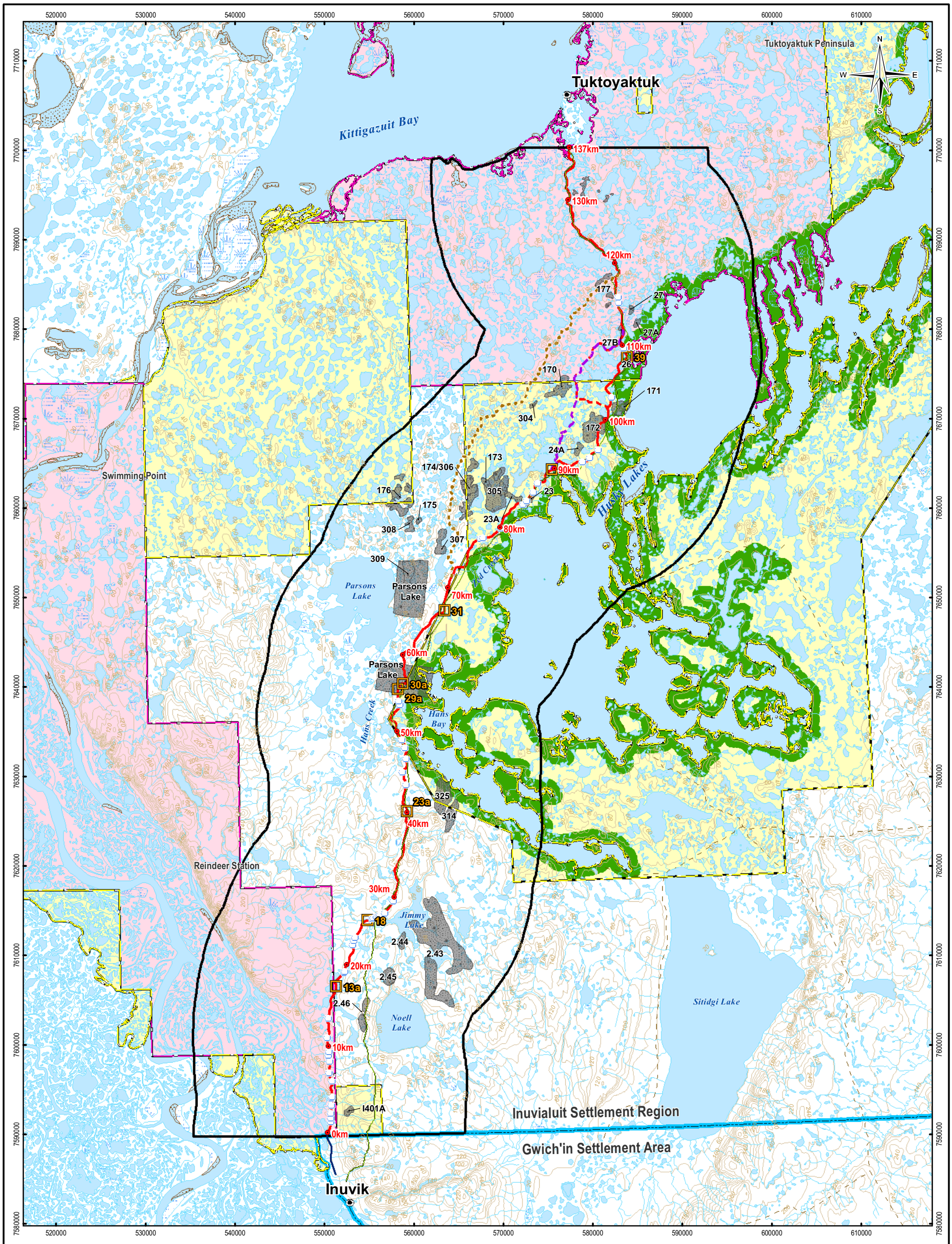
Based on the community inputs from the October 2009 consultation sessions, the Project Team conducted a more detailed evaluation of several alignment options. The alternatives that were initially considered are illustrated in Figure 1 and include:

- Primary Alignment - the Primary 2009 Route, which is an updated and refined version of the 1977 PWC alignment, but includes a minor encroachment on the Husky Lakes 1 km setback;
- Alternative 1 – the 2009 Minor Realignment of the Primary 2009 Route to fully achieve the Husky Lakes 1 km setback requirements; and
- Alternative 2 - the Upland Route, which diverts west from the Primary 2009 Route about 70 km north of Inuvik and re-joins the alignment near Source 177.

Also shown in Figure 1 is the proposed Alternative 3 (2010 Minor Realignment) recommended by Inuvialuit interests. The Project Team considers this alternative alignment in the Husky Lakes area to be a promising route option, but has not yet been able to assess the engineering considerations related to this option in the field. As a result, modeling results to more accurately identify the necessary geometric design factors are not yet available. However, Alternative 3 is similar to Alternative 1 (2009 Minor Realignment), in that it does not encroach on the Husky Lakes setback, yet it is shorter in length at approximately 135 km. If the Inuvik to Tuktoyaktuk Highway Project is approved, Alternative 3 would be further considered and likely adopted in the detailed design stage based on additional information to be gathered in future survey, geotechnical and other investigations.

Borrow material quantities and cost estimates were based on the conceptual designs for the alignments initially considered. Table 1 summarizes the overall quantity and cost estimates for each alignment. The quantity estimates include future upgrading of the now existing Tuktoyaktuk to Source 177 Access Road, based on the proposed Highway design. Table 1 differentiates between Highway surfacing material and embankment (base or subgrade) borrow material requirements.

Q:\Vancouver\GIS\ENVIRONMENTAL\V232\V23201322_TukRoad_EIS\Maps\EIS\V23201322_EIS_Map033_ExecutiveSummary.mxd modified 5/2/2011 by sleusink



LEGEND

- Stream Crossing
- Stream Crossing - Potential Bridge
- Regional Study Area (15 km buffer)
- Primary 2009 Route
- Alternative 1 (2009 Minor Realignment)
- Alternative 2 (Upland Route)
- Alternative 3 (2010 Minor Realignment)
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Borrow Sources
- Husky Lakes 1000m Setback
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand

NOTES

Base data source: NTS 1:250,000

Borrow Sources, ILA Lands, Husky Lakes 1000m Setback: Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY ENVIRONMENTAL IMPACT STATEMENT

Primary 2009 Route and Other Alternative Alignments Considered

PROJECTION: UTM Zone 8	DATUM: NAD83
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)	
FILE NO.: V23201322_EIS_Map033_ExecutiveSummary.mxd	
PROJECT NO.: V23201322	DWN: SL / CKD: TS / REV: 0
OFFICE: EBA-VANC	DATE: May 2, 2011

Figure 1

TABLE 1: SUMMARY OF QUANTITY AND COST ESTIMATES FOR ALIGNMENTS CONSIDERED

Element	Primary 2009 Route	Alternative 1 (2009 Minor Realignment)	Alternative 2 (Upland Route)
Estimated Highway Length	137 km	142 km	134 km
Estimated Embankment Quantity	4.5 million m^3	4.8 million m^3	5.4 million m^3
Estimated Surfacing Quantity	250,000 m^3	259,000 m^3	242,000 m^3
Estimated Capital Construction Cost	$221,000,000	$233,000,000	$258,000,000

The estimated capital construction costs presented in Table 1 do not include royalties or administrative fees associated with materials borrowed from sources that are on Inuvialuit owned lands. The initial constructability and cost analysis presented in this table favours the Primary 2009 Route with minor encroachment on the Husky Lake setback area, which represented a road length of less than 2 km.

However, based on a multiple accounts analysis that was undertaken and is presented in this EIS, the Project Team believes that the Primary 2009 Route (with incorporation of Alternative 3 (2010 Minor Realignment) should remain in consideration for the future design of the Highway and may even be considered the preferred final alignment.

It presents a balance of favourable and most favourable in consideration of the sub-indicators that were considered in the analysis and does not have a sub-indicator as presented in this evaluation where it is least favourable. Most importantly the adoption of this alternate realignment fully respects the Husky Lakes setback without significant negative impact relative to the remaining sub-indicators.

In particular, the Project Team believes that the adoption of this alternate realignment as part of the total Primary 2009 Route will capitalize on several important technical and economic advantages:

- One of the lowest cost alternatives for construction;
- Requires the least borrow material to construct;
- Closer to known borrow sources;
- Reduces project footprint (less land disturbance);
- Full conformance with the Husky Lakes setback;
- Traverses less rugged terrain and makes it easier to meet the design requirements for a public highway;
- Safer driving; and
- Easier and lower cost maintenance.

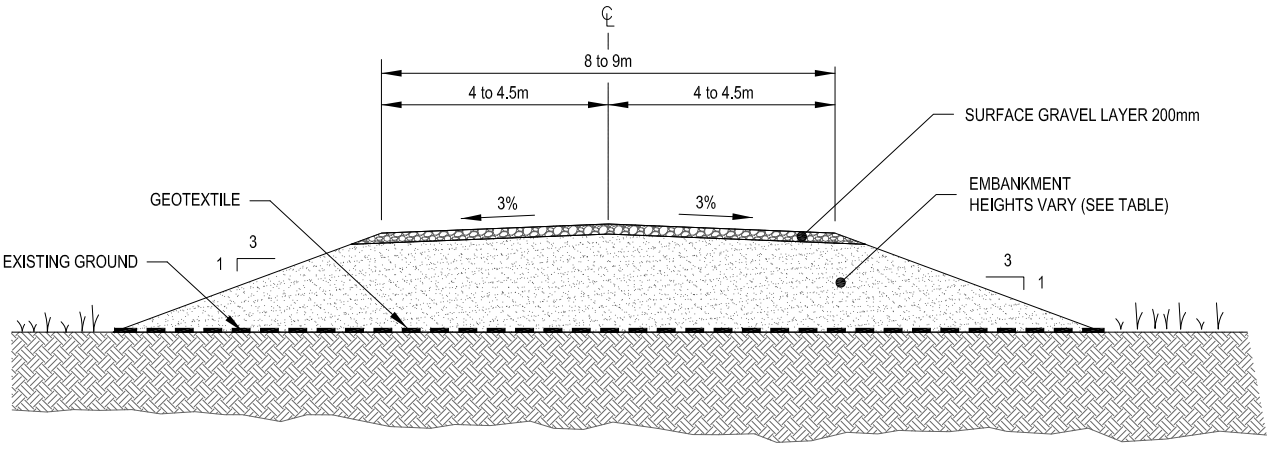
HIGHWAY DESIGN CONSIDERATIONS

For the purposes of this EIS, the proposed Inuvik to Tuktoyaktuk Highway remains about 137 km long and will be located entirely within the ISR (Figure 1). As previously mentioned this length could be reduced by about two kilometres with the adoption of Alternative 3 (2010 Minor Realignment) to fully meet the Husky Lakes setback. Approximately 71 km or 51.5% of the alignment will be located on Inuvialuit private lands which are regulated and administered by the Inuvialuit Lands Administration (ILA). Approximately 67 km, or 48.5% of the route will be located on Crown lands, which are regulated and administered by Indian and Northern Affairs Canada (INAC). Granular resource requirements for the Highway will be met using material from selected borrow sources located in the vicinity of the Highway alignment.

The Inuvik to Tuktoyaktuk Highway will be constructed and operated to the GNWT DOT standards/ guidelines for public highways under the management and operation of GNWT DOT. This will allow for year round use by haul trucks and passenger vehicles according to the size and weight limitations as defined in the Northwest Territories highway regulations. The posted speed limit on the Highway will be 80 km/hr.

The Highway operations will require a two lane gravel roadway (8 to 9 m wide with 3:1 side-slopes) with short span single lane bridges at select stream crossings. Assessments to date have determined that about eight stream crossing locations will likely require a bridge. Culverts will be used for all of the smaller streams and to manage overland surface flows. To protect the permafrost terrain along the proposed Highway alignment, typical 'cut and fill' techniques commonly employed in southern areas of the Northwest Territories and elsewhere will not be used for this Project. Such traditional construction methods cut into protective layers of surface vegetation and organics, with the possible results of a thawing in the permafrost below. Therefore, the current design involves the placement of frozen fill materials directly onto the frozen surface of the tundra along the Highway alignment.

The geometric design parameters (summarized in Table 2) incorporated during the design process were based on the operational needs of the Highway, the need to protect the permafrost layer below the road surface, and the application of the guidelines for public highways in the Northwest Territories. Figure 2 summarizes the design parameters for a typical highway cross section. Geotextile fabric will be placed between the existing ground and the base of the Highway along the entire alignment to prevent the migration of granular materials from the Highway embankment into the permafrost.



TYPICAL HIGHWAY CROSS SECTION

TERRAIN TYPE	DESCRIPTION	EMBANKMENT HEIGHTS
1	DRY (ICE POOR) TILL AND OUTWASH DEPOSITS	1.4 m
2	WET (ICE-MEDIUM TO ICE-RICH) TILL AND OUTWASH DEPOSITS	1.4 to 1.6 m
3	WET SILTS AND CLAYS (ICE-RICH)	1.6 to 1.8 m
4	THICK ORGANIC PEATLANDS AND ICE-RICH PERMAFROST	1.8 m

LEGEND

PROPOSED INUVIK - TUKTOYAKTUK HIGHWAY ENVIRONMENTAL IMPACT STATEMENT

TYPICAL HIGHWAY CROSS SECTION

PROJECTION	DATUM

Scale 1:150

1 0 1 3m

FILE NO.
V23201322 TYPICAL SECTIONS.dwg

PROJECT NO.	DWN	CKD	REV
V23201322	SM	RM	0

OFFICE	DATE
EBA-VANC	March 16, 2011

Town of Inuvik
Northwest Territories
KIGGIAK - EBA

Figure 2

TABLE 2: GEOMETRIC DESIGN PARAMETERS FOR THE INUVIK TO TUKTOYAKTUK HIGHWAY	
Design Parameters	
Desired Design Speed	90 km/hr
Minimum Design Speed	80 km/hr
Horizontal Alignment	
Desired Curve Radius	440 m
Minimum Curve Radius	250 m
Desired Sight Distance	500 m
Minimum Sight Distance	180 m
Length of Spiral	160 m
Vertical Alignment	
Minimum Passing Sight Distance	605 m
Minimum Stopping Sight Distance	150 m
Minimum Sag K Value	40
Minimum Crest K Value	50
Minimum Distance between PVI	90 m
Desired Maximum Slope	3%
Maximum Slope Full Speed	6%
Cross-Section	
Desired Finish Top Shoulder Rounding to Shoulder Rounding	9 m
Minimum Finish Top Shoulder Rounding to Shoulder Rounding	7 m
Lane Cross Fall	3%
Superelevation	6%
Side Slopes – All Sections	3:1
Embankment Height	
Dry (ice poor) Till and Outwash Deposits	1.4 m
Wet (ice medium to ice rich) Till and Outwash Deposits	1.4 m to 1.6 m
Wet Silts and Clays (ice rich)	1.6 m to 1.8 m
Thick Organic Peatlands and Ice Rich Permafrost	1.8 m
Thickness of Surfacing Gravel	200 mm

Although much work has been done by the Project Team so far, it will be necessary to undertake further engineering, environmental and heritage resource studies following approval of the Highway to confirm borrow source quality and quantities and to further refine the Highway alignment and stream crossing designs. This information will also be used to support follow-up regulatory applications and approvals to permit construction of the Inuvik to Tuktoyaktuk Highway to proceed.

HIGHWAY CONSTRUCTION AND SCHEDULE

An important principle of the Project's construction methodology is to complete most of the construction activities during the winter months. This strategy offers several advantages:

- Allows the use of temporary ice/winter road construction to provide access to borrow sources, without the need to construct more permanent all-weather access roads.
- Allows the placement of Highway base material directly onto frozen ground (with geotextile separation layer).
- Minimizes potential effects on vegetation and soils adjacent to the actual roadway.

Following each year of winter construction, it is anticipated that most embankment settlement will occur in the top layers of the emplaced borrow material as it thaws, dries and consolidates. Little to no thaw is expected in the lower layers of the embankment, leading to greater Highway stability. This is also expected to reduce potential longer term maintenance problems.

Construction activities will be limited, to the extent possible, to the planned footprint of the Highway. A temporary winter road will run roughly parallel to the alignment and other temporary winter roads, as necessary, will provide access to borrow sources during the winter construction periods. Before the beginning of construction, the route will be surveyed and staked, and temporary winter roads will be constructed to select borrow sources. Initially snow cats and small dozers will be used to clear snow from the staked footprint. Dozers used for snow clearing will be equipped with mushroom pads to protect the ground surface on the right-of-way. After the route is staked, the snow is cleared, and adequate material is stockpiled at the borrow source, the construction activities will commence.

Construction material will be loaded at the borrow sources using excavators and hauled along the temporary winter roads using both tractor-trailer units and articulated trucks. Material will be placed by end dump and spread with D6 and/or D7 Cats. An initial lift of approximately 300 mm to 400 mm will be placed, followed by smaller lifts, with the final surface elevation being left some 150 mm to 200 mm higher than design to accommodate settlement.

Culvert and bridge installation will proceed along with construction of the Highway. The bridges will typically be prefabricated as single spans that will be installed on binwall abutments. Design, ordering and fabrication of bridges will be undertaken months before the scheduled installation so that shipping schedules are achieved and structures and binwall materials arrive on site in time for installation.

Stream crossings will be accommodated by temporary ice crossings on the adjacent seasonal winter road near the bridge site. Prefabricated bridge structures will be shipped to the individual bridge sites by truck along the constructed portions of the Highway or along the winter road. Each of the four years of primary roadway construction and installation of drainage structures will be carried out in a similar manner.

Final compaction, adjustments of grade to correct settlements, adjustments to culverts or installation of additional culverts, completion of bridge construction, and placement of surfacing materials on

the sections of Highway embankment constructed during the previous winter will be undertaken in the following summer periods.

The Tuktoyaktuk to Source 177 Access Road provides a practical model for the construction of the Highway:

- The Highway will be built by local and regional contractors;
- Construction will proceed from both the north and south ends;
- The Project will take advantage of the winter seasons to develop materials sources and for construction of the main Highway embankment;
- Construction will begin by placing geotextile fabric and building forward in lifts of granular material;
- Construction will continue in a similar way for each of the four main winter construction seasons;
- Bridge construction and culvert installation will generally begin in the winter periods;
- Bridge completion and adjustments to culverts previously installed will generally occur during the summer periods;
- Certain culverts, such as those to be installed across identified fish habitat, may be installed during the summer periods; and
- Final shaping, compaction and placement of granular topping will take place on the constructed Highway embankment in the summer periods.

Subject to completion of the EIRB review process, regulatory approvals and funding, the current generalized construction schedule for the Inuvik to Tuktoyaktuk Highway is outlined in Table 3.

TABLE 3: GENERALIZED CONSTRUCTION SCHEDULE

Schedule	Activities
Spring 2012	Initiate upgrading of Tuktoyaktuk to Source 177 Access Road to Highway Standards
Summer 2012	Complete biophysical (e.g., rare plant, wildlife, and fish), archaeological, and engineering surveys and plans, as necessary, for permitting needed for the upcoming year of work
October 2012	Strip and develop initial borrow source(s) Pre-position equipment at next borrow source (e.g., pit located south of Source 177)
Nov - Dec 2012	Continue work at borrow sources, construct winter access and haul roads
Jan - April 2013	Transport, spread borrow material, construct road and install bridge(s) and culverts
June - Sept 2013	Complete installation of bridges and culverts. Compact and grade Year 1 embankment
Fall 2013 - Summer 2016	Repeat cycle of construction similar to Year 1

ENVIRONMENTAL CONSIDERATIONS AND MITIGATION MEASURES

Climate, Air Quality and Noise

Emissions from diesel engine combustion exhaust and dust generated during the construction and future operations phases are considered to be relatively minor. These emissions are expected to be localized, short-term and intermittent.

Highway construction activities will be intermittent, temporary and transient in nature. Most of the noise dust, and air emissions during the construction phase will be associated with equipment operation and blasting activities, if required, to break up the frozen borrow material during excavation. As indicated in Table 3, construction activities that will take place during the summer periods will be mainly related to the completion of bridges, culvert installation, and compaction and grading of the Highway. The diligent application of the GNWT *Guideline for Dust Suppression* is expected to be effective in controlling dust created by summer activities during both the construction and operations phases of the Highway.

While there are no local noise regulations that directly apply to construction noises, the contractors will be directed to apply reasonable mitigation to reduce possible effects associated with construction noise. These will include adequate maintenance of their construction equipment, including mufflers. Blasting activities, if required, will be timed to avoid periods when sensitive wildlife species are in the area. Prudent design, best management practices and mitigation will be combined to reduce sound levels during the construction phase.

Examples of prudent design and management practices include:

- Limiting construction activity during sensitive periods (based on available background information and recommendations from wildlife monitors) to reduce possible effects on wildlife;
- Effective logistics planning to minimize vehicle movements, such as the use of vans or extended cab pick-up trucks to transport workers;
- Regular maintenance of equipment and provision of appropriate mufflers for internal combustion engines; and,
- Minimizing and managing dust caused by construction materials handling, and the grading and compaction of the Highway.

Permafrost Protection and Climate Change Adaptation

The Inuvik to Tuktoyaktuk Highway corridor is located entirely within the zone of continuous permafrost. Ground temperatures are within the range of minus 2°C to 5°C. Permafrost is defined as rock or soil material that has remained below 0°C continuously for two or more years, without consideration of material type, ground ice distribution, or thermal stability. The stability of permafrost and the stability of infrastructure constructed on permafrost depend on maintaining ground temperatures to minimize the thickness of the active layer, and to impede thaw.

A risk-based approach for incorporating climate change into the design of highway infrastructure on permafrost is now recommended practice. This risk-based approach is documented in the national guidelines entitled *Development and Management of Transportation Infrastructure in Permafrost Regions*

published by the Transportation Association of Canada (TAC) in May 2010. The challenge for design and construction over thaw-sensitive permafrost terrain is to balance the capital cost of constructing the Highway, against the long term maintenance implications. The design parameters and construction techniques noted above are based on experience in the area and the case studies and lessons learned as presented in the TAC guideline.

These parameters and techniques take into consideration these risks and provide mitigative approaches in the Highway design. The two most significant elements of the design are the use of non-woven geotextile fabric between the existing ground and placed construction material, and maintaining a minimum thickness in the material placed, based on terrain type, to insulate the permafrost. Other risk factors that are related to climate uncertainty are precipitation, including both summer rain and winter snow. Key mitigative measures have been incorporated into the design parameters to manage uncertainty related to future climate trends and extremes in the permafrost region that this Highway will be constructed in. The measures include:

- The used of thick embankments that insulate and stabilize the active layer and the use of non-woven geotextile fabric to assist in maintaining the integrity of the Highway embankment;
- The use of appropriately sized culverts to accommodate seasonal overland surface flows where needed; and
- Adoption of construction methods that avoid cuts and minimize disturbance of the natural vegetation before fill is placed.

During the Highway operations phase, given the uncertainty of the events associated with climate change, greater vigilance and effort on the part of maintenance operators will be required including, greater effort for spring culvert clearing and fall protection of culverts and drainage structures, more frequent inspections, and monitoring of the performance of the infrastructure.

As with the design parameters and construction techniques noted above, the mitigative measures proposed for the operations phase of the Highway are based on experience in permafrost regions and the risk-based approach that is documented in the TAC May 2010 guide for Development and Management of Transportation Infrastructure in Permafrost Regions.

Vegetation

The proposed Highway is located mainly within the Tundra Plains Level II Ecoregion, with a small portion of the Highway alignment extending into the Taiga Plains Level II Ecoregion, near Inuvik. The Tundra Plains Level II Ecoregion, which includes the Tuktoyaktuk Peninsula, is characterized by fairly level topography that rises from sea level to approximately 100 m in elevation at Granular Source 177. Lakes, ponds, and streams are common across the Peninsula.

Vegetation grows on a veneer of unfrozen organic or granular substrate overlying permafrost. The dominant vegetation along the proposed Highway alignment is characterized by a continuous cover of shrubby tundra species, consisting of dwarf birch, willow, northern Labrador tea, *Drya*s spp., and sedge tussocks. In wetter areas, sedges, cotton-grasses, and *Sphagnum* moss species dominate high-centered and low-centered polygons. Drier areas support ericaceous shrubs. Riparian communities include wet sedge communities and taller shrubs.

The proposed Highway also traverses approximately 2.8 km of the Taiga Plains Level II Ecoregion near Inuvik. This Ecoregion is dominated by Canada's largest river, the Mackenzie, and its tributaries. Taiga Plains Level II Ecoregions are characterized by open, generally slow growing, conifer-dominated forests of predominantly spruce. The shrub component is often well developed and includes dwarf birch, Labrador tea, and willow. Bearberry, mosses, and sedges are dominant understory species. Upland and foothill areas and southerly locales tend to be better drained, are warmer, and support mixed wood forests characterized by white and black spruce, tamarack, white birch, trembling aspen, and balsam poplar.

As indicated in this EIS, the average width of the Highway footprint will be 20 to 28 m (depending on the surface finish width) including the embankment. Considering the 137 km length of the current preferred alignment, the total Highway footprint would directly affect approximately 383 ha of terrain and associated vegetation.

Construction of the Highway will involve the excavation of material from borrow sites and the end-dumping of this material over geotextile fabric placed on the frozen ground surface along the right-of-way. These activities will affect vegetation cover through direct removal at the borrow sites and the burial of vegetation beneath the embankment along the Highway right-of-way.

To minimize direct effects to vegetation cover, construction activities will be limited, to the extent possible, to the planned footprint of the Highway. Care will be taken to keep heavy equipment and trucks within the right-of-way on snow-compacted and flooded access roads and constructed road embankments. Temporary winter access roads, constructed of snow and ice over the frozen ground, will be used to access the borrow sites. The use of these winter access roads will also assist in minimizing potential effects to terrain and associated vegetation.

As indicated previously, to reduce possible effects of dust on vegetation during the summer, water will be applied. With the application of the proposed mitigation measures, effects on vegetation are generally expected to be limited to the physical footprint and are considered to be minor in the context of the overall Project area.

Wildlife

The Tuktoyaktuk Peninsula and Delta area in the vicinity of the proposed Highway supports a wide variety of wildlife. Records identify 34 terrestrial mammal species that may use the proposed Highway corridor. Key mammal species of greatest interest for the communities include caribou, moose, grizzly bear, wolverine and fox. The local and regional abundance and distribution of these species varies considerably depending on habitat availability and access to terrain suitable for various life history phases, such as calving and denning.

Approximately 108 bird species, including geese, ducks, swans, raptors and upland birds, have been recorded in the Regional Study Area. Most are migratory; but a few are year round residents.

Caribou are an important terrestrial mammal species, and have traditionally been harvested by the residents of Tuktoyaktuk and Inuvik. Three caribou herds occur in the Regional Study Area, the Bluenose-West herd, Cape Bathurst herd and Tuktoyaktuk Peninsula herd. All three herds' annual ranges overlap that of the proposed Highway alignment during part of the year, particularly the winter.

The proposed Highway alignment is located south of the traditional summer and fall caribou harvesting areas, but within the spring and winter caribou harvesting areas. As well, the alignment occurs within the Bluenose-west winter range management area. This area provides important winter habitat for the Bluenose-West caribou herd, which is valued for subsistence harvesting year-round by Inuvialuit communities and other Aboriginal communities outside the ISR.

Future management decisions related to the protection of wildlife and wildlife habitat for the Inuvik to Tuktoyaktuk Highway will be based on background information; field investigations; input from the Tuktoyaktuk and Inuvik Hunters and Trappers Committees; the Wildlife Management Advisory Committee (WMAC) and GNWT Department of Environment and Natural Resources (ENR) and the application of, appropriate best management practices. The objectives of wildlife management activities along the proposed Highway will be to mitigate potentially negative effects on wildlife in the following general ways:

- Minimize loss of habitat and reductions of habitat effectiveness via Project design;
- Minimize direct mortality due to collisions with vehicles;
- Reduce attractants at construction camps through responsible waste management and effective environmental awareness programs;
- Reduce the volume, duration, and frequency of noise producing activities;
- Selective timing of Project activities to avoid critical periods for wildlife;
- Conformance with pre-determined setback distances from key wildlife habitat features;
- Effective transportation, storage and disposal of wastes;
- Ensure Project personnel have appropriate levels of wildlife training and awareness; and
- Encourage organizations such as the Hunter and Trapper Committees, Wildlife Management Advisory Council and GNWT Department of Environment and Natural Resources to work together to develop guidelines and conditions for Highway usage and follow-up with monitoring of harvesting activities.

The GNWT Department of Transportation's operational policies are designed to mitigate potential impacts on wildlife and wildlife habitat. With the application of the numerous available mitigation measures described in this EIS, effects on wildlife and wildlife habitat are generally expected to be localized and limited and are considered to be minor in the context of the overall Project area.

Fish Resources

The proposed Inuvik to Tuktoyaktuk Highway will cross approximately 46 ephemeral and/or permanent streams, and come near many lakes along its route. The proposed Highway alignment is located in the vicinity of the spring, summer, fall, and winter fish harvesting area near Husky Lakes and the Fish Lakes and Rivers management area, an area which provides important fish habitat and historic and current subsistence harvest areas for the people of Inuvik and Tuktoyaktuk.

Limited fish surveys have been conducted previously in streams along the proposed Highway. These surveys identified the following fish species in some streams along the proposed Highway route: lake whitefish, round whitefish, inconnu, northern pike, Arctic grayling, lake trout, burbot, least cisco, ninespine stickleback, and sculpin. Actual species presence is dependent on several habitat and watershed characteristics, often including the availability and accessibility of upstream lakes that provide feeding, rearing, and/or overwintering habitats. It is unlikely that the streams along the Highway route would provide overwintering habitat.

A preliminary fish habitat field reconnaissance was carried out in fall 2009, and follow-up aquatic studies were completed in the spring of 2010 for two 25 km sections of the proposed highway alignment, the first extending north of Navy Road (just outside Inuvik) and the second extending south of Granular Source 177 (to the south of Tuktoyaktuk). Further site investigations will need to be carried out in future years, matched to the phased annual construction program, to assist with the design of the appropriate stream crossing structures including potential bridges and culverts.

The assessment of the potential effects of road construction on fish and fish habitat, and the development of effective avoidance or mitigation measures, are major components of the proposed Inuvik to Tuktoyaktuk Highway Project. From the perspective of fish and fish habitat protection and management, three categories of streams are recognized along the Highway route:

- non fish-bearing: streams that are not used by fish for any part of their life cycles;
- migratory channels: ephemeral and perennial (except in winter) streams that are used by fish only for migration during open water periods or that contribute to downstream habitat quality; and
- spawning/rearing/feeding streams: ephemeral and perennial streams that are used by one or more life cycle stages of fish during open water periods, in addition to migration.

Based on the work completed to date, the majority of the stream channels to be crossed by the proposed Highway are small, ephemeral streams that generally drain terrestrial upland areas or small, shallow lakes or ponds, most of which do not provide suitable fish habitat features. For these types of stream crossings, appropriately-sized and designed culverts will be installed and sediment and erosion control best management practices will be employed to protect downstream aquatic resources.

At this time, about eight of the larger streams, including Trail Valley Creek, Hans Creek and Zed Creek, will likely need single-span bridges to minimize or prevent potential impacts on fish and fish habitat. To the extent possible, DFO's Operational Statement for Clear Span Bridges and sediment and erosion control best management practices will be followed. These and other mitigation measures to protect fish and fish habitat will be incorporated into an overall fish and fish habitat protection plan that will be developed for the Highway construction program in consultation with DFO. The Project Team is committed to working closely with DFO to design appropriate crossing structures for each stream and to obtain *Fisheries Authorizations*, if determined to be required.

Considerable amounts of water will be required for winter access road construction and dust suppression during summer months. It is proposed that water for these purposes will be extracted from lakes in proximity to the Highway corridor. It is anticipated that Project water requirements

will exceed 300 m^3/day, which will trigger the need for a Type A Water Licence from the Northwest Territories Water Board.

In addition, water withdrawals from designated lakes along the Inuvik to Tuktoyaktuk Highway route will be conducted in conformance with the DFO *Protocol for Winter Water Withdrawal in the Northwest Territories*.

With the application of the available mitigation measures, effects on fish and fish habitat are generally expected to be localized and limited and are considered to be minor in the context of the overall Project area.

Archaeological Resources

Within the general study region encompassing the area east of the Mackenzie River and west of the Husky Lakes and from the coast to the southern limits of the Project area, 103 archaeological sites have been documented. Types of sites found in this region include lithic scatters and quarry/workshops; stone features such as tent rings, caches and cairns; hearths and fire cracked rock concentrations; cabin remains and semi-subterranean house remains; cache pits; middens; graves; various types of wood features; and cut/worked wood remains. A number of sites have been confirmed to range from the Northwest Microblade tradition (over 5000 years old) to the Paleoeskimo (as old as 4,300 years ago), through Neoeskimo representations (between 1,000 to 200 years old).

There are 12 previously recorded archaeological sites within 5 km of the proposed Highway route, which typically represent Mackenzie Inuit occupations with some small components ascribed to the Paleoeskimo period. Most of these sites are small camps characterized by lithic, bone and artifact scatters, some with structural features such as tent rings, hearths, semi-subterranean house remains, middens and caches.

An archaeological overview assessment of the proposed road route and selected borrow sources was completed in September 2009. The main goal was to assess the archaeological potential of terrain to be affected by this Project. The primary method used to rate archaeological potential was visual assessment of terrain by low and slow helicopter overflight following the proposed alignment using GPS coordinates. Potential borrow sources were also overflown and the boundaries were roughly approximated using topographic maps. Data gathered during the overview assessment were used to identify specific portions of the Highway Project that will require more detailed archaeological impact assessment before the commencement of each season of construction.

No previously recorded archaeological sites occur within the Primary 2009 Route; however, the sections of the Highway route that are closer to Husky Lakes and which cross elevated, dry terrain are judged to have good archaeological potential.

Archaeological sites in the Northwest Territories are protected by law. In the Northwest Territories, new regulations were enacted on June 15, 2001. These regulations provide greater protection for archaeological artifacts and sites and require that archaeological investigations be conducted under permit. The Project Team is committed to ensuring that archaeological and traditional sites are protected by:

- Conducting a survey of the road right of way and borrow sites during the summer 2012 and 2013;
- Submitting an Archaeological Impact Assessment to the PWHNC one month prior to construction activities each year;
- Undertake any site mitigations determined by the PWHNC and Proponents' Archaeologist;
- Abiding by the archaeological regulations in the *Territorial Land Use Regulations* or Terms and Conditions set by the ILA.

Environmental Protection and Incident Response

There exists the potential for accidents or malfunctions to occur in association with any human activity, including those proposed for the construction of the Inuvik to Tuktoyaktuk Highway. Environmental consequences of potential accidents or malfunctions associated with the Highway and associated aggregate borrow and construction camp activities would be primarily limited to those related to:

- Vehicle accidents; and
- Fuel storage, transportation and handling system failures.

To reduce the potential environmental risks associated with potential vehicle/equipment accidents or malfunctions and/or fuel management activities, several preventative and mitigation measures will be employed. These measures and response activities are detailed in the EIS and its appendices. In overview, preventative and mitigative measures to be employed will include:

- Implementation of best management practices to prevent or minimize the occurrence of accidents or malfunctions;
- Ensuring that on-site contractors have industry-compliant and satisfactory Health, Safety and Environmental (HSE) policies, programs and manuals and that they are successfully implemented throughout the Project;
- Compliance with the terms and conditions of the necessary Inuvialuit Land Administration and Indian and Northern Affairs Canada Land Use and Quarry permits and authorizations that will be issued for the construction project; and
- Implementation of spill reporting, containment, and cleanup protocols in accordance to Project-specific spill contingency plans.

The key strategy will be to prevent accidents and malfunctions through education, monitoring, and follow-up.

Worst Case Scenario

A fundamental goal of the EIRB as set out in the IFA is to consider a potentially possible scenario as a legitimate test by which to judge whether negative impacts to wildlife, wildlife habitat and wildlife harvesting can be minimized to acceptable levels by mitigative and remedial measures. Such a worst case scenario will also be used by the EIRB to establish the Developer's potential liability.

The Project Team determined that the most probable, although highly unlikely worst case scenario associated with the construction and operation of the proposed Highway would involve potential environmental damage to the Husky Lakes and effects to traditional activities and harvesting, caused by a fuel supply truck crash on the Highway, resulting in a fuel spill of greater than 10,000 litres into an open watercourse, which leads directly to the Husky Lakes.

The worst case scenario was further defined to assume that:

- The fuel supply truck crash occurs during spring freshet when water levels, discharge and velocity are at their yearly peak and the potential for the greatest number of available pathways for conveyance downstream to the Husky Lakes is present;
- The spill of diesel fuel into a fish-bearing watercourse and ultimately into Husky Lakes would result in residents avoiding consumption of fish because of the perception that the fuel would taint the fish;
- The fish harvest season from Husky Lakes would be lost as a result of the diesel fuel input to Husky Lakes; and
- The fouling of fishing gear would result in replacement costs.

The detailed analysis determined that the threat of the worst case scenario occurring is considered low due to: the short open water period, the small number of fuel truck deliveries during the open water season; the relatively short duration of persistence of diesel in the environment; the sufficiency of mitigation measures such as spill contingency plans employed by transportation contractors to respond to a potential spill; and safe road and bridge design to reduce the likelihood of accidents.

However, to estimate the potential liability of the Developer for impacts of the proposed Highway development as a result of such a worst case scenario occurring, the estimated potential monetary loss of an entire summer season of fishing from the Husky Lakes for all residents involved in fish harvesting was determined to be in the order of $486,000. It is also recognized by the Project Team that this estimated worst case loss does not, however, account for the possible effects on the psyche, spiritual or cultural values of the people who use and enjoy the Husky Lakes area.

Next Steps Towards Construction of the Inuvik to Tuktoyaktuk Highway

As evidenced by decades of planning, investigation, and consultation, the completion of the proposed Inuvik to Tuktoyaktuk Highway has been a long standing goal of the Town of Inuvik, the Hamlet of Tuktoyaktuk, and the residents of the Inuvialuit Settlement Region. It has also been a stated objective of the Government of the Northwest Territories.

From the regional perspective, the Highway is predicted to help reduce the cost of living in Tuktoyaktuk and produce a range of other benefits for both Tuktoyaktuk and Inuvik residents. It will improve Tuktoyaktuk residents' access to healthcare professionals and educational opportunities. The Highway will support year-round social, recreational and tourism opportunities and will enable family and community interactions that are currently limited to the winter months when the ice road is open. From a National perspective, completing the Highway and connecting Canada from Coast to Coast to Coast will address Canada's goal of establishing a year round transportation link to the Arctic coastline. The proposed all-weather infrastructure will be integral

Canadian sovereignty interests in the Arctic and providing diverse economic development opportunities for the future.

Based on the consultations that have been conducted over the past several years with the communities, regulatory authorities and other interested parties, the Project Partners have a high degree of confidence that the proposed Highway can proceed efficiently through the regulatory process to permitting, construction, and responsible long-term operation and maintenance. From many perspectives, the proposed Highway will be a key component of the Northwest Territories future transportation system.

TABLE OF CONTENTS

PAGE

EXECUTIVE SUMMARY ..... **i**

TABLE OF CONTENTS ..... **xxi**

ACRONYMS ..... **xlvii**

ACRONYMS – UNITS AND ELEMENTS ..... **lii**

DEFINITIONS ..... **lv**

TERMS WITH THE SAME MEANING ..... **lix**

CONCORDANCE TABLE ..... **lx**

COMMITMENTS TABLE ..... **lxxx**

1.0 INTRODUCTION **1**

1.1 The Developer 1

1.1.1 Consultants Involved in EIS Preparation 1

1.1.2 Environmental Performance 1

1.2 Development Overview 4

1.3 Development Purpose and Justification 6

1.4 The Development Setting 9

1.4.1 Proposed Alignment 9

1.4.2 Alternative Alignment 11

1.5 Regulatory Approvals and Non-regulatory Requirements 11

1.5.1 Previous Regulatory Approvals 15

1.5.2 Inuvialuit Settlement Region Consultation and Communication 19

1.6 Study Strategy and Methodology 20

1.6.1 Respect for and Use of Traditional Knowledge 21

1.6.2 Involvement of Potentially Affected Communities and the Public 22

1.6.2.1 October 2009 Consultations 23

1.6.2.2 January 2010 Consultations 28

1.6.2.3 ILA Consultations – November 2010 30

1.6.2.4 Consultations Summary 31

1.6.3 Recognition of the *Inuvialuit Final Agreement* and Community Conservation Plans 32

1.6.4 Consideration of Sustainability Goals 34

1.6.5 Precautionary Principle 36

TABLE OF CONTENTS

PAGE

2.0 PROJECT DESCRIPTION 37
2.1 Route Alignment Alternatives 37
2.1.1 Brief History of Alternative Alignments Considered 37
2.1.2 Alignments Considered in the Current Stage of Project Development 38
2.1.2.1 PWC 1977 40
2.1.2.2 Primary 2009 Route 40
2.1.2.3 Alternative 1 (2009 Minor Realignment) 42
2.1.2.4 Alternative 2 (Upland Route) 44
2.1.2.5 Alternative 3 (2010 Minor Realignment) 46
2.2 Comparison of Alignment Options 46
2.2.1 Evaluation Process 47
2.2.2 Environmental Factor 47
2.2.3 Economic Factor 48
2.2.4 Social Factor 49
2.2.5 Technical Factor 51
2.2.6 Summary of Evaluation 53
2.2.7 Conclusion on Preferred Alignment 54
2.3 Terrain Conditions Along Preferred Alignment 54
2.4 Key Highway Geotechnical Issues 57
2.4.1 Permafrost 57
2.4.2 Sensitive Terrain 58
2.4.2.1 Polygons 58
2.4.2.2 Thick Organics (Peatlands) 58
2.4.2.3 Thermokarst 59
2.4.2.4 Thaw Flow Slides 59
2.4.2.5 Pingos 59
2.5 Detailed Quantity Estimates for the Preferred Alignment 60
2.6 Project Components and Activities 63
2.6.1 Construction Overview 63
2.6.2 Winter Season Construction 64
2.6.3 Construction Activities 65
2.6.4 Design Embankment 68
2.6.5 Geometric Design 69
2.6.6 Stream Crossing Design Considerations 72

TABLE OF CONTENTS

PAGE

2.6.7 Drainage and Thermal Erosion Considerations 74
2.6.8 Borrow Sources 75
2.6.8.1 General Information on Borrow Sources in the Area 75
2.6.8.2 Available Information on Borrow Sources in the Area 76
2.6.8.3 Borrow Material Requirements 82
2.6.8.4 Further Investigation of Borrow Sources 83
2.6.8.5 Site Evaluation Criteria 83
2.6.8.6 Pit Development Plans 85
2.6.8.7 Winter Access Roads 86
2.6.9 Construction Camps 87
2.6.9.1 Locations 87
2.6.9.2 Domestic Water 87
2.6.9.3 Domestic Waste 87
2.6.9.4 Wastewater 88
2.6.9.5 Power Supply 88
2.6.9.6 Safety 88
2.6.9.7 Decommissioning 88
2.6.9.8 Water Usage 88
2.6.10 Construction Infrastructure 89
2.6.10.1 Construction and Equipment Staging Areas 89
2.6.10.2 Construction Material Storage 89
2.6.10.3 Excavation Equipment Storage Areas 89
2.6.10.4 Fuel and Oil Storage 89
2.6.10.5 Equipment Maintenance and Refueling Areas 89
2.6.10.6 Resupply of Personnel, Material, Food and Equipment 89
2.6.11 Operation and Maintenance 90
2.7 Development Phases and Schedule 91
2.7.1 Production Rate, Construction Staging and Overall Schedule 91
2.7.2 Schedule 92
2.7.3 Anticipated Construction Equipment and Personnel 93
2.7.4 Labour Requirements 94
2.7.5 Roles and Responsibilities 95
2.7.6 Cost 95
2.7.7 Recent Studies Completed and Additional Field Studies Required 95

TABLE OF CONTENTS

PAGE

2.8 Life of the Project 96

3.0 EXISTING ENVIRONMENT 99

3.1 Biophysical Environment 99

3.1.1 Terrain, Geology, Soils and Permafrost 99

3.1.1.1 Bedrock Geology 99

3.1.1.2 Surficial Geology 100

3.1.1.3 Borrow Materials 105

3.1.1.4 Permafrost Conditions 106

3.1.2 Climate 114

3.1.2.1 Location of Recording Stations and Length of Record 114

3.1.2.2 Spatial and Temporal Boundaries 114

3.1.2.3 Climate Related Extreme Events 119

3.1.2.4 Current Climatic Conditions for Baseline 119

3.1.2.5 Variability/Trends within the Current Climate Normal Period 122

3.1.2.6 Climate and Meteorological Conditions Relating to Air Quality 122

3.1.2.7 Contribution of Traditional Knowledge 124

3.1.2.8 Synthetic Climate Data 124

3.1.2.9 Climate Change 125

3.1.3 Air Quality 126

3.1.3.1 Airshed Spatial boundaries 126

3.1.3.2 Emission Sources and Factors Affecting Air Quality 127

3.1.3.3 Ambient Air Quality Standards 128

3.1.3.4 Air Quality Monitoring Stations 130

3.1.3.5 Air Quality Baseline Data 133

3.1.3.6 Climate and Meteorological Conditions Relating to Air Quality 139

3.1.4 Noise 139

3.1.4.1 Noise Spatial Boundaries 140

3.1.4.2 Relevant Standards and Guidelines 140

3.1.4.3 Environmental 141

3.1.4.4 Existing Noise Conditions 142

3.1.4.5 Previous Noise Monitoring 142

3.1.5 Water Quality 143

3.1.6 Hydrology 147

3.1.7 Fish and Fish Habitat 150

TABLE OF CONTENTS

PAGE

3.1.7.1 Burbot 152
3.1.7.2 Lake Whitefish 153
3.1.7.3 Round Whitefish 153
3.1.7.4 Least Cisco 153
3.1.7.5 Inconnu 154
3.1.7.6 Northern Pike 154
3.1.7.7 Lake Trout 156
3.1.7.8 Arctic Grayling 156
3.1.7.9 Fish and Fish Habitat Information Review 156
3.1.7.10 Stream Crossing Site Investigations (2009 and 2010) 158
3.1.8 Vegetation 182
3.1.8.1 Ecoregion Classification 182
3.1.8.2 Characteristics of Level IV Ecoregions within the Project Study Area 186
3.1.8.3 Vegetation Types 189
3.1.8.4 Rare Plants 207
3.1.8.5 Vegetation Types of Concern 210
3.1.8.6 Harvested Plants 210
3.1.8.7 Merchantable Timber 211
3.1.8.8 Baseline Contaminant Concentrations 211
3.1.8.9 Invasive Plants 212
3.1.8.10 Forest and Tundra Fire Frequency 213
3.1.9 Wildlife and Wildlife Habitat 215
3.1.9.1 Terrestrial Mammals 215
3.1.9.2 Non-native Species 216
3.1.9.3 Species at Risk 216
3.1.9.4 Valued Components 217
3.1.9.5 Barren-ground Caribou 218
3.1.9.6 Moose 239
3.1.9.7 Grizzly Bear 241
3.1.9.8 Wolverine 252
3.1.9.9 Red and Arctic Fox 254
3.1.9.10 Other Mammals 257
3.1.9.11 Species and Areas Subject to Exclusive or Preferential Rights Granted by Land Claims 258

TABLE OF CONTENTS

PAGE

3.1.9.12 Habitat Fragmentation 259
3.1.9.13 Contaminants and Wildlife 260
3.1.10 Birds and Habitat 261
3.1.10.1 Species at Risk 265
3.1.10.2 Valued Components 266
3.1.10.3 Horned Grebe 267
3.1.10.4 Tundra Swan 268
3.1.10.5 Greater White-fronted Goose (“Yellow legs”) 269
3.1.10.6 Snow Goose 270
3.1.10.7 Canada Goose 272
3.1.10.8 Mallard 273
3.1.10.9 Northern Pintail 274
3.1.10.10 Peregrine Falcon 275
3.1.10.11 Rock Ptarmigan and Willow Ptarmigan 277
3.1.10.12 Short-eared Owl 278
3.1.10.13 Rusty Blackbird 279
3.1.10.14 Species or Areas Subject to Preferential Rights Granted by Land Claims 281
3.1.10.15 Baseline Contaminant Concentrations In Harvested Species 281
3.2 Human Environment 282
3.2.1 Background 282
3.2.1.1 Tuktoyaktuk 282
3.2.1.2 Inuvik 282
3.2.2 Demographics 282
3.2.2.1 Population and Population Trends 282
3.2.2.2 Trends for Age, Gender and Ethnicity 286
3.2.2.3 Incidences of Births and Deaths 288
3.2.2.4 Households 290
3.2.2.5 Migration and Migration Patterns 293
3.2.3 Regional and Local Economies 295
3.2.3.1 Gross Domestic Product 295
3.2.3.2 Local and Regional Economic Development Goals and Objectives 297
3.2.4 Employment 298
3.2.4.1 Employment Rate 298

TABLE OF CONTENTS

PAGE

3.2.4.2 Income 317
3.2.4.3 Education 326
3.2.5 Infrastructure and Institutional Capacity Community Services 331
3.2.5.1 Government Services 331
3.2.5.2 Status of Community and Local Government Institutions and Organizations 338
3.2.5.3 Health Facilities and Services 338
3.2.5.4 Emergency Response and Law Enforcement Services 340
3.2.5.5 Waste Disposal and Management 341
3.2.5.6 Water and Sewage Facilities 341
3.2.5.7 Power and Fuel Services 342
3.2.5.8 Transportation Systems 343
3.2.5.9 Telephone and Communication Services 347
3.2.5.10 Fire Protection and Emergency Response 348
3.2.5.11 Housing 349
3.2.5.12 Safe Houses and Shelters 352
3.2.5.13 Child Care and Elder Care Services 352
3.2.5.14 School and Education Services 353
3.2.5.15 Recreation Services 354
3.2.5.16 Management of Renewable Resources 355
3.2.5.17 Supply of Aggregate and Granular Materials 356
3.2.5.18 Planned Projects 356
3.2.6 Human Health and Community Wellness 359
3.2.6.1 Age, Gender and Ethnicity 359
3.2.6.2 Mortality, Morbidity and Relevant Non-Communicable and Infectious Diseases 359
3.2.6.3 Children's Health 364
3.2.6.4 Nutrition 366
3.2.6.5 Country Foods 367
3.2.6.6 Social Pathology or Dysfunction 372
3.2.6.7 Support Services and Programs 383
3.2.7 Socio-cultural Patterns 385
3.2.7.1 Cultural and Spiritual Life 385
3.2.7.2 Family and Community Life 387

TABLE OF CONTENTS

PAGE

3.2.7.3 Traditional Activity Participation 390
3.2.7.4 Social Relations 392
3.2.7.5 Social and Cultural Support Systems and Programs 393
3.2.8 Harvesting 395
3.2.8.1 Contribution of Harvesting to the Economy 395
3.2.8.2 Resource Accessibility, Quality and Level of Harvest 398
3.2.8.3 Participation in Harvesting Activities for Household Food Supply 418
3.2.8.4 Encroachments and Restrictions of Harvesting Activities 422
3.2.8.5 Harvesting Rights 422
3.2.8.6 Trapping, Outfitting and Related Area Use 423
3.2.9 Land Use 423
3.2.9.1 Historic/Traditional Land Use 424
3.2.9.2 Current Land Uses 426
3.2.9.3 Land Use Designations 432
3.2.9.4 Valued Locations and Attributes 437
3.2.9.5 Past and Present Non-Traditional Land Uses 438
3.2.9.6 Proposed Future Land Uses 439
3.2.10 Archaeological Resources 442
3.2.10.1 Human History Summary 442
3.2.10.2 Previous Archaeological Studies 445
3.2.10.3 Archaeological Overview Assessment 449
4.0 IMPACT ASSESSMENT 456
4.1 Biophysical and Socio-Economic Assessment Methods 458
4.1.1 Project Scoping 460
4.1.2 Valued Components 461
4.1.3 Study Boundaries 462
4.1.3.1 Spatial Boundaries 462
4.1.3.2 Temporal Boundaries 463
4.1.3.3 Effects Assessment 465
4.1.4 Assessing Level of Consequence 466
4.2 Biophysical Components 467
4.2.1 Terrain, Geology, Soils and Permafrost 467
4.2.1.1 Potential Effects Due to Highway Construction Activities 467

TABLE OF CONTENTS

PAGE

4.2.1.2 Potential Effects Due to the Physical Presence and Operation of the Highway 468
4.2.1.3 Spatial Boundaries 469
4.2.1.4 Residual Effects 470
4.2.2 Air Quality 470
4.2.2.1 Applicable Standards, Objectives and Guidelines 471
4.2.2.2 Key Indicators 472
4.2.2.3 Emission Sources 473
4.2.2.4 Emissions of Concern 474
4.2.2.5 Potential Effects 477
4.2.2.6 Project Design and Mitigation Measures 481
4.2.2.7 Residual Effects 482
4.2.3 Noise 482
4.2.3.1 Noise Emission Sources 482
4.2.3.2 Potential Effects 483
4.2.3.3 Applicable Standards and Guidelines 486
4.2.3.4 Project Design and Mitigation Measures 486
4.2.3.5 Residual Effects 486
4.2.4 Water Quality and Quantity 487
4.2.4.1 Potential Effects 487
4.2.4.2 Project Design and Mitigation Measures 492
4.2.4.3 Residual Effects 494
4.2.5 Fish and Fish Habitat 494
4.2.5.1 Potential Effects and Mitigation Measures 495
4.2.5.2 Monitoring 504
4.2.5.3 Residual Effects 504
4.2.6 Vegetation 508
4.2.6.1 Removal and/or Burial of Vegetation Types and Plant Species 509
4.2.6.2 Effects of Dust 513
4.2.6.3 Potential Introduction and Spread of Invasive Plants 514
4.2.6.4 Alteration of Local Hydrology 514
4.2.6.5 Contaminants in Plants 515
4.2.6.6 Project Design and Mitigation Measures 515
4.2.6.7 Residual Effects 517

TABLE OF CONTENTS

PAGE

4.2.7 Wildlife and Wildlife Habitat 519
4.2.7.1 Species at Risk 519
4.2.7.2 Caribou and Caribou Habitat 520
4.2.7.3 Grizzly Bear and Grizzly Bear Habitat 529
4.2.7.4 Moose and Moose Habitat 539
4.2.7.5 Furbearers and Furbearer Habitat 547
4.2.7.6 Birds and Bird Habitat 556
4.3 Human Environment Components 568
4.3.1 Demographics 569
4.3.1.1 Potential Effects 569
4.3.2 Regional and Local Economies 570
4.3.2.1 Contribution to Gross Domestic Product and Direct Taxes 571
4.3.2.2 Available Labour Supply, Participation, and Income Assistance 581
4.3.3 Education, Training and Skills 583
4.3.3.1 Education and Training Participation Levels 583
4.3.3.2 Language and Literacy Levels 584
4.3.4 Infrastructure and Institutional Capacity 585
4.3.4.1 Transportation Infrastructure 585
4.3.4.2 Emergency Response and Local Law Enforcement Services 586
4.3.4.3 Medical and Health Care Infrastructure and Services 587
4.3.4.4 Social and Community Support Services 588
4.3.4.5 Education and Recreational Infrastructure and Services 588
4.3.4.6 Water, Sewage and Waste Disposal Infrastructure 588
4.3.4.7 Quarries and Quarry Materials 589
4.3.4.8 Management of Renewable Resources 590
4.3.4.9 Service Industry Capacity 590
4.3.4.10 Housing 590
4.3.5 Human Health and Community Wellness 591
4.3.6 Socio-cultural Patterns 594
4.3.7 Harvesting 595
4.3.8 Land Use 597
4.3.8.1 Potential Effects 598
4.3.8.2 Project Design and Mitigation Measures 605
4.3.8.3 Residual Effects 605

TABLE OF CONTENTS

PAGE

4.3.9 Archaeological Resources 606
4.3.9.1 Potential Effects 607
4.3.9.2 Project Design and Mitigation Measures 607
4.3.9.3 Residual Effects 609
4.4 Accidents and Malfunctions 609
4.4.1 Fuel Storage and Spills 610
4.4.2 Refuelling Operation 610
4.4.3 Waste Management 611
4.4.3.1 General Waste Management Planning 611
4.4.3.2 Waste Handling and Separation, Storage and Processing at Source 611
4.4.3.3 Food and Food-Contaminated Waste and Animal Attraction 611
4.4.3.4 General Camp Waste and Sewage 611
4.4.3.5 Industrial Waste 612
4.4.3.6 Hazardous Waste 612
4.4.3.7 Project Waste Quantities and Disposal Options 613
4.4.4 Vehicle Crashes 614
4.4.5 Worst Case Scenario 614
4.4.5.1 Diesel Fuel Transportation 615
4.4.5.2 Fate of Fuel in the Environment 616
4.4.5.3 Spill Mitigation 618
4.4.5.4 Vehicle Accident Mitigation 619
4.4.5.5 Fishing Effects and Compensation Values 619
4.4.5.6 Final Worst Case Scenario Determination 621
4.5 Effects of the Environment on the Project 622
4.5.1 Climate Change 622
4.5.2 Seismic Activity 624
4.5.3 Landslides 624
4.5.4 Wildfire 625
5.0 CUMULATIVE EFFECTS ASSESSMENT 626
5.1 Spatial Boundaries 627
5.2 Temporal Boundaries 627
5.3 Other Past, Present and Future Projects / Activities Considered 627
5.3.1 Past and Existing Projects 628
5.3.1.1 Ikhil Gas Development and Pipeline Project 628

TABLE OF CONTENTS

PAGE

5.3.1.2 Tuktoyaktuk to Source 177 Access Road 630
5.3.1.3 Winter Access Trails 631
5.3.1.4 Former NCPC Power Line 632
5.3.1.5 Seismic Lines 632
5.3.1.6 Oil and Gas Well Sites 633
5.3.2 Potential Future Projects/ Activities 633
5.3.2.1 Mackenzie Gas Project 633
5.3.2.2 Parsons Lake Gas Field, Associated Infrastructure and Gathering Pipeline 636
5.3.2.3 Tuktoyaktuk Harbour Project 637
5.3.2.4 Husky Lakes Development 638
5.4 Valued Components and the Project 640
5.4.1 Significance Determination for the Highway in Relation to Past, Present and Future Projects 642
6.0 MITIGATION AND REMEDIATION SUMMARY 646
7.0 FOLLOW-UP AND MONITORING 651
7.1 Biophysical Monitoring 652
7.1.1 Construction 652
7.1.2 Operations 653
7.2 Socio-Economic Monitoring 653
7.2.1 Construction 653
7.2.2 Operations (Long-term) 653
7.3 NWT Cumulative Impact Monitoring Program (CIMP) 653
REFERENCES 655

TABLES

Table 1: Summary of Quantity and Cost Estimates for Alignments Considered vi
Table 2: Geometric Design Parameters for the Inuvik to Tuktoyaktuk Highway ix
Table 3: Generalized Construction Schedule xi
Table A: Acronyms xlvii
Table B: Acronyms: Units and Elements lii
Table C: Definitions lv

Table D: Terms with the Same Meaning lix
Table E: Concordance Table lx
Table F: Commitments Table lxxx
Table 2.2-1: Comparison of Estimated Quantity of Granular Materials and Costs per Route Option 46
Table 2.2.4-1: Comparison of Geometric Features per Route Option 49
Table 2.2.6-1: Summary of Evaluation 53
Table 2.2.6-2: Summary of Favourability 54
Table 2.3-1: Terrain Conditions Along Primary 2009 Route 55
Table 2.5-1: Estimated Fill Quantity by Topography and Terrain 60
Table 2.5-2: Estimated Lengths for Potential Single Span, Pre-Fabricated Bridges 61
Table 2.6.4-1: Design Parameters for Embankment Fill Thickness 69
Table 2.6.5-1: Geometric Design Parameters for the Inuvik to Tuktoyaktuk Highway 70
Table 2.6.8-1: Information on Borrow Sources along the Primary 2009 Route 79
Table 2.6.8-2: Estimated Quantities from Potential Borrow Sources 82
Table 2.6.11-1: Typical Highway Maintenance Activities 90
Table 2.7.2-1: Proposed Schedule of Activities 92
Table 2.7.3-1: Estimated Personnel Requirement per Spread 94
Table 3.1.1-1: Terrain Units along the Proposed Alignment 102
Table 3.1.2-1: Climate Data, Inuvik-A Station, NWT, 1971-2000 115
Table 3.1.2-2: Climate Data, Inuvik-A Station, NWT, 1976-2005 116
Table 3.1.2-3: Climate Data, Tuktoyaktuk-A Station, NWT, 1971-2000 117
Table 3.1.2-4: Climate Data, Tuktoyaktuk-A Station, NWT, 1978-2007 118
Table 3.1.2-5: Summary of Available Fog and Ice Fog Data (Inuvik) 122
Table 3.1.2-6: Climate Conditions and Change in the Inuvialuit Settlement Region 125
Table 3.1.3-1: Territorial and Federal Ambient Air Quality Standards 129
Table 3.1.3-2: Comparison of Parameters Monitored at Inuvik to Federal and Territorial Standards and Objectives 131
Table 3.1.3-3: Air Pollutant Emissions for Northwest Territories, 2008 135
Table 3.1.4-1: NWT *Safety Act* – Occupational Noise Exposure Limits 141
Table 3.1.4-2: Baseline Sound Levels at Inuvik Area Facility 142

Table 3.1.5-1: Results of INAC Water Quality Assessment of Selected Watercourse Crossing Locations 145
Table 3.1.5-2: Field Water Quality Analyses, June 2010 146
Table 3.1.6-1: Approximate Freeze Thaw Dates in Subarctic Regions 148
Table 3.1.7-1: Fish Species with Potential to Exist along the Inuvik to Tuktoyaktuk Highway 151
Table 3.1.7-2: Life History Information for Common Fish Species in Streams along the Proposed Highway 155
Table 3.1.7-3: Stream Channel and Habitat Characteristics at Selected Stream Crossings along the Proposed Highway, September 2009 161
Table 3.1.7-4: June 2010 Approximate Sampling Locations Inuvik to Tuktoyaktuk Highway 168
Table 3.1.7-5: Spring 2010 Aquatic Field Program Fish and Fish Habitat, and In-Situ Water Quality Sampling Results 172
Table 3.1.7-6: Fisheries Assessment Results 175
Table 3.1.7-7: Aerial Reconnaissance of Alternate Routes (Tuktoyaktuk Segment) 176
Table 3.1.7-8: Generalized Stream Crossing Structure and Mitigation Measures 177
Table 3.1.7-9: Proposed Stream Crossing Structures Based on Stream and Fish Habitat Characteristics or Potential 178
Table 3.1.8-1: NWT Ecoregions Crossed by the Proposed Inuvik to Tuktoyaktuk Highway 182
Table 3.1.8-2: Level IV Ecoregion Distribution within the Proposed Inuvik to Tuktoyaktuk Highway Project Area 186
Table 3.1.8-3: Vegetation Types by Ecoregion along the Proposed Inuvik to Tuktoyaktuk Highway 190
Table 3.1.8-4: Distribution of Land Cover Classes within the Inuvik to Tuktoyaktuk Highway Study Areas 191
Table 3.1.8-5: Plant Species of Concern Identified in the RSA 208
Table 3.1.8-6: Distribution of Treed Areas within the Inuvik to Tuktoyaktuk Highway Study Areas 211
Table 3.1.8-7: Invasive Plant Species Common to NWT 212
Table 3.1.9-1: Terrestrial Mammals Potentially Occurring within the Regional Study Area 215
Table 3.1.9-2: Selection of Terrestrial Mammals as Valued Components 217
Table 3.1.9-3: Cape Bathurst Herd Census 220
Table 3.1.9-4: Bluenose-West Herd Census 222
Table 3.1.9-5: Moose Population Estimates in the Inuvik Area 239
Table 3.1.9-6: Grizzly Bear Seasonal EOSD Habitat Used by Gender 248

Table 3.1.10-1: Bird Species Potentially Occurring Within the Regional Study Area 262
Table 3.1.10-2: Bird Species Categorized as Valued Components....266
Table 3.2.2-1: Northwest Territories Population by Gender and Ethnicity, 2009....286
Table 3.2.2-2: Tuktoyaktuk Population by Gender and Ethnicity, 2009....287
Table 3.2.2-3: Inuvik Population by Gender and Ethnicity, 2009....288
Table 3.2.2-4: Migration Activity, NWT, 1999-2010....294
Table 3.2.4-1: Average Annual Income of Active Trappers in Inuvik and Tuktoyaktuk....314
Table 3.2.4-2: Percentage of Households in the NWT with Less than $30,000 Income, by Selected Characteristics, 2004....320
Table 3.2.4-3: Yellowknife Consumer Price Index Selected Indexes, 2010....324
Table 3.2.4-4: Community Price Index, 2000-2010....326
Table 3.2.4-5: Comparison of Programs Offered at Aurora College to Occupation Categories....329
Table 3.2.5-1: Government Services....332
Table 3.2.5-2: Transportation Infrastructure....343
Table 3.2.6-1: Health History for the Participants of the Inuit Health Survey, 2007....359
Table 3.2.6-2: Summary of Country Foods....368
Table 3.2.7-1: Percent of Persons in Harvesting Activities, by Selected Characteristics for the NWT, 2002....389
Table 3.2.8-1: Inflation Rates for Yellowknife and Adjusted Food Cost....396
Table 3.2.8-2: Percentage of Households Consuming Country Foods....397
Table 3.2.8-3: GNWT Annual Harvest Totals, 2007-2008....397
Table 3.2.8-4: Percent of Persons Involved in Harvesting Activities, by Selected Characteristics for the NWT, 2002....420
Table 3.2.10-1: Archaeological Sites near Project Components....447
Table 4-1: Biological, Physical, and Human Elements and Goal Statements....456
Table 4.1.2-1: Selected Valued Components....462
Table 4.1.4-1: Effects Assessment and Consequence Criteria....465
Table 4.2.1-1: Summary of Mitigation Measures....469
Table 4.2.2-1: Emissions of Concern Generated from Highway Construction....474
Table 4.2.2-2: Emissions of Concern Generated from Highway Operation....475

Table 4.2.4.1: Potential Effects of Construction and Operation of the Proposed Highway on Water Quality and Quantity 493
Table 4.2.5-1: Potential Effects of Construction and Operation of the Proposed Highway on Fish and Fish Habitat 497
Table 4.2.5-2: Residual Effects Assessment for Fish and Fish Habitat in the LSA 505
Table 4.2.6-1: Distribution of Vegetation Types within the Footprint Area 510
Table 4.2.6-2: Potential Effects and Mitigation Strategies for Vegetation along the Highway 516
Table 4.2.6-3: Residual Effects Summary for Effects to Vegetation Types 518
Table 4.2.7-1: Mitigation Measures for Caribou and Caribou Habitat 524
Table 4.2.7-2: Residual Effects Assessment for Caribou and Caribou Habitat in the LSA 527
Table 4.2.7-3: Residual Effects Assessment for Caribou and Caribou Habitat in the RSA 528
Table 4.2.7-4: Mitigation Measures for Grizzly Bear 533
Table 4.2.7-5: Residual Effects Assessment for Grizzly Bear and Grizzly Bear Habitat in the LSA 537
Table 4.2.7-6: Residual Effects Assessment for Grizzly Bear and Grizzly Bear Habitat in the RSA 538
Table 4.2.7-7: Mitigation Measures for Moose 544
Table 4.2.7-8: Residual Effects Assessment for Moose and Moose Habitat in the LSA 545
Table 4.2.7-9: Residual Effects Assessment for Moose and Moose Habitat in the RSA 546
Table 4.2.7-10: Mitigation Measures for Furbearers and Furbearer Habitat 551
Table 4.2.7-11: Residual Effects for Furbearers and Furbearer Habitat in the LSA 554
Table 4.2.7-12: Residual Effects for Furbearers and Furbearer Habitat in the RSA 555
Table 4.2.7-13: Mitigation Measures for Birds and Bird Habitat 563
Table 4.2.7-14: Summary of Mitigation Measures for Bird Species at Risk 564
Table 4.2.7-15: Residual Effects Assessment for Birds and Bird Habitat in the LSA 566
Table 4.2.7-16: Residual Effects Assessment for Birds and Bird Habitats in the RSA 567
Table 4.3-1: Valued Socio-economic Component Assessment Summary 568
Table 4.3-2: Socio-economic Assessment Summary 569
Table 4.3.2-1: Total Economic Impacts of the Highway (Excluding the Mackenzie Gas Project) 572
Table 4.3.2-2: Economic Effects of Highway Construction 574
Table 4.3.2-3: Annual Economic Effects of Highway Maintenance 575
Table 4.3.2-4: Annual Economic Effects from Loss of Inuvik to Tuktoyaktuk Winter-Road 576

Table 4.3.2-5: Net Tuktoyaktuk Consumer Savings with the Highway 577
Table 4.3.2-6: Economic Effects of Increased and Lengthened Tourist Visitations 579
Table 4.3.2-7: Total Economic and Financial Effects Related to Mackenzie Gas Project....580
Table 4.3.2-8: Potential Available Labour Supply, 2009 582
Table 4.4.3-1: Classification of Camp Waste 612
Table 4.4.3-2: Classification of Industrial Waste 612
Table 4.4.5-1: Reported Diesel Fuel Spills of Greater than 10,000 L in the NWT....617
Table 4.4.5-2: Average Fish Harvests from June to September in Inuvik and Tuktoyaktuk (1988-1997) 621
Table 5.4-1: Residual Effects for Valued Ecosystem Components and Valued Socio-Economic Components 641
Table 5.4.1-1: Screening Matrix for Cumulative Effects to Valued Ecosystem Components and Valued Socio-economic Components at a Local and Regional Scale 644
Table 6-1: Summary of Mitigation Strategies for Identified Valued Components....647
Table 7.3-1: Comparison of NWT CIMP Components and Project Valued Components 654

FIGURES

Figure 1 Primary 2009 Route and Other Alternative Alignments Considered....v
Figure 2: Typical Highway Cross Section viii
Figure 1.5-1 Proposed Project Location 13
Figure 1.5-2 Inuvik to Tuktoyaktuk Route Options and Potential Borrow Source Locations 14
Figure 2.1.2-1 Preferred Inuvik to Tuktoyaktuk Alignment, Other Alternatives Considered, Priority Borrow Sites, and Proposed Bridges 39
Figure 2.1.2-2 Route Alternatives 43
Figure 2.5-1 Potential Bridge Locations....62
Figure 2.6.5-1 Typical Highway Cross Section....71
Figure 2.6.6-1 General Arrangement Pre-Fabricated Steel Box Girder Bridge 73
Figure 2.6.8-1 Available and Potential Borrow Sources Along the Proposed Route 78
Figure 2.6.8-2 Potential Borrow Sources Requiring Further Investigation for Potential Use....84
Figure 3.1.1-1 Surficial Geology 101

Figure 3.1.1-2 Near Surface Ground Temperatures, late 1960s to early 1970s....107
Figure 3.1.1-3 Near Surface Ground Temperatures, 2003 to 2007....108
Figure 3.1.1-4 Distribution of Landslides on the Tuktoyaktuk Peninsula....113
Figure 3.1.2-1 Climate and Air Quality Monitoring Stations....120
Figure 3.1.3-1 Fine Particulate Matter ($PM_{2.5}$) at Inuvik, 2009....134
Figure 3.1.3-2 Coarse Particulate Matter (PM_{10}) at Inuvik, 2009....136
Figure 3.1.3-3 Nitrogen Dioxide (NO_2) at Inuvik, 2008....137
Figure 3.1.3-4 Ground Level Ozone (O_3) at Inuvik, 2009....138
Figure 3.1.6-1 Hydrograph for Trail Valley Creek....149
Figure 3.1.7-1 Spring 2010 Aquatic Field Program....165
Figure 3.1.7-2 Fish and Fish Habitat Sampling Locations Inuvik Segment....166
Figure 3.1.7-3 Fish and Fish Habitat Sampling Locations Tuktoyaktuk Segment....167
Figure 3.1.7-4 Clear Span Bridge Crossing Locations....181
Figure 3.1.8-1 Level II Ecoregions....183
Figure 3.1.8-2 Level IV Ecoregions....185
Figure 3.1.8-3 EOSD Land Cover Map....194
Figure 3.1.8-4 At Risk Plant Locations....209
Figure 3.1.8-5 Historical Fires and Fire Ignition Causes within the Regional Study Area....214
Figure 3.1.9-1 Cape Bathurst Caribou Herd Ranges....219
Figure 3.1.9-2 Bluenose-West Caribou Herd Ranges....221
Figure 3.1.9-3 Winter Caribou Herd Ranges (December 1 to March 31)....223
Figure 3.1.9-4 Spring, Spring Migration and Pre-Calving Caribou Observations and Herd Ranges (April 1 to May 31)....224
Figure 3.1.9-5 Calving/ Post Calving Caribou Observations and Herd Ranges (June 1 to 25)....225
Figure 3.1.9-6 Early Summer Caribou Observations and Herd Ranges (June 26 to July 15)....226
Figure 3.1.9-7 Mid-Summer Caribou Observations and Herd Ranges (July 16 to August 7)....227
Figure 3.1.9-8 Late Summer Caribou Observations and Herd Ranges (August 8 to October 7)....228
Figure 3.1.9-9 Fall/Rut Caribou Observations and Herd Ranges (October 7 to 31)....229
Figure 3.1.9-10 Fall/Post Rut Caribou Observations and Herd Ranges (November 1 to 30)....230

Figure 3.1.9-11 Percent Utilization and Distribution of Cape Bathurst Bluenose-West, and Bluenose-East in NWT during the Fall (Rut) 232
Figure 3.1.9-12 Percent Utilization and Distribution of Cape Bathurst Bluenose-West, and Bluenose-East in NWT during the Fall (Post Rut) 233
Figure 3.1.9-13 Percent Utilization and Distribution of Cape Bathurst Bluenose-West, and Bluenose-East in NWT during the Winter 234
Figure 3.1.9-14 Wildlife Management Areas with Hunting Restrictions for the Barren-ground Caribou 236
Figure 3.1.9-15 Grizzly Bear Subpopulations in the Mackenzie Delta 243
Figure 3.1.9.16 Arithmetic Mean Centers for Annual Grizzly Bear Ranges in the Mackenzie Delta 244
Figure 3.1.9-17 Grizzly and Polar Bear Denning Areas 246
Figure 3.1.9-18 Grizzly Bear Harvest by Type and Sex, July 2003 to June 2008 250
Figure 3.1.9-19 Tuktoyaktuk West (I/BG/04) Grizzly Bear Harvest Locations, July 2003 to June 2008 251
Figure 3.1.9.20 Concentration of Mercury and Cadmium in the Liver of Caribou from the Canadian Arctic 261
Figure 3.1.10-1 Current Range of the Horned Grebe in the NWT 267
Figure 3.1.10-2 Total Estimated Annual Goose Harvests for Aklavik, Inuvik, and Tuktoyaktuk, 1988-1997 272
Figure 3.1.10-3 Total Estimated Annual Duck Harvests for Aklavik, Inuvik, and Tuktoyaktuk, 1988-1997 275
Figure 3.1.10-4 Current Range of the Short-Eared Owl in the NWT 279
Figure 3.1.10-5 Current Range of the Rusty Blackbird in the NWT 280
Figure 3.2.2-1 Northwest Territories Estimated Population, 2001-2010 283
Figure 3.2.2-2 Northwest Territories Projected Population, 2010-2030 283
Figure 3.2.2-3 Tuktoyaktuk Estimated Population, 2001-2010 284
Figure 3.2.2-4 Tuktoyaktuk Projected Population, 2010-2030 284
Figure 3.2.2-5 Inuvik Estimated Population, 2001-2010 285
Figure 3.2.2-6 Inuvik Estimated Population, 2010-2030 285
Figure 3.2.2-7 Northwest Territories Population by Age, 2009 286
Figure 3.2.2-8 Tuktoyaktuk Population by Age Group, 2009 287
Figure 3.2.2-9 Inuvik Population by Age Group, 2010 288
Figure 3.2.2-10 Incidences of Births, Teen Births and Deaths in the Northwest Territories, 1998-2007 289

Figure 3.2.2-11 Incidences of Births, Teen Births and Deaths in Tuktoyaktuk, 1998-2007 289
Figure 3.2.2-12 Inuvik Gross Births, Teen Births and Deaths, 1998-2007 290
Figure 3.2.2-13 Average Number of Persons per Household in Tuktoyaktuk and Inuvik, 1981-2009 291
Figure 3.2.2-14 Households by Number of Residents, NWT, Tuktoyaktuk and Inuvik, 2009 291
Figure 3.2.2-15 Percent of Households with 6 Persons or More in Tuktoyaktuk and Inuvik, 1981-2009 292
Figure 3.2.2-16 NWT, Tuktoyaktuk and Inuvik Households by Tenure, 2009 293
Figure 3.2.3-1 Chained (2002) GDP for Canada and Provinces, 2005-2009 296
Figure 3.2.3-2 Chained (2002) GDP for Territories, 2005-2009 297
Figure 3.2.4-1 NWT Employment by Class of Worker, 2001-2009 298
Figure 3.2.4-2 Percent of NWT Employees Working Full-Time and Part-Time, 1999-2009 299
Figure 3.2.4-3 Percent of Tuktoyaktuk Employees Working Full-Time and Part-Time, 1999-2009 300
Figure 3.2.4-4 Percent of Inuvik Employees Working Full-Time and Part-Time, 1999-2009 300
Figure 3.2.4-5 NWT Seasonal Employment Rates, 2001-2010 301
Figure 3.2.4-6 NWT Average Seasonal Employment Rates 2001-2010 302
Figure 3.2.4-7 Occupation Participation by Gender, NWT, 2006 303
Figure 3.2.4-8 Occupation Participation for Tuktoyaktuk and Inuvik, 2006 304
Figure 3.2.4-9 NWT Industry Participation by Gender, 2006 305
Figure 3.2.4-10 Industry Participation for Tuktoyaktuk and Inuvik, 2006 306
Figure 3.2.4-11 NWT, Tuktoyaktuk, and Inuvik Age Based Employment Rates, 2009 307
Figure 3.2.4-12 NWT Population (Aged 15 & Older) by Labour Force Activity, 2001-2009 308
Figure 3.2.4-13 Tuktoyaktuk Population (Aged 15 & Older) by Labour Force Activity, 1986-2009 309
Figure 3.2.4-14 Inuvik Population (Aged 15 & Older) by Labour Force Activity, 1986-2009 310
Figure 3.2.4-15 NWT Population 15 Years and Older Reporting Unpaid Work, 2006 311
Figure 3.2.4-16 Population 15 Years and Older Reporting Unpaid Work in Tuktoyaktuk and Inuvik, 2006 311
Figure 3.2.4-17 Participation in Traditional Activities, NWT, Tuktoyaktuk and Inuvik, 2008 315
Figure 3.2.4-18 Persons 15 and Over Who Hunted or Fished in Previous Years, 1999-2009 316
Figure 3.2.4-19 Persons 15 and Over Who Trapped in Previous Years, 1999-2009 316
Figure 3.2.4-20 Average Personal Income in Tuktoyaktuk and Inuvik, 1999-2008 317
Figure 3.2.4-21 Average Family Income in the NWT Tuktoyaktuk and Inuvik, 1999-2008 318

Figure 3.2.4-22 Percent of Families with Annual Income less than $30,000, 1998-2008 319
Figure 3.2.4-23 NWT Income Assistance Cases and Beneficiaries, 2001-2010 321
Figure 3.2.4-24 Tuktoyaktuk and Inuvik Income Assistance Cases and Beneficiaries, 2001-2010 322
Figure 3.2.4-25 NWT Income Assistance Payments, 2001-2010 322
Figure 3.2.4-26 Tuktoyaktuk and Inuvik Income Assistance Payments, 2001-2010 323
Figure 3.2.4-27 Yellowknife Consumer Price Index, 2009-2010 324
Figure 3.2.4-28 Percent of Population with Highschool Diploma or more in the NWT Tuktoyaktuk and Inuvik, 1986-2009 326
Figure 3.2.4-29 Level of Education Attained by NWT Residents, 2006 327
Figure 3.2.4-30 Level of Education Attained by Tuktoyaktuk and Inuvik Residents, 2006 328
Figure 3.2.4-31 NWT Employment Rate by Level of Education, 2004-2009 331
Figure 3.2.5-1 Tuktoyaktuk Airport – Aircraft Movement Compared by Year 346
Figure 3.2.5-2 Inuvik Airport – Aircraft Movement Compared by Year 347
Figure 3.2.5-3 Percent of Population in NWT, Tuktoyaktuk and Inuvik with Home Internet Access, 2009 348
Figure 3.2.5-4 Average Number of Persons per Household in Tuktoyaktuk and Inuvik, 1981-2009 350
Figure 3.2.5-5 Households by Number of Residents, NWT, Tuktoyaktuk and Inuvik, 2009 350
Figure 3.2.5-6 Percent of Households with 6 Persons or More in Tuktoyaktuk and Inuvik, 1981-2009 351
Figure 3.2.5-7 Beaufort-Delta Region and Communities, Households by Tenure, 2009 352
Figure 3.2.6-1 Percent of Ex-Smokers, Current Smokers, and Smokers by Age and Gender, 2007-2008 360
Figure 3.2.6-2 Cases of Respiratory Diseases Treated by Physicians, 2000-2010 361
Figure 3.2.6-3 Cases of Infectious and Parasitic Diseases Treated by Physicians, 2000-2010 362
Figure 3.2.6-4 Three-Year Average Number of Sexually Transmitted Infections Treated by Physicians in Tuktoyaktuk and Inuvik, 2000-2010 363
Figure 3.2.6-5 Cases of Accidents, Injuries and Poisonings Treated by Physicians, 2000-2010 363
Figure 3.2.6-6 Cases of Mental Disorder Treated by Physicians, 2000-2010 364
Figure 3.2.6-7 Incidences of Low, High Birth Weights, and Healthy Births in NWT, 1990-2007 365
Figure 3.2.6-8 Infant Mortality Rate in the NWT and Canada, 1981–2007 365
Figure 3.2.6-9 Average Caloric Intake of Inuit People by Age and Gender, 2007-2008 367

Figure 3.2.6-10 Most Commonly Consumed Country Food in the ISR, 2007-2008 371
Figure 3.2.6-11 Average Daily Consumption of Country Food in the ISR, 2007-2008 372
Figure 3.2.6-12 NWT Crimes, 1998-2009....373
Figure 3.2.6-13 Tuktoyaktuk Crimes, 1999-2009 374
Figure 3.2.6-14 Inuvik Crimes, 1999-2009 374
Figure 3.2.6-15 Proportion of Current Drinkers by Demographic Characteristics among Residents Aged 15+, NWT 2009....375
Figure 3.2.6-16 Trends in the Frequency of Drinking among Current Drinkers Aged 15+, NWT 1996-2009....376
Figure 3.2.6-17 Demographic Characteristics of Those Aged 15+ Drinking More Than Once a Week, NWT 2009....377
Figure 3.2.6-18 Usual Number of Drinks Consumed on a Single Occasion by Current Drinkers Aged 15+, NWT 1996-2009 378
Figure 3.2.6-19 Demographic Characteristics of Current Drinkers Aged 15+ Consuming 5+ Drinks on a Single Occasion, NWT 2009 379
Figure 3.2.6-20 Demographic Characteristics of Current Drinkers Aged 15+ Drinking Heavily at Least Once per Month, NWT 2009 380
Figure 3.2.6-21 Demographic Characteristics of Current Drinkers Aged 15+ Scoring 8+ in AUDIT, NWT 2009....381
Figure 3.2.6-22 Proportion of Cannabis Use in the Past 12 Months by Demographic Characteristic among Residents Age 15+, NWT 2009 382
Figure 3.2.6-23 Cocaine/crack, Hallucinogens, Speed, Ecstasy and Heroin “Ever Used in Lifetime” among Residents Age 15+, NWT 2009 383
Figure 3.2.8-1 Caribou Harvesting Areas Spring, Summer, Fall, Winter 401
Figure 3.2.8-2 Estimated Annual Caribou Harvest, Tuktoyaktuk, 1988-1997....400
Figure 3.2.8-3 Estimated Annual Caribou Harvest, Inuvik, 1988-1997 402
Figure 3.2.8-4 Moose Harvsting Areas Spring....403
Figure 3.2.8-5 Estimated Annual Big-game Harvest, Per Species, Tuktoyaktuk, 1988-1997 404
Figure 3.2.8-6 Estimated Annual Big-game Harvest, Per Species, Inuvik, 1988-1997 405
Figure 3.2.8-7 Estimated Annual Furbearers/ Small Mammals Harvest, Per Species, Tuktoyaktuk, 1988-1997....406
Figure 3.2.8-8 Estimated Annual Furbearers/ Small Mammals Harvest, Per Species, Tuktoyaktuk, 1988-1997....407

Figure 3.2.8-9 Estimated Annual Furbearers / Small Mammals Harvest, Per Species, Inuvik, 1988-1997 408
Figure 3.2.8-10 Estimated Annual Muskrat Harvest, Inuvik, 1988-1997 408
Figure 3.2.8-11 Wolverine Harvesting Areas Winter 409
Figure 3.2.8-12 Estimated Annual Bird Harvest (Goose and Ptarmigan), Tuktoyaktuk, 1988-1997 410
Figure 3.2.8-13 Goose Harvesting Areas Spring, Summer, Fall 411
Figure 3.2.8-14 Estimated Annual Bird Harvest (Eider and Mallard), Tuktoyaktuk, 1988-1997 412
Figure 3.2.8-15 Estimated Annual Bird Harvest (Goose and Mallard), Inuvik, 1988-1997 412
Figure 3.2.8-16 Fish Bearing Lakes along the Proposed Alignment 414
Figure 3.2.8-17 Fish Harvesting Areas Spring, Summer, Fall, Winter 415
Figure 3.2.8-18 Estimated Annual Fish Harvest, Per Species, Tuktoyaktuk, 1988-1997 416
Figure 3.2.8-19 Estimated Annual Fish Harvest, Per Species, Tuktoyaktuk, 1988-1997 416
Figure 3.2.8-20 Estimated Annual Fish Harvest, Per Species, Inuvik, 1988-1997 417
Figure 3.2.8-21 Estimated Annual Fish Harvest, Per Species, Inuvik, 1988-1997 418
Figure 3.2.8-22 Percent of Persons 15 Years of Age & Older Involved in Harvesting Activities, 2002 419
Figure 3.2.8-23 Percent of Households that Obtained Half or More of Meat and Fish Consumed by Hunting and Fishing, 2008 420
Figure 3.2.8-24 Persons 15 and Over Who Hunted or Fished in Previous Years, 1999-2009 421
Figure 3.2.8-25 Persons 15 and Over Who Trapped in Previous Years, 1999-2009 421
Figure 3.2.9-1 Existing Land Uses 427
Figure 3.2.9-2 Traditional Trails 429
Figure 3.2.9-3 Cabins and Polar Bear Camps 430
Figure 3.2.9-4 All Site Designations in the Inuvik Planning Area 434
Figure 3.2.9-5 Special Management Areas 435
Figure 3.2.9-6 Proposed Future Land Use 441
Figure 3.2.10-1 Archaeological Sites Previously Recorded 448
Figure 3.2.10-2 Archaeological Potential Areas (Map 1 of 2) – Southern Portion 451
Figure 3.2.10- 3 Archaeological Potential Areas (Map 2 of 2) – Northern Portion 452
Figure 3.2.10-4 Historical and Cultural Sites 454
Figure 3.2.10-5 Burial Sites and Cemeteries 455

Figure 4.1.3-1 Project Study Areas....464
Figure 4.3.8-1 Existing Land Uses....600
Figure 4.3.8-2 Proposed Future Land Uses....601
Figure 4.4.5-1 Dissipation Rates of 20,000 L and 48,000L Winter Mix Diesel Spills in Cold Water (10 °C) and 20,000 L Summer Mix Fuels in Cold Water (10 °C)....618

PHOTOGRAPHS

Photo 1.6.2-1 Tuktoyaktuk Community Meeting, October 27, 2009....24
Photo 1.6.2-2 Tuktoyaktuk Community Meeting, October 27, 2009....24
Photo 1.6.2-3 Inuvik Community Meeting, October 28, 2009....25
Photo 1.6.2-4 Tuktoyaktuk Community Meeting, October 27, 2009....25
Photo 1.6.2-5 Inuvik Community Meeting, October 28, 2009....26
Photo 1.6.2-6 Project Team meeting with ILA in Tuktoyaktuk, October 27, 2009....26
Photo 1.6.2-7 Tuktoyaktuk Community Meeting, January 14, 2010....29
Photo 2.1.2-1 Looking west from Husky Lakes to area where PWC 1977 alignment was considered....40
Photo 2.1.2-2 Looking south along 2009 Route Near Hans Creek....42
Photo 2.1.2-3 Partially complete access road from Tuktoyaktuk to Source 177....44
Photo 2.1.2-4 Looking south along Alternative 2 (Upland Route) at typical terrain....45
Photo 2.1.2-5 Looking south along Alternative 2 (Upland Route) at typical terrain....45
Photo 2.6.3-1 Example of winter road access constructed parallel to the road (Tuktoyaktuk to Source 177 Access Road, 2009)....66
Photo 2.6.3-2 The winter construction approach; note grader in the distance clearing snow from the embankment footprint (Tuktoyaktuk to Source 177 Access Road, 2009)....66
Photo 2.6.3-3 An example of geotextile placement and the proposed end-dumping method of construction (Tuktoyaktuk to Source 177 Access Road, 2009)....67
Photo 2.6.4-1 Ice-rich polygonal patterned ground along the 2009 Route....68
Photo 2.6.4-2 Thermokarst lakes and hummocky terrain along 2009 Route....69
Photo 2.6.6-1 Single span prefabricated bridge on gravel filled binwall abutments....72
Photo 3.1.7-1 Stream Crossing 03 aerial view, September 2009....159
Photo 3.1.7-2 Stream Crossing 03 ground view, looking upstream, September 2009....159
Photo 3.1.7-3 Stream Crossing 21 aerial view, September 2009....160
Photo 3.1.7-4 Stream Crossing 21 ground view, looking upstream, September 2009....160

Photo 3.1.7-5 Stream Crossing 30, Hans Creek, looking upstream....163
Photo 3.1.7-6 Stream Crossing 31, Zed Creek, looking upstream....164
Photo 3.1.8-1 The northern edge of the Level II Taiga Plains Ecoregion is dominated by slow growing spruce forest....187
Photo 3.1.8-2 The forest surrounding Inuvik is predominantly spruce; however, it quickly changes to deciduous forest and shrub closer to the treeline....187
Photo 3.1.8-3 At the treeline, the deciduous forest is increasingly replaced by shrubs....188
Photo 3.1.8-4 General appearance of the gently undulating Tuktoyaktuk Peninsula with numerous pothole lakes surrounded by dwarf birch-dominated shrub tundra on uplands and sedge tussock fens....188
Photo 3.1.8-5 Upland shrub represents another common vegetation type and is dominated by willow, *Salix glauca*....196
Photo 3.1.8-6 The dominant vegetation along the proposed highway alignment is characterized by shrubby tundra vegetation, consisting of dwarf birch and willow....197
Photo 3.1.8-7 Dwarf shrub heath is a common tundra vegetation type occurring on Tuktoyaktuk Peninsula and is characterized by narrow-leaved Labrador tea and alpine bilberry....198
Photo 3.1.8-8 Cotton-grass tussock vegetation are found on lower slopes and lowlands where ground water creates hygric to subhydric soil conditions. 200
Photo 3.1.8-9 High-centered polygons displaying net-like pattern with high center surrounded by water-filled troughs with ice bottoms. 201
Photo 3.1.8-10 Low-centered polygon vegetation are localized in depression areas and drained lake basins on the Tuktoyaktuk Peninsula, typically adjacent to areas of standing water....202
Photo 3.1.8-11 Riparian shrub vegetation are found along streams and drainage basins in the southern portion of the proposed Highway corridor....204
Photo 3.1.8-12 Riparian sedge – cotton-grass vegetation types form the perimeters of small lakes and ponds....205
Photo 3.1.8-13 Hans Creek (crossing 30A) 207
Photo 3.1.9-1 Caribou were periodically seen during the aerial reconnaissance survey along the proposed Highway alignment. Three bull caribou were seen grazing on sedges....218
Photo 3.1.9-2 Several moose were observed along the proposed Highway alignment, in association with lush willow growth along rivers 240
Photo 3.1.9-3 A number of freshly dug grizzly bear dens were documented, such as this one found on a south-facing slope hidden amongst shrubs 245
Photo 3.1.9-4 Red foxes commonly occur along the proposed Highway alignment. 255
Photo 3.2.7-1 The Delta Good Times Band and Ingamo Friendship Dancers at the Inuvik Christmas feast 386

Photo 3.2.7-2 Summer Fish Harvest....391
Photo 3.2.7-3 Elders share oral traditions with school children....392
Photo 3.2.7-4 Inuvialuit Communications Society publications....395
Photo 3.2.10-1 Terraces and benches along Husky Lakes suggestive of good archaeological potential. 449
Photo 3.2.10-2 Checking surface exposures on a good potential ridge to be used as a borrow source. 450
Photo 4.2.7-1 A pair of Gyrfalcons perched on top of a communications tower at Tuktoyaktuk. Their nest is just out of view, below the bottom edge of the photo....560
Photo 4.2.7-2 This Gyrfalcon and its mate were observed regularly using the telephone poles during their hunting activities....560
Photo 4.2.7-3 Wilson's Snipe nest with eggs 20 m from active roadway on the edge of Tuktoyaktuk....561
Photo 4.2.7-4 Adult male Red-necked Phalarope on nesting territory adjacent to an active road, Tuktoyaktuk 561
Photo 5.3.1-1 Right-of-way at the end of Navy Road 630

APPENDICES

Appendix A Green Light: Signalling the Department of Transportation's Commitment to the Environment
Appendix B Community Consultations and Meeting Summaries
Appendix C Spring 2010 Aquatic Field Program Results
Appendix D Inuvik to Tuktoyaktuk 1:25,000 Map Book
Appendix E Management Plans
Appendix F Inuvik to Tuktoyaktuk All-Weather Road Economic Analysis

ACRONYMS

Table A lists the acronyms used throughout the EIS and Table B lists the Acronyms for Units and Elements

TABLE A: ACRONYMS

Abbreviation	Definition
ABE	Adult Basic Education
ABLE	Adult Literacy and Basic Education
ALCIP	Aboriginal Language and Cultural Instructor Program
ASTt	Arctic Small Tool tradition
ATV	All-Terrain Vehicle
AUDIT	Alcohol Use Disorder Identification Test
BAM	Beta Attenuation Monitor
BCP	Building Canada Program
BDHSS	Beaufort Delta Health and Social Services
BDR	Beaufort Delta Region
BMPs	Best Management Practices
CanNor	Canadian Northern Economic Development Agency
CCME	Canadian Council of Ministers of the Environment
CCP (s)	Community Conservation Plan (s)
CEA	Cumulative Effects Section
CEAA	Canadian Environmental Assessment Act
CEPA	*Canadian Environmental Protection Act*
CI	Continuous Improvement
CIMP	Cumulative Impact Monitoring Program
CMHC	Canadian Mortgage and Housing Corporation
COGOA	Canada Oil and Gas Operations Act
COPE	Committee for Original Peoples Entitlement
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPA	Canadian Petroleum Association
CWSs	Canada-wide Standards
CWS	Canadian Wildlife Service
DETR	Department of the Environment, Transport and the Regions
DIAND	Department of Indian and Northern Affairs

TABLE A: ACRONYMS	
Abbreviation	**Definition**
DFO	Department of Fisheries and Oceans, or Fisheries and Oceans Canada
DOT	Department of Transportation, GNWT
DRR	Department of Renewable Resources, Government of the Yukon
EC	Environment Canada
ECE	Education, Culture and Employment, GNWT
e.g.	exempli gratia (for example)
EGT	E. Gruben's Transport Ltd.
EIRB	Environmental Impact Review Board
EIS	Environmental Impact Statement
EISC	Environmental Impact Screening Committee
EMP	Environmental Management Plan
EMS	Environmental Management System
ENR	Environment and Natural Resources Department, GNWT
EOSD	Earth Observation for Sustainable Development of Forests
ERP	Emergency Response Plan
EUB	Energy and Utilities Board, Province of Alberta
FJMC	Fisheries Joint Management Committee
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GMVF	Genuine Mackenzie Valley Furs
GNWT	Government of the Northwest Territories
GPS	Global Positioning System
GSA	Gwich'in Settlement Area
GSC	Geological Survey of Canada
HADD	Harmful Alteration, Disruption or Destruction
HSE	Health, Safety and Environment
HSS	Department of Health and Social Services, GNWT
HTC	Hunters and Trappers Committee
HWMP	Hazardous Waste Management Plan
IBL	Inuvialuit Business List
IICP	Inuvik Inuvialuit Conservation Plan

TABLE A: ACRONYMS

Abbreviation	Definition
ICC	Inuvik Community Corporation
ICRC	Inuvialuit Cultural Resource Centre
ICS	Inuvialuit Communications Society
i.e.	id est (that is)
IFA	*Inuvialuit Final Agreement*, as Amended April 2005
IGC	Inuvialuit Game Council
IHS	Inuvialuit Harvest Study
INAC	Indian and Northern Affairs Canada
ILA	Inuvialuit Land Administration
IOL	Imperial Oil Resources Ventures Limited Partnership
IRC	Inuvialuit Regional Corporation
IDRC	International Development Research Centre
ISR	Inuvialuit Settlement Region
ITC	Inuit Tapirisat of Canada
ITI	Department of Industry, Tourism, and Investment, GNWT
JRP	Joint Review Panel
KCAC	Keeping-Clean-Areas-Clean
LICO	Low Income Cut Offs
LIM	Low Income Measure
LSA	Local Study Area
LWD	Large Woody Debris
MACA	Ministry of Municipal and Community Affairs, GNWT
MBM	Market Basket Measure
MEMP	Mackenzie Environmental Monitoring Program
MGP	Mackenzie Gas Project
MOU	Memorandum of Understanding
MSC	Midnight Sun Complex
MSW	Municipal Solid Waste
MVAPL	Mackenzie Valley Aboriginal Pipeline Ltd.
N/A	Not Applicable
NAAQO	National Ambient Air Quality Objectives
NAPS	National Air Pollution Surveillance

TABLE A: ACRONYMS

Abbreviation	Definition
NCP	Northern Contaminants Program
NCPC	Northern Canada Power Commission
ND	No Date
NEB	National Energy Board, Government of Canada
NGLs	National Gas Liquids
NNL	No Net Loss
NOAA	National Oceanic and Atmospheric Administration
NOGAP	Northern Oil and Gas Action Program
NPRI	National Pollutant Release Inventory
NRC	National Research Council
NRCAN	Natural Resources Canada
NT	Northwest Territories
NTCL	Northern Transportation Company Ltd.
NTPC	Northwest Territories Power Corporation
NWT	Northwest Territories
NWTLC	Northwest Territories Literacy Council
NWTWB	Northwest Territories Water Board
OSB	Ocean Studies Board
OS	Operational Statement
PDPs	Pit Development Plans
PDR	Project Description Report
PFB	Prime Fur Bonus
PG	Pasquill-Gifford
PM	Particulate Matter
POPs	Persistent Organic Pollutants
PWC	Public Works Canada
PWNHC	Prince of Wales Northern Heritage Centre
RCMP	Royal Canadian Mountain Police
RIC	Resource Information Committee
RKL	Ripley Klohn Leonoff International Ltd.
ROW	Right-of-Way
RSA	Regional Study Area

TABLE A: ACRONYMS

Abbreviation	Definition
RWED	Resources, Wildlife and Economic Development, GNWT
SARA	*Species At Risk Act*
SCP	Spill Contingency Plan
SNWT	Spectacular Northwest Territories
Spp.	Species
STD	Sexually Transmitted Diseases
Subsp.	Sub-species
SWD	Small Woody Debris
TAC	Transportation Association of Canada
TCCP	Tuktoyaktuk Community Conservation Plan
TK	Traditional Knowledge
TSP	Total Suspended Particulate
UTM	Universal Transverse Mercator
US EPA	United States Environmental Protection Agency
US DOT FHWA	United States Department of Transortation Federal Highway Administration
UV	Ultraviolet
VC	Valued Components (referring to VECs and VSCs collectively)
VEC	Valued Ecosystem Component
VSC	Valued Socio-Economic Component (including cultural considerations)
WMAC	Wildlife Management Advisory Committee
YTG	Government of the Yukon
ZOI	Zone of Influence

TABLE B: ACRONYMS – UNITS AND ELEMENTS	
Abbreviation	**Definition**
Al	Aluminum
As	Arsenic
B	Boron
Ba	Barium
Be	Beryllium
˚C	Celsius
Cd	Cadmium
CH_4	Methane
cm	Centimeters
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
Co	Cobalt
Cr	Chromium
Cu	Copper
dBA	Decibels
Fe	Iron
Ft	Feet
ha	hectare
H_2S	Hydrogen Sulphide
Hg	Mercury
hr	Hour
KM or Km	Kilometre
kPa	kilopascal
Kt	Kilotonne
kV	kilovolts
kW h	Kilowatt Hour
L	Litre
Leq	Energy Equivalent Sound Level
L/s	Litres per Second
m	Metre
M^3	Cubic Metres

TABLE B: ACRONYMS – UNITS AND ELEMENTS	
Abbreviation	**Definition**
m^3/s	Metres Cubed per Second
mg	Milligrams
mg/L	Milligrams per Litre
Mi.	Mile
$Mi.^2$	Miles Squared
Mm or mm	Millimeters
Mn	Manganese
Mo	Molybdenum
m/s	Metres per Second
MW	Megawatt
NH_3	Ammonia
Ni	Nickel
N_2O	Nitrous Oxide
NO	Nitric Oxide
No.	Number
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxide
O	Ozone
O_3	Ground Level Ozone
OCs	Organochlorines
Pb	Lead
pH	Potential of Hydrogen
psi	Pounds per Square Inch
s	Second
Se	Selenium
Si	Silicon
Sn	Tin
SOx	Sulphur Oxides
SO_2	Sulphur Dioxide
SO_3	Sulphur Trioxide
Sr	Strontium
Te	Tellurium

TABLE B: ACRONYMS – UNITS AND ELEMENTS	
Abbreviation	**Definition**
Th	Thorium
Tl	Thallium
U	Uranium
V	Vanadium
µm	Micrometers

DEFINITIONS

The following definitions provide guidance for the purposes of the environmental impact review process.

TABLE C: DEFINITIONS

Term	Definition	Source
Airshed	The air supply of a given region; also the geographical area covered by such an air supply. In terms of air quality, it is the space in which air emissions interact.	Merriam-Webster's Dictionary
Archaeological Artifacts	Defined as any tangible evidence of human activity that is more than 50 years old, in respect of which an unbroken chain of possession cannot be demonstrated.	*Northwest Territories Archaeological Sites Regulations*
Archaeological Site	Defined as a site where an archaeological artifact is found.	*Northwest Territories Archaeological Sites Regulations*
Cumulative Effects	Changes to the environment that "are likely to result from the project in combination with other projects or activities that have been or will be carried out".	CEAA
Developer	A person, the government, or any other legal entity owning, operating or causing to be operated any development in whole or in part in the Inuvialuit Settlement Region (ISR), and includes any co-contractant of such owner or operator.	IFA s.2
Development	(a) any commercial or industrial undertaking or venture, including support and transportation facilities related to the extraction of non-renewable resources from the Beaufort Sea, other than commercial wildlife harvesting; or (b) any government project, undertaking or construction whether federal, territorial, provincial, municipal, local or by any Crown agency or corporation, except government projects within the limits of Inuvialuit communities not directly affecting wildlife resources	IFA s.2
Environment	Means the components of the Earth, and includes: (a) land, water and air, including all layers of the atmosphere, (b) all organic and inorganic matter and living organisms, and (c) the interacting natural systems that include components referred to in paragraphs (a) and (b).	CEAA s.2
Environmental Assessment	Means, in respect of a project, an assessment of the environmental effects of the project.	CEAA s.2
Environmental Effect	Means, in respect of a project, (a) any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*,	CEAA s.2

TABLE C: DEFINITIONS		
Term	**Definition**	**Source**
	(b) any effect of any change referred to in paragraph (a) on i. health and socio-economic conditions, ii. physical and cultural heritage, iii. the current use of lands and resources for traditional purposes by Aboriginal persons, or iv. any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, or (c) any change to the project that may be caused by the environment.	
Exclusive Right to Harvest	Means the sole right to harvest the wildlife referred to in paragraphs 12(24)(b) and (c) and 14(6)(b) to (d), to be allocated the total allowable harvest and to permit non-Inuvialuit to harvest any such wildlife.	IFA s.2
Fish Habitat	Means the spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.	*Fisheries Act*
Follow-up Program	Means a program for (a) verifying the accuracy of the environmental assessment of a project, and (b) determining the effectiveness of any measures taken to mitigate the adverse environmental effects of the project.	CEAA s.2
Furbearers	Means all species of game that are or may be harvested by trapping and, for greater certainty but without limiting the generality of the foregoing, includes: Castor including beaver; Alopex including white fox, arctic fox; Lutra including otter; Lynx including lynx; Martes including martens and fishers; Mephitis including skunk; Mustela including ermine, weasel, least weasel and mink; Ondatra including muskrat; Tamiasciurus including red squirrel; Vulpes including red, cross, black and silver fox; Gulo including wolverine; Canis including wolves and coyotes; Marmota including marmots; Lepus including hares; Spermophilus including ground squirrels; but does not include members of the genus Ursus including black and grizzly bears;	IFA s.2
Gross Domestic Product	Defined as the complete unduplicated value of the goods and services produced in an economic territory of a country or region during a specific period of time.	Statistics Canada 2009a
Inuvialuit	Those people known as Inuvialuit, Inuit or Eskimo who are beneficiaries under [the *Inuvialuit Final Agreement*] by reason of the settlement of their claim to traditional use and occupancy of the land in the ISR and who are represented by the Committee for Original Peoples" Entitlement (COPE) and, where the context requires, includes the Inuvialuit Regional Corporation, the	IFA s.2

TABLE C: DEFINITIONS		
Term	**Definition**	**Source**
	Inuvialuit Land Corporation, the Inuvialuit Development Corporation, the Inuvialuit Investment Corporation, the Inuvialuit community corporations and any other corporation, trust or organization controlled by the Inuvialuit that may be established by or pursuant to [the *Inuvialuit Final Agreement*]. Inuvialuit includes the Inuvialuit Game Council and the Hunters and Trappers Committees.	
Inuvialuit Corporations	Means the Inuvialuit Land Corporation, the Inuvialuit Development Corporation, the Inuvialuit Investment Corporation, the Inuvialuit Regional Corporation, the Inuvialuit community corporations, and any other corporations controlled by the Inuvialuit established by or pursuant to this Agreement.	IFA s.2
Inuvialuit Lands	Means all lands provided to the Inuvialuit by or pursuant to the IFA.	IFA s.2
Inuvialuit Settlement Region	Means that portion of the Northwest Territories shown in Annex A of the IFA.	IFA s.2
Invasive Plants	Refer to plant species (native or introduced) that have the ability to out-compete native species when introduced into a particular environmental setting.	Haber 1997
Life of the Project	The planned length of time the development will be operational, as determined by the Developer in its Project Description.	EIRB
Local Study Area	The area within 0.5 km of the Highway center-line (1 km total width).	
Mitigation	Means, in respect of a project, the elimination, reduction or control of adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through re-placement, restoration, compensation or any other means.	CEAA s.2
Noise	Loud, unwanted, unpleasant or unexpected sound.	
Permafrost	A ground condition of either soil or rock that remains at or below 0ºC for long periods. The minimum period is at least one full year.	TAC 2010
Precautionary Principle	Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.	CEPA 1999
Project	Means, in relation to a physical work, any proposed construction, operation, modification, decommissioning, abandonment or other undertaking in relation to that physical work.	CEAA, s.2
Propagule	A structure in a plant from which a new individual may arise, and which may often also be a unit of dispersal.	Begon et al. 1990
Regional Study Area	The area within 15 km of the Highway center-line (30 km total width).	

TABLE C: DEFINITIONS

Term	Definition	Source
Residual Effects	Residual effects are those effects remaining after the application of appropriate mitigation/ management measures.	
Resource Use	Defined as subsistence and recreational use of well managed renewable resources is desirable and consistent with their conservation.	Community of Tuktoyaktuk et al. 2008; Community of Inuvik et al. 2008
Responsible Authority	In relation to a project, means a federal authority that is required pursuant to subsection 11(1) to ensure that an environmental assessment of the project is conducted;	CEAA, s.2
Subsistence Usage	Means: a) with respect to wildlife other than migratory game birds, migratory non-game birds and migratory insectivorous birds, subject to international conventions, the taking of wildlife by Inuvialuit for their personal use for food and clothing and includes the taking of wildlife for the purpose of trade, barter and, subject to section 12, sale among Inuvialuit and trade, barter and sale to any person of the non-edible by-products of wildlife that are incidental to the taking of wildlife by Inuvialuit for their personal use; and b) with respect to migratory game birds, migratory non-game birds and migratory insectivorous birds, subject to the *Migratory Birds Convention Act*, the taking of such birds by Inuvialuit for their personal use for food and clothing, and includes the taking of such birds for the purpose of trade Inuvialuit and trade, barter and sale to any person of the non-edible parts of such permitted under regulations made pursuant to *Migratory Birds Convention Act*.	IFA s.2
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs	Brundtland Commission
Valued Component	The components of the environment that are valued by society are the recommended focus of an assessment.	Beanlands and Duinker 1983
Valued Ecosystem Component	Environmental attributes or components identified as a result of a social scoping exercise as having legal, scientific, cultural, economic, or aesthetic value.	Sadar 1994
Valued Socio-Economic Component	The socio-economic and cultural components, identified as a result of a social scoping exercise, that have a positive direct or indirect influence on the lives and circumstances of people, their families and their communities.	MVEIRB 2007
Wildlife	All fauna in a wild state other than reindeer.	IFA s.2

For the purposes of these Terms of Reference, the following pairs of terms have the same meaning and may be used interchangeably in this document:

TABLE D: TERMS WITH THE SAME MEANING

Term 1	Other Term(s)
Highway	Project
Development	Project
Developer	Proponent, Project Team, Project Partnership
Effect	Impact
Environmental Assessment	Impact Assessment, Impact Review

Please note that all references in this document to the IFA are to: The Inuvialuit Final Agreement, As Amended, Consolidated Version, April 2005.

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
4.0	**Executive Summary**	Executive Summary
5.0	**Introduction**	1.0
5.1	**Introduction to the Developer**, Consultants, Contractors and key personnel that prepared the EIS. Contact information and record of the environmental performance.	1.1, 1.1.1, 1.1.2
5.2	**Contextual Summary of the Development** Brief summary of the development, location, components, phases, spatial extent, temporal extent, workforce, and equipment, associated activities, schedule, and cost.	1.2
5.3	**Purpose and Justification**, including any regional and national interests.	1.3
5.4	**Development Setting** General overview of the geographic, ecological, social, economic and cultural setting and similar information for all considered alternatives.	1.4
5.5	**Permits and Authorizations** and all land-tenure requirements (including area and ownership), and on any non-regulatory requirements that may be needed for the development to proceed.	1.5
5.6	**Study Strategy and Methodology** Steps in EIS Preparation. Approach, strategy, and methodology and justification. Guidance documents or BMP's used or modified for proposed construction and operation – Plus, justification for modifications. How EIRB Goals and Principles were incorporated into the EIS Methodology.	1.6
5.6.1	**Traditional Knowledge**	
	How TK influenced assessment results and overall Project design. Includes, details of how the Developer and TK holders have worked together; where TK and scientific knowledge differed and how these differences were resolved; TK Study methodology; How TK was gathered and verified. Summary of issues, concerns, and recommendations arising from TK studies. Discusses how, issues, concerns, and recommendations were responded to.	1.6.1, 1.6.3, 1.6.5, 3.1.2, 3.1.9, 3.1.9, 3.1.10, 3.1.10, 4.1.2, 4.3.9, 6.0
5.6.2	**Engagement and Consultation**	
	Issues and concerns raised by potentially affected parties, including communities, regulators and other reviewers. How these issues and concerns have been or will be addressed.	1.6.2
	Summary of the public engagement process in the EIS, including the following: Community, competent authority or Party contacted; Contact names; Dates of contact; Communication/consultation format ; and Reason(s) for communication/consultation, and topic(s) of discussion, including the issues and concerns that were raised, and how the issues and concerns were responded to and/or resolved.	1.5, 1.5.1, 1.5.7, 1.5.2, 1.6.1, 1.6.2, 1.6.3, 1.6.4, 3.2.8, 3.2.9, 4.3.5, 4.3.6, 4.3.7, 5.3, Appendix B

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	Any commitments made by the Developer as a result of the communication/ consultation.	1.6.1, 1.6.2, 1.6.4, 4.4.3
	How the planning, design and/or implementation of the proposed development was influenced and/or changed as a result of consultation and by any issues and concerns raised.	1.6.5, 2.1.1, 2.1.2, 2.1.2, 2.2.1, 2.2.4, 2.2.7,4.4.5, 6.0
5.6.3	**Recognition of IFA and CPP**	
	Potential development affects on the various land categories identified in applicable community's CCP. Demonstration that Developer has reviewed applicable CPPs and consulted with appropriate communities and organizations about any potential conflicts. Mitigation measures and commitments to eliminate potential impacts potentially caused by the development to identified category lands and waters. Environmental Management Integration Plan: demonstration of how information and guidelines from CCPs and other regional plans will be adhered to and complied with.	1.5, 1.6.2, 1.6.3, 3.0, 4.0, 6.0
5.6.4	**Sustainability Goals**	
	Summary of how the principles of sustainability were incorporated into the Project and how sustainability goals have been achieved.	1.6.4
	Provides a methodology and list of indicators used.	1.6.4
	The extent to which the development makes a positive overall contribution towards environmental, social, cultural and economic sustainability – locally, regionally, territorially, and nationally.	1.6.4, 4.0, 5.3, 5.4
	How the planning and design of the development have considered how it affects achieving sustainable development.	1.6.4, 2.0, 4.0
	How monitoring, management and reporting systems have incorporated indicators of sustainability.	1.6.4, 4.0, 6.0, 7.0
	How the public and communities have been given opportunity to participate in and contribute to the planning and design of the development and that their views have been considered in the review process.	1.6.2, 2.0, Appendix B
5.6.5	**Precautionary Principle**	
	Identifies which Project components may warrant a precautionary approach. Discusses the potential for serious or irreversible adverse impact to the environment as a result of the Project and how they can be avoided. Describes ways to reduce the risk to the environment, including a discussion of Project design and available technology with respect to effectiveness and cost.	1.6.5, 2.2, 3.0, 4.0, 5.0, 6.0
6	**Detailed Project Description**	
	Plus, required management plans, and management related activities.	1.5, 2.0, 4.0, 6.0, 7.0, Appendix E
6.1	**Alignment Alternatives**	
	Information on the preferred alignment and the alternatives considered.	2.1, 2.2

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	Plus, information on the nature and rationale for any changes since the Project Description submission.	1.6.2, 2.0, 2.1, 2.2
6.2	**Scope of Project Components and Activities**	
	Description of Project components, their timing, and location.	2.0, 2.6
	Description of related Project activities, their timing and location.	2.0, 2.6, 4.0, 7.0
	Including as applicable: Construction, operation and maintenance; Closure, decommissioning and restoration; Modification; and Abandonment of permanent and temporary structures.	2.6
6.3	**Development Phases and Schedule**	
	Location, spatial and temporal extent of Project components and activities as they relate to workforce, roles and responsibilities of governing agencies; and costs.	2.7
6.3.1	**New Work and Additional Field Studies Required**	
	Discussion of field work conducted, since filing the Project Description, and any additional field work proposed to be conducted, including a schedule and how results may affect the environmental review and the final decision on the development. Explanation of why this work wasn't included in the current development submission.	2.7.7
6.4	**Life of the Project**	
	How this development fits with the overall goals, objectives, and long term planning of the Government of the Northwest Territories (GNWT) for Territorial Highways. Including: responsible governing bodies, funding sources, anticipated use, government response to increased use, contribution of the Project to the objectives of the Government of Canada.	2.7.5, 2.8
6.4.1	**Other Parties**	
	Roles and responsibilities of the Hamlet of Tuktoyaktuk and the Town of Inuvik to support and promote this development proposal, including long-term management.	2.7.5
7	**Consideration of Alternatives**	
7.1	**Alternative Means of Carrying out the Project**	
	Discussion and analysis of alternative technical and economical options, their feasibility, environmental effects, and how they contribute to sustainable development in the ISR.	1.6.2, 2.1, 2.2, 2.3, 2.4, 2.5, 4.0
	Evaluation of relationships and interactions among the various components of the ecosystem, including affected communities.	2.2, 4.0
	Discussion of environmental effects, and technical and economic feasibility for the preferred option and comparison to alternatives.	2.2, 4.0, Appendix F
	Criteria and/or constraints used to identify any alternative means as acceptable or unacceptable, and how these criteria and/or constraints were applied.	1.6.2, 2.1, 2.2, 3.0, 4.0
	Rationale for selection of route and rejection of alternatives. Identification of the environmental effects of the various route alternatives.	1.6.2, 2.2.6, 2.2.7, 4.2

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
7.2	**Alternative Route Options**	
	A description of each alternative route considered and the criteria for selecting them.	1.6.2, 2.1.2, 2.2
	Environmental assessment of the alternatives to substantiate their inclusion as viable alternatives.	2.2, 4.2
	How or why they are not environmentally, technically and/or economically feasible (constraints), and the rationale for rejecting any alternatives that are excluded from further assessment.	2.1, 2.2, 2.3, 2.7.6
	How community engagement/consultation, TK and valued components (from the impact assessment) have influenced these determinations.	1.6.1, 1.6.2, 1.6.3
	Answers to the following safety questions: What makes the preferred alignment safer than the alternative routes? Which parts of the alternate routes are dangerous and why? How many dangerous areas are present in each of the three routes? How much additional risk is posed by these dangerous features, compared to the preferred alignment? What mitigations can be put in place to alleviate these additional risks? What is the cost of these additional risk mitigation features? What sources of information were used in these determinations?	2.1, 2.2, 2.3, 2.4, 2.7
8.0	**Key Issues and Study Area Boundaries**	
8.1	**Key Issues**	
	Identification of VCs, for which effects have been predicted, and justification of the methods used to select them.	4.1, 4.1.2
8.2	**Study Boundaries**	
8.2.1	**Spatial Boundaries**	
	Description of the boundaries used to assess each biophysical or socio-economic element, for all components of the development.	4.1.3
	Justification and rationale for all of the study area boundaries.	4.1.3
	Description of the boundaries in a regional context showing existing and planned future land use, surface disturbance, and any current infrastructure.	3.2.9, 4.1.3
8.2.2	**Temporal Boundaries**	
	Description of temporal boundaries for construction, operation, maintenance, and where relevant, closure, decommissioning and restoration of the sites affected by the development.	2.6, 2.7, 4.1.3
	Discussion of seasonal and annual variations of environmental components, as applicable, in relation to each phase of the development.	2.6, 2.7, 4.1.3

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
9	**Existing Environment and Baseline Information**	
	Identification of all potential direct and indirect biological, physical and human elements which could be affected by the proposed development, focusing on relevant issues and considering historical conditions.	3.0
	List of Elements and Goal statements, plus any additional elements identified by the developer. Justification for any deviation from the elements used in the EIRB goals.	4.0
	Details on any data manipulation, including accuracy assessments, confidence intervals, and margins of error.	3.0
9.1	**Biophysical Environment**	
	Demonstration of the Developer's understanding of the biophysical environment of the proposed development area, through the presentation of appropriate and current data on the following:	3.1
	Terrain, Geology, Soils and Permafrost;	3.1.1
	Climate;	3.1.2
	Air Quality;	3.1.3
	Noise;	3.1.4
	Water Quality and Quantity;	3.1.5, 3.1.6
	Fish and Fish Habitat;	3.1.7
	Wildlife and Wildlife Habitat;	3.1.9
	Birds and Bird Habitat; and	3.1.10
	Vegetation.	3.1.8
9.2	**Human Environment**	
	Demonstration of the Developer's understanding of the Human environment of the proposed development area, through the presentation of appropriate and current data on the following:	3.2
	Demographics;	3.2.2
	Regional and Local Economies;	3.2.3
	Education, Training and Skills;	3.2.4
	Infrastructure and Institutional Capacity;	3.2.5
	Human Health and Community Wellness;	3.2.6
	Socio-cultural Patterns;	3.2.7
	Harvesting;	3.2.8
	Land Use; and	3.2.9
	Heritage Resources.	3.2.10
10	**Impact Assessment**	
	Methods used for the environmental effects assessment, in sufficient detail so the reviewers can understand the rationale, logic, assessment process, and how conclusions were reached.	4.1, 4.2, 4.3, 4.4, 4.5

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	Description of environmental effects of all development components over all phases of the development, including long-term operations and maintenance, including: Direct, indirect, reversible, irreversible, short-term, long-term, and cumulative;	4.0, 5.0
	The location, extent, and duration of affected elements and their overall impact;	4.1, 4.2, 4.3
	Focus on the biophysical and socio-economic elements (valued components) identified for the development;	4.0
	Reference of impacts to elements and goal statements;	4.0
	Quantified confidence levels for impact predictions that can be used in follow monitoring programs to verify predictions; and	4.0, 5.4.1
	Consideration of the historic biophysical and human environment conditions in impact assessment and mitigation/ reclamation plans.	1.6.2, 3.0, 4.0, 5.0, 6.0
10.1	**Biophysical Components**	
	Potential impacts of the Project on physical environment VECs.	4.2
	Assessment of the Areas of Concern.	4.0
	The nature of potential impacts and how conclusions were reached, for each VEC.	4.2, 5.4.1
	Clear description of the path from the baseline (current) conditions, to potential impacts, mitigation, residual impacts and determination of significance.	4.2
	Consider how natural variation or events (e.g., Climate Change) could affect the descriptions of Project impacts.	2.6, 3.1.2, 4.5
10.1.1	**Terrain, Geology, Soils, and Permafrost**	
	Potential impacts of the Project on terrain, geology, soils and permafrost, including a consideration of:	4.2.1
	Slope and soil stability;	4.2.1
	Erosion on overland low angle sloping terrain;	4.2.1
	Subsidence;	4.2.1
	Granular resource extraction areas (include quantity and quality of granular resources);	4.2.1
	Thaw slumps and compaction of organic peatlands and potential for melt of ice-rich ground;	4.2.1, 4.2.6
	Drainage beside and beneath the road;	4.2.1, 4.2.4
	Channelization and non-channelization flow; and	4.2.1, 4.2.4
	Consideration of mitigation to prevent degradation of permafrost.	2.6, 4.2.1

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	With respect to potential impacts of the Project on permafrost, include the consideration of: Permafrost as a design feature in the road bed; failure modes analysis and associated contingency plans; Thermal condition, active layer thickness, thaw depth, distribution and Stability; Ice rich soils (thaw settlement, thermokarst) permafrost thaw and related settlement; Frost heave of frost susceptible soils in thin permafrost as well as seasonally frozen soils; Thaw or settlement-related impacts on drainage and surface hydrology; and Shorelines, channels, taliks.	2.6, 4.2.1, 4.2.4
	Combined impacts of the Project and tundra fires.	4.5.4
10.1.2	**Air Quality**	
	Potential impacts of the Project on air quality including a consideration of: the Project activities and components which would be sources of air emissions;	4.2.2
	Emissions of concern by source for each Project phase, including quantity, timing and duration, normal operation conditions and upsets;	4.2.2
	If appropriate, secondary particulate matter, diesel particulate matter, and air pollutants on the List of Toxic Substances in Schedule 1 of CEPA Registry;	4.2.2
	Air quality parameters that could be affected by these emissions;	4.2.2
	Acid deposition;	4.2.2
	How changes in air quality could impact humans, wildlife and vegetation (short-term and long-term over the Project lifespan);	4.2.2, 4.2.6, 4.2.7
	Ice fog, visibility; and	4.2.2
	Terrain.	4.2.2
	Also includes: Discussion of relevant territorial, provincial and federal air quality standards or guidelines, including their purpose and use in relation to the Project phases; Consideration of the CCME's guidance document (CI and KCAC); and Discussion and evaluation of dust suppression techniques.	3.1.3, 4.2.2
10.1.3	**Noise**	
	Potential impacts of Project-related noise, including a consideration of: Project components or activities that could produce noise levels of concern, including source location, timing and duration;	4.2.3
	Terrain and weather;	4.2.3
	Disturbance to fish, wildlife and birds including barren-ground caribou and grizzly bear;	4.2.3, 4.2.5, 4.2.7
	Disturbance of harvest and recreational activities, including tourism;	4.2.3
	Potential impacts to harvesting activities;	4.2.3

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	Impacts to communities;	4.2.3
	Discussion of relevant territorial, provincial and federal noise standards or guidelines, including their purpose and use in relation to the Project phases;	3.1.4, 4.2.3
	Comparison of anticipated noise levels along the highway with current industrial, municipal or ambient noise levels;	3.1.4, 4.2.3
	Assessment of the potential health impacts related to Project-related changes in noise levels, including potential impacts of sleep disturbance and annoyance; and	4.2.3
	Description of the proximity of the Project to sensitive receptors and environmental elements.	4.2.3
10.1.4	**Water Quality and Quantity**	
	Potential impacts of the Project on water quality and quantity, including a consideration of: Changes to surface drainage patterns and surface water hydrology including changes caused by Project-related impacts on terrain, soils and permafrost;	4.2.4
	Hydrogeological resources;	3.1.6, 4.2.4
	Drinking water quality for humans and wildlife;	3.1.5, 4.2.4
	Recreational water quality;	3.1.5, 4.2.4
	Discharge or seepage of wastewater effluent, contaminants, chemical additives;	4.2.4, 4.3.4, 4.4.3
	In-stream activities (e.g. watercourse crossings);	4.2.4
	Changes to water quality at water crossings (bridges, culverts and other wetted areas);	4.2.4
	Changes to water quality due to thaw slumps;	4.2.4
	Erosion, sediment deposition, sediment re-suspension;	4.2.4
	Dust and dust suppression;	4.2.4
	Increased turbidity;	4.2.4
	Subsidence;	4.2.4
	Slope stability;	4.2.4
	Flow or water levels including the formation of frost bulbs and related icings at watercourse crossings;	4.2.4
	Water withdrawal and volume of withdrawal; and	1.5.1, 4.2.4
	Gravel extraction.	1.5.1, 4.2.4
10.1.5	**Species of Concern**	
	Consideration of any change that the Project may cause to a listed wildlife species, its critical habitat, or the residences of individuals of that species, as outlined in subsection 2(1) of SARA.	4.2.7
	Discussion of the potential impacts of the Project on species of concern and proposed mitigation in relation to applicable legislation, policy, management plans, recovery strategies, action plans or land use planning initiatives.	4.2.7

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
10.1.6	**Fish and Fish Habitat**	
	Potential impacts of the Project on VECs related to fish and fish habitat, including: Proposed watercourse crossings and temporary vehicle crossing methods;	4.2.4, 4.2.5
	Standards or guidelines related to watercourse crossings that would be applied;	1.5.1, 4.2.4, 4.2.5
	Relevant policies, management plans or other measures to protect or enhance fish and fish habitat, including timing restrictions, protected areas or regulations;	1.5.1, 4.2.4, 4.2.5
	Disruption of sensitive life stages or habitat including loss of substrate habitat, known sensitive or important sites;	4.2.4, 4.2.5
	Features such as in-stream structure, riparian zones, water quality and flow regimes;	3.1.5, 3.1.6, 3.1.7, 4.2.4, 4.2.5
	Impacts on food resources;	4.2.5,4.3.7
	Impacts on water quality or quantity;	4.2.4, 4.2.5
	Distribution or abundance;	4.2.5
	Sensitive or important areas or habitat;	4.2.5
	Contaminant levels in harvested species that could be changed by the Project, if applicable;	4.2.5
	Fish health and condition;	4.2.5
	Blockages to movement;	4.2.5
	Blasting (if required);	4.2.5
	Dredging or disposal of sediments;	4.2.5
	Underwater noise associated with Project activities;	4.2.5
	Water withdrawal;	1.5.1, 4.2.5
	How Project-related changes in harvest pressures could impact the resource;	4.2.5, 4.3.7
	Effects to fish populations and harvest activities;	4.2.5
	Description of any works that may result in potential impacts to fish and fish habitat that cannot be avoided or mitigated, and that may result in harmful alteration, disruption, or destruction (HADD) on fish habitat;	4.2.5
	The condition(s) to which the ROW (instream and riparian) and temporary work areas would be reclaimed or restored, and maintained once construction has been completed;	4.2.5
	Criteria for evaluating the success of mitigation or reclamation measures, and indicate when and how this evaluation would be conducted; and	4.2.5, 5.4.1, 6.0, 7.0
	The monitoring program for fish and habitat resources of waterbodies along the highway corridor.	4.2.5, 7.0
10.1.7	**Wildlife and Wildlife Habitat**	
	Potential impacts of the Project on VECs related to wildlife or wildlife habitat, including a consideration of: Direct and indirect alteration of habitat including Project footprint impact;	4.2.7

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	Visual or auditory disturbance, including habitat avoidance and effective habitat loss in relation to Project facilities or activities;	4.2.7
	Wildlife mortality due to harvesting and vehicle collisions;	4.2.7
	Disruption of sensitive life stages or habitat;	4.2.7
	Wildlife movement patterns, home ranges, distribution and abundance;	4.2.7
	Sensitive or important areas or habitat;	4.2.7
	Population cycles;	4.2.7
	Predatory-prey relationships;	4.2.7
	Increased human-wildlife interactions;	4.2.7
	How Project-related changes in harvest pressures could impact the resource;	4.2.7, 4.3.7
	Contaminant levels in harvested species that could be changed by the Project;	3.1.9, 4.2.7
	Wildlife health and condition; and	4.2.7
	Discussion on the duration and geographic extent of potential impacts in relation to how wildlife populations and harvest activities could be affected.	4.2.7, 4.3.7
10.1.8	**Birds and Bird Habitat**	
	Potential impacts of the Project on VECs related to birds and bird habitat, including a consideration of: Disruption of sensitive life stages or habitat;	4.2.7
	Direct and indirect alteration of habitat including footprint;	4.2.7
	Sensitive or important areas or habitat;	4.2.7
	Visual or auditory disturbance, including habitat avoidance in relation to Project facilities or activities and light disturbance;	4.2.7
	Bird distribution or abundance;	4.2.7
	Contaminant levels in harvested species that could be changed by the Project;	4.2.7
	Bird health and condition;	4.2.7
	How Project-related changes in harvest pressures could impact the resource;	4.2.7
	Project-induced subsidence;	4.2.7
	Highway maintenance;	4.2.7
	Attraction of predators of birds and bird eggs to the Project, or the provision of nesting or denning habitat for predators and scavengers;	4.2.7
	Potential mortality from collisions with temporary or permanent tall structures or wires;	4.2.7
	Potential mortality from vehicle collisions.	4.2.7
10.1.9	**Vegetation**	
	Potential impacts of the Project on vegetation, including consideration of: Alteration or loss of species, or vegetation assemblages that are rare, valued, protected or designated sensitive or important areas or habitat;	4.2.6
	Sensitive or important areas;	4.2.6

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	Introduction of non-native and/or invasive species;	4.2.6
	How road dust might impact vegetation and surface albedo near highway;	4.2.6
	How changes might impact permafrost and the highway itself;	4.2.6
	Changes to the soil, hydrological or permafrost regimes;	4.2.1, 4.2.4, 4.2.6
	Re-establishment of vegetation and reclamation of borrow sites and other disturbances;	2.6.8, 4.2.6
	How Project-related changes in harvest pressures could impact vegetation resources;	4.2.6, 4.3.6, 4.3.7, 4.3.8
	Changes in contaminant levels in harvested species that could be changed by the Project, including parts of plants such as roots, leaves and berries; and	4.2.6
	Vegetation control.	4.2.6
10.1.10	**Biodiversity**	
	Discussion about changes to the biodiversity of the Study Area(s) during construction, operations and any post-reclamation and the significance of these changes in a local and regional context. Description of how the Project could result in changes to biodiversity, including a consideration of: Ecosystem and habitat loss;	4.2.2, 4.2.5, 4.2.6, 4.2.7
	Habitat fragmentation/ barriers to movement and gene flow;	3.1.9, 4.2.7
	Ability of habitat or species to recover;	4.2.6,4.2.7
	Response to edge effects;	4.2.7
	Species distribution and abundance;	4.2.6, 4.2.7
	Invasive/non-native species;	4.2.6
	Changes to special management areas;	4.3.8
	Pollution – spills, runoff, water and emissions to air;	4.2.2, 4.2.4, 4.4
	Species of special management concern;	3.1.7, 3.1.8, 3.1.9, 3.1.10, 4.2.6, 4.2.7
	Project-related changes in harvest levels; and	4.2.7, 4.3.7
	Changes to important habitat areas.	4.2.7
10.1.11	**Country Foods**	
	Linkages and related sources of contaminants and other impacts in relation to the potential for contamination of country foods.	3.1.9, 3.2.6, 4.3.7
	Identification of which country foods are consumed, or expected to be consumed, contaminants of concern, and an indication of whether transport pathways of contaminants into country foods will result from the proposed Project and associated activities.	3.1.9, 3.2.6, 4.3.7

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
10.2	**Human Environment Components**	
10.2.1	**General**	
	Positive and negative impacts of the Project on the VCs selected for the human environment.	4.3, 5.4.1
	Potential changes to social, cultural, and economic conditions that may occur as a result of Project-related biophysical impacts.	1.6.2, 4.3, 4.4.5, Appendix F
	Social, cultural, and economic impacts, both positive and negative, of year-round access between Tuktoyaktuk and Inuvik, and opened access to harvesting areas and areas of ecological and cultural importance.	1.6.2, 4.3, Appendix F
	Direct and indirect impacts of the Project that may enhance and/or impair the current social, cultural, and economic ways of life in the communities, and community aspirations for the future.	1.6.2, 3.2.10, 4.3, Appendix F
	The needs and interests of various segments of the local populations (e.g. youth, Elders, women, harvesters), and how the Project may affect each of them.	1.6.2, 3.2.4, 4.3
	Possible reactions to Project-related effects, as well as the capacity of local residents, communities, and institutions to respond to the Project.	1.6.2, 4.3
	How people, communities, institutions, and governments might be expected to adapt to Project-induced changes to the human and biophysical environments.	4.3
	Local residents' perceptions of impacts and how these are grounded in their culture, social organization, and historical experience.	1.6.2, 4.3
	The limitations of this study in identifying any of the potential effects.	4.3
	How mitigation would address impacts experienced by residents: by age group, gender and ethnicity (where appropriate).	4.3, 5.4.1, 6.0
	How Inuvialuit organizations will be involved in the development, application and ongoing evaluation of mitigation measures. Parties responsible for the implementation of mitigation measures and how a lack of resources and/or information may have the potential the effectiveness of mitigation measures.	1.5.1, 4.2, 4.3, 6.0
10.2.2	**Demographics**	
	Potential impacts of the Project on demographics and mobility, including a consideration of:	4.3.1
	Age and gender;	4.3.1, 4.3.2
	Residence patterns; and	4.3.1
	In/out migration, by community and for the Inuvialuit Settlement Region (ISR).	4.3.1
10.2.3	**Regional and Local Economies**	
	Potential impacts of the Project on local, regional (ISR), and territorial economies, including consideration of: Project contribution to the GDP - direct, indirect, and induced economic activities for the regional (to the extent possible), provincial, territorial, and national economies;	4.3.2, Appendix F

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	Direct taxes (estimated) for business and persons;	4.3.2, Appendix F
	Employment and income for every year of construction and operation;	4.3.2, Appendix F
	The extent to which the skills of the available workers match the job requirements;	4.3.2
	The level of interest in Project-related work;	1.6.2, 4.3.2
	Commuting arrangements for workers;	2.6.9
	How any unionized labour could impact employment and income;	4.3
	Hiring opportunities, priority hiring practices;	2.7.3, 2.7.4, 4.3.2
	Skill or certification requirements;	2.7.4, 3.2.4, 4.3.2
	The equitable distribution of benefits to residents and communities in the Project area;	1.6.2, 2.2.4, 2.6.8, 4.3.2, 4.3.8
	Competition for labour between the Project and existing businesses, government institutions and traditional activities and related wage and salary impacts;	1.3, 4.3.2, 4.3.7
	Community income and household economics, including subsistence activities and the sustainability of traditional economies;	3.2.3, 3.2.4, 3.2.8, 4.3.2, 4.3.7
	Local consumer prices, inflation and costs of living, particularly with regard to food, transportation, utilities, and shelter; and	3.2.3, 3.2.4, 3.2.8, 4.3.2, 4.3.5, 4.3.7
	How Project-related impacts on harvested resources or harvest activities (both positive and negative) affect community income and household economies, and sustainability of traditional economies.	4.3.7, 4.3.8, 4.4.5, 5.4.1
10.2.4	**Education, Training and Skills**	
	Describe and evaluate the potential impacts of the Project on education, training and skills, including a consideration of: Participation in education and training, by age, gender and ethnicity;	4.3.3
	Educational achievement and attainment;	4.3.3
	Literacy levels (English and Inuvialuktun);	4.3.3
	Education and training programs required for Project-related construction and operation employment, including: Local and regional training opportunities available to local people;	3.2.4, 4.3.3
	Timing and duration of programs, in relation to the Project schedule;	2.7.2, 3.2.4, 4.3.3
	Which skills and experience gained in the Project workforce that could be applied to other available projects or sectors; and	2.7.4, 4.2.7, 4.3.3
	Programs that would be provided by, or sponsored by, the Proponents.	1.1.2, 2.7.4, 4.2.7, 4.3.3

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
10.2.5	**Infrastructure and Institutional Capacity**	
	Describe and evaluate the potential impacts of the Project on infrastructure and institutional capacity, including a consideration of: Temporary and permanent changes to infrastructure and services and the capacity of institutions and organizations to deliver those services identified in the baseline description;	1.3, 4.3.1, 4.3.4
	Changes in the capacity of the service industries to provide local goods and services;	1.3, 4.3.1, 4.3.4
	Changes in the availability, quality and affordability of housing in communities, including factors that influence accessibility to housing (e.g. age, gender); and	4.3.4
	Measures to address any changes in the level of demand for infrastructure and institutional capacity and an estimate of incremental costs to municipal, regional, territorial, and federal governments resulting from the Project.	4.3.2, 4.3.4
10.2.6	**Human Health and Community Wellness**	
	Potential impacts of the Project on human health and community wellness, including a consideration of: Local perceptions of physical, mental and social health and changes in the quality of life, including differences or similarities in perceptions within and between Inuvik and Tuktoyaktuk;	1.6.2, 4.3.5, 4.3.6, 4.3.7
	Measures of mortality and morbidity, and of social pathology and dysfunction such as teen pregnancies, sexually transmitted infections, communicable diseases, substance abuse, family violence, and crime; and	3.2.2, 3.2.6, 4.3.5
	Changes in diet and use of country food.	1.6.2, 3.2.6, 3.2.8, 4.3.5, 4.3.7
	How Project-related changes in the quality of country food affect health, including possible sources of contaminants, exposure pathways and consumption patterns (i.e., age group, sex).	1.6.2, 3.1.9, 3.2.6, 4.3.5, 4.3.7
	How Project-related impacts on harvested resources or harvest activities affect health and wellness.	1.6.2, 4.3.5, 4.3.6, 4.3.7
	Describe and evaluate potential impacts that may arise from changes in: Water quality and air quality;	4.2.4, 4.2.5, 4.3.5, 4.4
	Poverty and homelessness;	3.2.4, 4.3.5
	Literacy skills and education levels; and	3.2.4, 4.3.3
	The presence or absence of support systems and programs, regionally and locally and their capacity to address human health and community wellness.	3.2.6, 3.2.7, 4.3.6
10.2.7	**Socio-cultural Patterns**	
	Describe and evaluate the potential impacts of the Project on social and cultural patterns and cohesion, including: How Project-related impacts on harvested resources or harvest activities affect social and cultural patterns and cohesion;	1.6.2, 4.3.6, 4.3.7
	Traditional lifestyles, values and culture;	3.2.7, 4.3.6, 4.3.7, 4.3.8, 4.4.5

TABLE E: CONDORDANCE TABLE

ToR Section	Information Requested	EIS Location
	Cultural and spiritual life of the communities, including language loss or retention;	3.2.7, 4.3.3, 4.3.6, 4.3.8, 4.4.5
	Patterns of social organization at the household and community level, including the organization of work, mutual aid and sharing;	3.2.7, 4.3.6
	Family dynamics or structure, including child and elder care;	1.6.2, 3.2.5, 3.2.7, 4.3.5, 4.3.6
	How the influx of tourists, and potential influx of Project-related employees for future projects and workers could impact communities;	1.6.2, 4.3.1, 4.3.2, 4.3.4, 4.3.6, 4.3.8
	Social relations between residents and non-residents, and between Aboriginal and non-Aboriginal persons; and	1.6.2, 3.2.7, 4.3.1, 4.3.2, 4.3.6, 4.3.8
	Programs that could support cultural patterns and cohesion.	3.2.5, 3.2.7, 4.3.3, 4.3.6
10.2.8	**Harvesting**	
	Potential impacts of the Project, for the preferred and alternate routes, on harvesting during both construction and operation including a consideration of: Changes in access, including increased access to the land and surrounding lakes, as well as increased access to an environmentally and culturally sensitive area (Husky Lakes);	4.3.7, 4.3.8
	Changes in the abundance and distribution of harvested resources, including wildlife, birds, fish and vegetation that would negatively affect harvesting;	4.2.5, 4.2.6, 4.2.7, 4.3.7
	Disturbance of harvest patterns, or loss or alteration of high-value harvest areas;	4.2.7, 4.3.7, 4.3.8, 4.4.5
	Changes in the quality of harvested species (including contamination) that would negatively affect their consumption or sale;	3.1.9, 4.2.5, 4.2.6, 4.2.7, 4.3.7, 4.4.5
	Measures to avoid or minimize changes in the abundance, distribution, or quality of harvested species, or mitigate the consequences of such changes;	4.2.5, 4.2.6, 4.2.7, 4.3.7
	Mechanisms to control Project workforce-related hunting, fishing, or harassment of wildlife; and	4.2.5, 4.2.7, 4.3.7, 6.0
	Mechanisms of resource management agencies and other parties to control hunting, fishing, or harassment of wildlife.	3.1.9, 3.2.8, 4.2.5, 4.2.7, 4.3.7, 6.0
10.2.9	**Land Use**	
	Potential impacts of the Project on land use, including a consideration of various land uses, including: Traditional use; Tourism and changes in tourism access; Industrial use and changes in access;	3.2.9, 4.3.8
	Patterns of use and changes in these patterns; and	3.2.9, 4.3.8
	Impacts on particular sites or features.	3.2.9, 4.3.8

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	Conformity of proposed Project-related land uses with designated land use management areas as described in approved and draft management plans, community conservation plan, and proposed land use designations and identification of discrepancies.	3.2.9, 4.3.8
	An evaluation of the potential impacts of the Project on protected areas and special management areas, including a consideration of the following: Community conservation plans; Regional land use plans; Existing and proposed protected areas; Special management areas; Other proposed special management areas such as parks, sanctuaries or preserves; and Implementation of plans, action plans, strategies and guidelines.	3.2.9, 4.3.8
10.2.10	**Heritage Resources**	
	Describe and evaluate the potential impacts of the Project on cultural heritage and special management areas, including a consideration of the following: Historic, archaeological, paleontological, cultural and heritage resources/ sites/ trails;	3.2.10, 4.3.9
	Resource potential;	3.2.10, 4.3.9
	Encounter of resources during Project activities; and	3.2.10, 4.3.9
	Valued visual and aesthetic locations and their attributes.	3.2.9, 4.3.8
10.3	**Potential Accidents and Malfunctions**	
	Possible accidents or malfunctions, their probable and potential effects on the environment, including impacts on social, economic, and cultural elements of the environment and human health to people in close proximity of accidents or malfunctions, including spills of contaminants for the life of the Project.	4.4
	The process for the implementation of any mitigation measures or contingency plans.	4.4.5
	Discussion of the developer's commitment to having an Environmental Protection Plan (EPP) and Emergency Response Plan (ERP) that would address potential accidents and malfunctions for the life of the Project.	4.0, 4.4, 6.0, Appendix E
	Sensitive elements, including those identified in the IFA and CPPs, of the environment that could be affected in the event of an accident or malfunction over the life of the Project.	4.4
	The probability of impacts, taking into account weather or extreme external events that present contributing factors.	4.4, 4.5
	For each Project phase, the potential accidents or malfunctions that may occur as a result of the Project.	4.4
10.4	**Effects of the Environment on the Project**	
	The effects of the environment on the Project.	4.5
	How the Project is engineered and designed to integrate into its environmental surroundings and operate safely and reliably over its life.	4.5

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	How physical and biological changes in the environment could have implications for the Project.	2.4, 4.5
10.5	**Determination of Significance**	
	Approaches used to determine the significance of effects for each biophysical or socio-economic element assessed	4.1
	Definition of impacts in terms of magnitude, geographic extent, duration, and frequency.	4.0, 4.1
	Justification and rationale for thresholds relating to the impacts criteria and how the impacts criteria inform the assessment about the significance of impacts, under the assumption that mitigation measures will be implemented successfully.	4.1, 4.2, 4.3, 5.4.1
	Positive and negative impacts.	4.1, 4.2, 4.3, 5.4.1
11	**Cumulative Effects**	
	Assessment of cumulative effects, showing that long-term cumulative effects are adequately considered and can be successfully mitigated.	5.0
	Discussion of the incremental contribution of all projects or activities (including operation of the hwy) in the delineated Study Area(s), and of the Project alone, to the total cumulative effect on the VEC or VSC over the life of the Project.	5.0
	Spatial and temporal boundaries for the cumulative effect assessment for each VEC selected.	5.1, 5.2
	Analysis of impacts of Project activities when they are combined with the impacts of other past, present, and future projects and activities.	5.3, 5.4
	Different types of potential impacts, different forms of effects, such as synergistic, additive, induced and spatial or temporal overlap; and impact pathways and trends.	5.0, 5.4.1
	Rationale for the process chosen to carry out the cumulative effects assessment; and description of, and rationale for, the approach and methods used to identify and assess cumulative effect; and the approach of the assessment in the context of the IFA and updated CCPs.	5.0
	Identification and justification of (VECs or VSCs) for all Project components involved in the cumulative effects assessment, including those for alternative routes.	4.1, 5.4
	Evaluation of the potential for this Project to catalyze future projects and the effects these potential projects and the associated loss of remoteness.	1.3, 2.8, 3.2.8, 4.3.2, 5.3, 5.4.1, Appendix F
	Contribution of the Project to a total potential cumulative effect.	5.3, 5.4
	Potential cumulative Project effects in a regional context, considering regional plans, community conservation plans, species recovery plans, management plans, objectives and/or.	5.3, 5.4
	Identification of any changes in the original environmental effects and significance predictions for the Project.	5.4

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
	Effectiveness of the proposed mitigation and/or other restitution measures, the response to such changes, and implications for monitoring and follow-up programs.	4.0, 5.4, 6.0, 7.0
	Proposed management tool(s) for cumulative effects resulting from the proposed Project.	4.0, 5.4, 6.0
12	**Mitigation, Mitigative and Remedial Measures, and Worst Case Scenario**	
	Examination of all mitigation measures, identified during the impact assessment to identify development impacts that could affect wildlife harvesting, from a worst case scenario perspective.	4.2.7, 4.3.7, 4.3.8, 4.4.5
	Discussion and conclusions reached in this chapter are necessary to address the specific requirements of the IFA and have been requested for liability/compensations purposes.	4.4.5
12.1	**Mitigation**	
	Summary table of detailed mitigation commitments of the Developer, including: measures, implementation methods, identified impacts and VCs.	4.2, 4.3, 6.0
12.2	**Mitigation and Remedial Measures**	
	Mitigative and remedial measures designed to reduce or eliminate negative impact to wildlife, wildlife habitat and wildlife harvesting in the EIS.	4.2, 4.3, 6.0
12.2.2	**What Developers Shall Consider**	
	A description of any potential impacts to the biophysical and human environment, wildlife, wildlife habitat, and wildlife harvesting activities.	4.2, 4.3, 5.4, 6.0
	A description of the proposed mitigation to reduce or eliminate potential impacts.	4.2, 4.3, 6.0
	Measures to address sensory disturbances to wildlife, particularly barren-ground caribou and grizzly bear.	4.2.7, 6.0
	An outline of emergency response plans and any management and monitoring plans proposed and/or required for the development to proceed.	4.0, 4.4, 6.0, Appendix E
	Where appropriate, a clear indication of the party responsible for implementing the mitigation.	2.7.5, 4.0, 6.0
	Mitigation to reduce the potential negative effects of a development.	4.2, 4.3, 6.0
	Measures that are built into the design of the development can be included in the discussion of development activities.	1.6.2, 2.6, 3.0, 4.0
	Rationale for mitigation measures and examples of where these measures have been used effectively.	2.6.1, 4.2, 4.3, 6.0
12.3	**Worst Case Scenario**	
	Worst case scenario estimate for negative impacts to wildlife, wildlife habitat and wildlife harvesting, as a result of the proposed development.	4.4.5

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
12.3.1 12.3.2	**Wildlife Compensation, Liability and Worst Case Scenario**	
	The Developer's potential Liability, based on worst case scenario. If there is a possibility that damage to wildlife or wildlife habitat may occur as a result of the Project, the EIRB must recommend terms and conditions relating to mitigative and remedial measures that are necessary to minimize the negative impact of a proposed development on wildlife harvesting. The Worst Case Scenario will be used to calculate a security amount to be held by the federal Minister.	4.4.5
12.3.4	**Wildlife Habitat Restoration**	
	Restoration includes post-development measures that would enhance recovery of harvested populations to pre-development levels. Determining the practicality and potential costs of restoration resulting from a "worst case scenario".	4.4.5
13	**Follow-up and Monitoring**	
	"Follow-up" program for verifying the accuracy of the environmental assessment of the Project, and determining the effectiveness of any measures taken to mitigate the adverse environmental effects of the Project, including: Regulatory and non-regulatory monitoring requirements for the life of the Project; Purpose of each program, responsibilities for data collection, analysis and dissemination, and how results will be used in an adaptive management process; and How Project-specific monitoring will be compatible with the NWT CIMP or other regional monitoring programs.	4.0, 7.0
13.1	**Environmental and Socio-Economic Effects Monitoring**	
	Table with effects monitoring requirements, including: effects, indicators and parameters for each effect or concern; and the target or management goal.	7.0
13.2	**Compliance Monitoring**	
	Environmental Monitoring Inspection Requirements Table, that includes: Current conditions of any applicable permits, licenses and approvals; The frequency, nature, and period of time of inspections; and Demonstrates how the terms and conditions set out in regulatory approvals, licenses and permits, and in the commitments submitted by the Developer will be adhered to and met and will be used by the environmental monitoring to verify and report the work being done.	7.0
13.3	**Environmental Management Plans**	
	Environmental management plans for specific areas of concern to meet environmental goals for life of the Project, including: Methods for the implementation of mitigation measures; Methods for the monitoring of mitigation effectiveness; Reporting mechanism on goals; and Incorporation of plans identified by the Developer in the EIS as being required and other plans deemed necessary.	4.2, 4.3, 6.0, 7.0, Appendix E

TABLE E: CONDORDANCE TABLE		
ToR Section	**Information Requested**	**EIS Location**
13.4	**Socio-economic and Cultural Effects Management, Policies, and Commitments**	
	Management plans, policies, commitments, and arrangements directed at promoting beneficial or mitigating negative impacts to social, cultural, or economic conditions where they have been presented as a form of mitigation. Discuss any requirements for contractors and sub-contractors to comply with these policies.	4.0, 4.3.2, 6.0, 7.2
	Recruitment, training, hiring, pay equity and employment policies, including those policies specifically for Aboriginal and local candidates, and those promoting participation.	1.3, 1.6.2, 4.2.7, 4.3.2, 4.3.3, 7.2
	Contracting and procurement policies, including those which promote local sourcing, and participation of local businesses and how this will be accomplished.	1.3, 1.6.2, 2.2.4, 2.2.6, 4.3.2
	Employment policies, including policies on alcohol and drugs on the job site, harassment policies, firearms policies, work and pay schedules, and any policies related to worker access to harvesting areas.	4.3.8, 7.2
	Commuting and work rotation of workers and contractors.	2.6.9, 4.3
	Policies to managing hunting, fishing and gathering on, or from, the work site by non-Inuvialuit employees and contractors, while respecting the harvest rights of Aboriginal employees and contractors.	3.1.9, 3.2.8, 3.2.9, 4.2.7, 4.3.7, 4.3.8, 6.0
	Occupational health and safety and related training, and emergency response plans for workplace accidents.	4.2, 4.4 Appendix E
	Scheduling of construction activities to accommodate needs of Aboriginal harvesters (employees, contractors, and non-employees).	4.3.8
	Scheduling of work activities to accommodate needs of Aboriginal employees and contractors to pursue other traditional activities.	4.3.8
	Promoting activities and programs that increase community stability and wellness.	1.6, 3.2.6, 4.3
14	**References**	
	Information used to prepare the EIS, including: primary, peer-reviewed literature, government and consultant reports, personal communications, guidelines and best practices.	References

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
SOCIO-ECONOMIC	
The Developer is committed to observing the relevant economic measures of the Inuvialuit Final Agreement (IFA).	Design, Construction, Operations
The Developer is committed to preferential employment opportunities for qualified local residents and contractors.	Construction, Operations
The IFA guidelines for business operation will apply to this Project, giving priority hiring to companies included on the Inuvialuit Business List.	Construction, Operations
The Developer and on-site Project contractors will be responsible for the implementation of focused socio-economic measures, including recruitment and skills training.	Construction
The Developer will install educational signage related to harvesting, fishing, hunting, and responsible use of the Highway at appropriate and highly visible locations.	Operations
The Developer will require that its Project contractor(s) ensure that all heavy equipment operators are suitably trained in proper machinery maintenance and operation; that equipment is regularly inspected and serviced; and that contractor staff obey posted Highway rules (e.g., speed limits, hunting/fishing restrictions).	Construction
The Developer will require that its contractor(s) educate their staff on the prevention of accidents and malfunctions. The training received will be outlined for the Developer, including emergency spill response.	Construction
The Developer commits to ensuring that its contractor(s) have Health, Safety and Environment (HSE) manuals; work procedures documents; and site-specific health and safety plans.	Design, Construction
PLANNING AND DESIGN	
The Developer is responsible for the design and construction of the Highway, including field studies and data collection during Highway design and construction, and future operations funding, similar to other NWT highways.	Design, Construction, Operations
The Developer will conform to the IFA and the Tuktoyaktuk and Inuvik Inuvialuit Community Conservation Plans (CCPs) and will integrate the goals of these documents into the Project's environmental management.	Design, Construction
The Developer will undertake further engineering, environmental and archaeological studies in areas scheduled for construction during that same year.	Design
The Developer is committed to addressing the performance criteria and management goals identified in the ILA's draft Husky Lakes Special Cultural Area Criteria, pending approval.	Design
On approval of the Highway, the Developer commits to further consider Alternative 3 (2010 Minor Realignment) as the final alignment for the Highway.	Design
The Developer commits to using, as a guideline, the design parameters and construction techniques in the Transportation Association of Canada (TAC 2010) *Development and Management of Transportation Infrastructure in Permafrost Regions*. This will include mitigation strategies such as: -Accessing and hauling from borrow sources during the winter months; -Constructing embankments during the winter months;	Design, Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
-Conducting summer construction activities (such as grading and compacting the embankment, and placing of surfacing materials) only when the Highway can be accessed over the embankment; -Stockpiling surfacing material along the embankment during the winter for use in the summer; -Minimizing the surface area of open cut; -Grading slopes to minimize slumping; -Grading material storage and working areas to promote drainage ; -Reclaiming borrow sources when construction is complete by grading slopes to blend with the natural topography and drainage of the surrounding area; -Designing and constructing thick or high embankments to create an insulative layer that promotes the development of a frozen embankment core; -Designing the alignment to avoid unfavorable terrain, such as areas with thick organic deposits and ice-rich polygonal or patterned ground; -Installing culverts to manage seasonal overland flows; -Installing sufficient cross drainage during construction to prevent or minimize potential water ponding; and -Inspecting and maintaining culverts, as needed, in the spring and fall.	Design, Construction
CONSTRUCTION	
The Developer and its contractors will adhere to all applicable legislation, regulations, guidelines, and terms and conditions.	Construction
The Developer and on-site Project contractors will implement the mitigation measures identified in this EIS.	Construction
The Developer is committed to constructing the proposed Inuvik to Tuktoyaktuk Highway, borrow sources, and associated winter access roads in a safe and environmentally responsible manner.	Design, Construction
The Developers and their contractors will meet the standards required for a safe work environment.	Design
The Developer commits to working towards achieving the Environmental Impact Review Board's goal statements for all phases of the proposed development.	Design, Construction, Operations
Blasting, if required, will occur only during winter borrow source development.	Construction
The Developer is committed to building the roadway with 3:1 side slopes.	Construction
The Developer will use winter roads to access borrow sources; permanent all-weather access roads will not be required.	Construction
The Developer is committed to performing the majority of the construction activities during the winter months.	Construction
BORROW SOURCES	
The Developer is committed to limiting the footprint of each borrow source and minimizing the number of borrow sources developed.	Construction.
Borrow pits will be closed as soon as they are no longer required and reclaimed in a progressive manner, as described in the Pit Development Plan.	Construction, Operations, Reclamation
Pit Development Plans will conform to the approving authority's regulations and permitting requirements.	Design, Construction, Operations

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
Pit Development Plans will include mitigation measures to address potential environmental concerns, and operational and reclamation plans. Mitigation measures include: -Developing borrow sources only during winter periods; -Maintaining an appropriate amount of undisturbed land between borrow source locations and any waterbody; and -Applying appropriate erosion and sediment control BMPs for the construction of ditches and cross drainage channels.	Construction
The Developer commits to ensuring that borrow source development is monitored by environmental monitors.	Construction
OPERATIONS	
The Developer, using local contractors, will be responsible for ongoing operation, maintenance, and safety of the Highway.	Operations
The Developer will construct and operate the Highway to GNWT DOT standards and guidelines for public highways.	Construction, Operations
Should the Mackenzie Gas Project proceed, the Developer will work with the Mackenzie Gas Developers to ensure that increasing traffic on the Highway is effectively managed.	Operations
MANAGEMENT PLANS	
An Environmental Management Plan (EMP) will be prepared prior to construction, and will be submitted for regulatory approval prior to use. The EMP will clearly define expectations for compliance monitoring, responsibilities, requirements for training, and reporting.	Construction
The EMP will contain the following types of plans: -Environmental management; -Spill contingency; -Erosion and sediment control; -Pit development for borrow sources; -Fish and fish habitat protection; -Wildlife management; -Health and safety; -Waste management; -Hazardous waste management; and -Archaeological site(s) protection. Where necessary, the Developer and its contractor(s) will seek approval for the plans prior to use.	Design, Construction
SPILL CONTINGENCY PLAN	
The Developer will require that Project contractors prepare spill contingency plans, outlining spill reporting, containment, and clean-up, in accordance with INAC's *Guidelines for Spill Contingency Planning* (1987).	Design, Construction
The Developer will ensure that the Project contractor has appropriate spill response equipment on-site.	Construction
The Developer's contractors will report all spills greater than 5 litres to the GNWT Spill Line and other appropriate agencies.	Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
In the event of a spill, the Developer's contractors will respond according to the site-specific spill contingency plan and the contractor's HSE manual and procedures.	Construction
The Developer will develop and implement an erosion and sedimentation control plan as part of the EMP. The plan will comply with appropriate erosion and sediment control guidelines, GNWT best management practices (currently being prepared in coordination with DFO), and measures outlined in the DFO (1993) *Land Development Guidelines for the Protection of Aquatic Habitat*. Some measures that will be followed include: -Limiting the use of construction equipment to the immediate footprint of the Highway or borrow source; -Minimizing vegetation removal and conducting progressive reclamation at the clear-span abutments, culvert installations and borrow sources; -Keeping ice bridge and ice road surfaces free from soils and fine gravel that may be tracked out by vehicles; -Avoiding the use of heavy equipment in streams or on stream banks during summer months, and the adherence to the DFO *Operational Statement for Temporary Stream Crossings* (DFO 2008), where this is deemed necessary; -Installing silt fencing and/or checking dams, and cross drainage culverts as necessary to minimize siltation in runoff near waterbodies; and -Appropriately sizing and installing culverts, based on hydrological assessments and local experience, to avoid backwatering and washouts.	Design, Construction
The Developer commits to ensuring that any exposed areas will be suitably stabilized prior to the spring thaw period.	Construction
The Developer is committed to using heavy equipment during Highway embankment construction through the winter months when all watercourse crossing locations are frozen.	Construction
FISH AND FISH HABITAT	
No instream work will occur in fish bearing streams during critical time periods.	Construction
Where critical fish habitat cannot be avoided, mitigation will be incorporated into the design.	Construction
Individual site-specific circumstances might preclude complete adherence to DFO Operational statements. In such cases, DFO will be consulted in advance to discuss and approve of proposed plans, which will include mitigation measures necessary to prevent or minimize effects.	Construction
In accordance with DFO (2009a), the installation of culverts in fish bearing streams will not permitted between April 1 and July 15 for watercourses that provide habitat for spring/summer spawners.	Construction
The Developer will consider, at a minimum, stream category when determining the type of structure to be placed at stream crossings.	Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
The Developer will develop and implement a fish and fish habitat protection plan in consultation with DFO that will include mitigation measures such as: -Designing appropriate crossing structures based on site conditions; -Completing primary construction activities during winter months; -Applying erosion and sediment control measures and best practices -Minimizing riparian disturbance (footprint); -Following the DFO *Operational Statement for Clear-span Bridges* (DFO 2009b) where appropriate; -Placing abutments at a sufficient distance from active stream channels; -Employing best management practices for culvert installation; -Annually monitoring for culvert subsidence or lifting; -Constructing in non-fish bearing streams during winter; -Sizing culverts appropriately based on hydrological assessments and local experience; -Maintaining equipment away from waterbodies; -Having on-site spill containment equipment and operators trained to handle spills; -Reported spills will be contained by trained maintenance crews; -Maintaining a sufficient buffer of undisturbed land between borrow sources and waterbodies; -Following DFO *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky 1998); -Following DFO (2010) *Protocol for Winter Water Withdrawal in the Northwest Territories*; -Allowing filtration by natural vegetation; -Installing silt fences at each road-stream intersection; -Building regularly spaced cross-drainage culverts; -Following the DFO *Operational Statement for Culvert Maintenance* (DFO 2009b) where applicable; -Applying spill response measures according to an approved spill contingency plan -Creating and enforcing Regulations or guidelines on fish harvest by FJMC with input from DFO, local fisherman and Hunters and Trappers Committees; -Posting signage at regular, visible intervals on Highway; -Constructing or installing stream crossing structures to avoid the impingement of active stream channels; -Effectively suppressing dust (i.e., through the use of water trucks) during the dry season; and -Following the recommendations of the Water License (once approved)	Design, Construction, Operation
WILDLIFE AND WILDLIFE HABITAT	
General	
The Developer will develop and implement species specific Wildlife Management Plans (WMP) that will include specific mitigation measures for Species at Risk, caribou, grizzly bears, moose, furbearers, and birds.	Design, Construction
The Developer or its contractor(s) will develop Bear Safety Guidelines and will educate staff accordingly.	Design, Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
The Developer's contractor(s) will be responsible for eduating and training staff on applicable practices contained within the Wildlife Management Plans and the Bear Safety Guidelines, including the proper use of non-lethal wildlife deterrent materials (e.g., bear spray).	Construction
-Camps and associated infrastructure will be designed to incorporate features that ensure safety for both personnel and wildlife, including installing adequate lighting, implementing proper waste management, cleaning and maintaining the kitchen and dining area, and implementing appropriate wildlife detection and deterrent strategies.	Design, Construction
Pre-disturbance surveys for critical habitat features (e.g., dens, nests) will be conducted prior to construction, in cooperation with GNWT ENR, as required.	Design, Construction
All wildlife encounters and mortalities will be reported to the environmental monitor, Safety Advisor, and GNWT ENR	Design, Construction, Operations
The Developer will implement general wildlife protection measures along the proposed Highway as follows: -Minimizing loss of habitat and the reduction of habitat effectiveness through Project design; -Educating users of the Highway that wildlife have the right-of-way at all times; -Posting signage along the Highway, emphasizing areas of high wildlife use; -Implementing a policy whereby Project personnel and contractors will not disturb any wildlife or critical habitat features such as dens or nests; -Implementing a system during the construction phase that serves to notify workers of wildlife presence in or near construction areas; -Hiring environmental monitors to during construction to watch for wildlife; -Adhering to spill contingency plans, as required, in a timely manner; -Conducting follow-up monitoring of spill sites to verify effectiveness; -Utilizing clean equipment, particulalry when deployed in or near water; -Implementing appropriate dust control measures to minimize effects to habitat and forage quality; -Adhering to waste management plans and procedures to avoid attracting wildlife; -Timing construction activities to avoid critical periods; -Applying and conforming with pre-determined setback distances from key wildlife habitat features; -Implementing a "no hunting" policy for Highway construction and maintenance workers; and -Working with agencies such as the HTCs, WMAC and GNWT ENR to develop guidelines and conditions for Highway usage and follow-up with monitoring of harvesting activities.	Design, Construction, Operations

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
Types of Mitigation for Caribou	
Types of mitigation measures that the Developer will integrate into the Project design, construction, and anticipated future operational practices to reduce or minimize potential impacts of the proposed Highway on caribou are: -Limiting blasting activities, if required, to borrow sites and will only occur when caribou are >500 m from the blast site; -Working with agencies such as the HTCs, WMAC, and GNWT ENR to develop guidelines for periodic Highway closures, if required, as a way of minimizing the disruption of migration patterns to barren-ground caribou; -All sightings of caribou will be reported to environmental staff on-site; -Maintaining a minimum distance of 500 m between field operations and caribou for the duration of construction; -Caribou sightings will be recorded (including a GPS location if possible) and be submitted to the GNWT DOT Planning, Policy and Environmental Division and GNWT ENR upon completion of construction; and -Caribou crossing signs will be placed along the Highway, as needed.	Design, Construction, Operation
Types of Mitigation Measures for Grizzly Bears and Furbearers	
Types of mitigation measures that the Developer will integrate into the Project design, construction, and anticipated future operational practices to reduce or minimize potential impacts of the proposed Highway on grizzly bears and furbearers include: -Freshly dug dens will be mapped such that construction activities will avoid active dens during the hibernation period; -If possible, no activities will occur within 500 m of an active den during the denning period (October to April); and -No blasting will occur if active bear dens are confirmed within 500 m of a proposed blasting area.	Construction
-Maintaining a minimum distance of 500 m between identified grizzly bear/wolverine den sites and personnel during construction; -Dens (grizzly bear, wolverine) discovered within 500 m of the Highway after the pre-construction survey will be reported immediately to GNWT ENR to determine the appropriate course of action; -Providing the wildlife monitor and designated, trained staff access to non-lethal deterrent materials (e.g., bear spray). The use of any deterrent method on wildlife will be reported to GNWT ENR;	Construction
-Minimizing and properly disposing of wildlife attractants such as garbage, food wastes, and other edible and aromatic substances; -Storing all food, grease, oils, fuels, and garbage in bear/wolverine-proof containers and/or areas; -No waste will be incinerated on- or off-site; and -Transporting waste to Tuktoyaktuk and/or Inuvik municipal solid waste facilities for disposal. Disposal of wastes at these facilities will follow the specified terms and conditions for use.	Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
Types of Mitigation Measures for Birds	
Types of mitigation measures that the Developer will integrate into the Project design, construction, and anticipated future operational practices to reduce or minimize potential impacts of the proposed Highway on birds include: -Conducting pre-disturbance bird nest surveys in June-July to document use by nesting birds; -Avoiding conducting Project activities within 500 m of an active raptor nest during nesting season; -Designing structures in a way that limits or prevents their potential use as nesting structures; and -Allowing nesting birds who have utilized structures to remain in place.	Design, Construction
Types of Mitigation Measures for Peregrine Falcons	
The Developer will incorporate the following mitigation measures for Peregrine Falcons including: -Lights will be positioned to shine down or will be fixed with shielding to direct light downward on buildings and other infrastructure sites, wherever possible; -Lighting will be switched off, whenever possible (i.e., when camps and facilities are not in use); -Conducting an aerial survey of the final alignment and borrow sources to identify areas where Peregrine Falcons could be nesting that may require mitigation; and -Appropriate federal (CWS) and territorial (GNWT ENR) authorities will be contacted immediately before continuing work if a Peregrine Falcon nest is identified within predetermined set-back distances (as determined through consultation with CWS/ENR).	Design, Construction
Types of Mitigation Measures for Bird Species At Risk	
The Developer will incorporate additional mitigation measures for bird Species at Risk including: -Immediately contacting appropriate federal (CWS) and territorial (GNWT ENR) authorities if a nest of a key bird species is identified within predetermined set-back distances (as determined through consultation with CWS/ENR).	Construction
WASTE MANAGEMENT	
The Developer will develop a waste management plan for all wastes associated with pre-construction and construction activities. The waste management plan will apply to the Developer and all associated Project contractors involved in the generation, treatment, transferring, receiving, and disposal of waste materials for the Project.	Design, Construction
The Developer commits to the following steps prior to disposal of waste: -Obtaining approval from the Town of Inuvik and Hamlet of Tuktoyaktuk to use their sewage lagoon and solid waste disposal facilities; -Providing an estimate of the amount and type of domestic waste generated by the Project compared to the facility's available capacity; -Following all applicable Licence, Permits, and/or municipal bylaws regarding the use of the facility in Inuvik and Tuktoyaktuk; and -Recording the amount of domestic waste shipped to the landfills.	Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
The Developer will develop and implement a hazardous waste management plan (HWMP). The HWMP will encompass all pre-construction and construction phases of the Project and will apply to the Developer and all Project contractors involved in receiving, transferring, and transporting hazardous waste for the Developer's activities on land, water, and air.	Construction
FUEL MANAGEMENT	
The Developer commits to storing fuel used for borrow source and Highway construction activities in double-walled fuel storage tanks, and in accordance with CCME guidelines.	Construction
All vehicles and equipment will be refueled at least 100 m from water bodies following INAC (DIAND) fuel storage guidelines.	Construction
WATER QUALITY AND QUANTITY	
The Developer will ensure that the DFO water withdrawal protocol criteria are followed.	Construction
The Developer is committed to carrying out bathymetric surveys on all lakes proposed for water extraction.	Construction
The Developer will minimize effects to water quality and quantity as a result of Highway design through the design and use of crossing structures that are appropriate for site-specific flow conditions; by employing erosion and sediment control best management practices and DFO *Operational Statements* (where possible) as per approved Environmental Management Plans; installing appropriately sized culverts to divert and manage Highway and surface drainage flows; and undertaking primary Highway embankment construction activities during the winter months.	Design, Construction
The Developer is committed to completing hydrological assessments prior to bridge design to determine suitable span widths and abutment placement.	Design, Construction
During the bridge design of the Project, should individual site-specific circumstances preclude complete adherence to the DFO *Operational Statements*, the Developer will consult with DFO in advance to discuss and approve of proposed plans.	Design
Some of the mitigation measures for water quality and quantity effects the Developer will follow include: -Limiting the use of construction equipment to the immediate footprint of the Highway or borrow source; -Minimizing vegetation removal and conducting progressive reclamation at the clear-span abutments, culvert installations, and borrow sources; -Keeping ice bridge and ice road surfaces free from soils and fine gravel that may be tracked out by vehicles; -Avoiding the use of heavy equipment in streams or on stream banks during summer months, and the adherence to the DFO *Operational Statement for Temporary Stream Crossings* (DFO 2008), where this is deemed necessary; -Implementing the erosion and sediment control plan to be developed as part of the overall EMP; -Appropriately sizing and installing culverts based on hydrological assessments and local experience, to avoid backwatering and washouts.	Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
-Completing Highway embankment construction during winter months; -Adhering to the DFO *Operational Statement for Clear-Span Bridges* for all applicable activities; -Implementing appropriate dust control measures to minimize effects to waterbodies and aquatic habitat; -Following the DFO *Operational Statement for Culvert Maintenance* (DFO 2010) where necessary; -Maintaining equipment away from waterbodies; and -Adhering to spill contingency plans, as required, in a timely manner	Construction
STREAM CROSSINGS	
The Developer (under appropriate seasonal conditions), will conduct further assessments of the proposed water crossing locations and will provide information about watercourse characteristics and proposed crossing structure designs sufficient to meet the requirements of the Northwest Territories Waters Regulations.	Design, Construction
The Developer is committed to working closely with DFO to design appropriate crossing structures for each stream and to obtain Fisheries Authorizations, if determined to be required.	Design, Construction
The Developer will install culverts according to established guidelines and will follow culvert installation guidelines such as those contained within the DFO Land Development Guidelines (1993) and the INAC Northern Land Use Guidelines for Roads and Trails (INAC 2010).	Construction
The Developer will install appropriately sized culverts to minimize changes in water flow pattern and timing.	Construction
The Developer will not install culverts in critical aquatic habitats.	Construction
The Developer will carry out routine monitoring and inspections at watercourse crossings and culverts, including reporting on culvert performance and maintenance requirements.	Construction, Operations
The Developer will ensure that maintenance requirements for culverts will adhere to the DFO Culvert Maintenance Operational Statement.	Operations
The Developer will ensure that when crossings are completed, disturbed materials will be replaced with similar-sized substrates and the bed and banks of the watercourse are stabilized and restored.	Construction
VEGETATION	
The Developer commits to surveying borrow sources prior to construction for the presence of Yukon stitchwort and other rare plant species. Should rare plants be identified, they will be avoided where possible. If avoidance is not an option specimens will be collected, transferred to another suitable location, and/or donated to local herbaria for educational purposes.	Design, Construction
The Developer commits to minimize direct effects to vegetation cover by limiting construction activities, to the extent possible, to the planned footprint of the Highway.	Construction
Surveys ahead of construction in the vicinity of Holmes Creek and Hans Creek will be carried out to verify the location of the road alignment and stream crossings with respect to the unique Riparian Black Spruce/Shrub vegetation type.	Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
Controlling the effects of dust during construction and operation of the Highway will include applying water as needed, as per the *GNWT Guideline for Dust Suppression* (GNWT 1998).	Construction
The Developer commits to using appropriate northern, native plant species for any deliberate re-vegetation efforts of borrow sources.	Construction, Operations
The Developer or contractor(s) will apply strategies for mitigating potential effects to the vegetation types in the vicinity of the Highway and associated borrow operations such as: -Restricting off-site activities (e.g., ATV use) to the footprint area; -Ensuring machinery and equipment is clean prior to use on site; -Periodically monitoring roadsides for invasive species establishment; -Designing and engineering roadbed and drainage structures appropriately to accommodate unique environmental conditions; and -Containing and cleaning-up spills immediately in accordance with the spill contingency plans.	Design, Construction
AIR QUALITY	
The Developer will conform with applicable ambient air quality objectives by using pollution prevention measures and best management practices.	Construction
Mitigation measures for air quality during the construction phase will include: -Applying water as per the GNWT's *Guideline for Dust Suppression* (GNWT 1998) during summer months; -To the extent possible, aggregate stockpiling activities will be conducted well downwind of potentially sensitive receptors (based on prevailing winds); -Closing and progressively reclaiming borrow pits as soon as they are no longer required to reduce potential fugitive dust; -Ensuring proper maintenance of heavy equipment to minimize air emissions; and -Restricting speed limits along the access roads and Highway during construction to minimize dust production.	Construction
The Developer will be responsible for the ongoing maintenance of the Highway during the operations phase and will conform to the GNWT's *Guideline for Dust Suppression* (GNWT 1998).	Operations
LAND USE	
The Developer will implement mitigation measures to minimize potential land use effects such as: -Ensuring that construction vehicles stay on access roads or the construction site at all times; and -Prohibiting the recreational use of the Highway by Project staff during construction, including the use of ATVs and snowmachines.	Construction
During the operations phase, the Developer will work with appropriate parties to install signage and/or develop educational materials to encourage users to stay on the Highway and not adjacent areas.	Operations
NOISE	
The Developer will consult with wildlife experts to minimize noise effects on wildlife, particularly blasting activities.	Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
The Developer will use appropriate design, scheduling, logistics, and maintenance measures to reduce the effects of noise.	Design, Construction
Project contractors will be directed to apply reasonable mitigation measures to reduce possible effects associated with construction noise, including adequate maintenance of construction equipment and provision of appropriate mufflers for all internal combustion engines.	Construction
Blasting activities, if required, will be timed to avoid periods when sensitive wildlife species are in the area.	Construction
ARCHAEOLOGY	
The Developer will hire a qualified archaeologist to perform a final Archaeological Impact Assessment within a 100 m wide corridor along the alignment and all associated components such as borrow sources, work staging areas, and construction camps. All types of terrain will be sampled, including those with limited archaeological potential.	Design, Construction
Mitigation measures will be designed on an individual basis, and require prior approval by the Prince of Wales Northern Heritage Centre.	Construction
The Developer will, on recommendation from the contract archaeologist or Prince of Wales Northern Heritage Centre, implement avoidance or mitigation measures to protect archaeological sites or to salvage the information they contain through excavation, analysis, and report writing.	Construction
The Developer will prepare an archaeological site(s) protection plan to facilitate the continued protection and management of archaeological resources during the construction phase of the Project.	Construction
The Developer and its Project contractors will make every effort to avoid and protect recorded and unrecorded archaeological and heritage resources in accordance with the terms and conditions of the Northwest Territories archaeological regulations during the Project.	Construction
MONITORING	
The Developer requires that Project contractors employ an adaptive management approach to ensuring sensitive species/ species at risk are adequately protected during all phases of construction.	Construction
The Developer is committed to hiring environmental monitors to ensure the application of prescribed mitigation, identify unforeseen and potential erosion sites that could lead to the discharge of sediment to surface or groundwater, and prevent erosion and subsequent sedimentation.	Construction
Compliance and effects monitoring activities will be conducted to ensure the terms and conditions set out in regulatory approvals, licences and permits, the EMP, and in the commitments are met, and to check the effectiveness of mitigation measures in avoiding or minimizing potential effects.	Construction, Operations
The Developer will prepare an effects monitoring table and an inspection table prior to construction. The effects monitoring table will describe the indicators and parameters to be monitored and the target or management goal. The inspections table will describe the types of inspections required, the frequency of the inspections, and which phase of the Project the inspection will occur.	Design, Construction

TABLE F: SUMMARY OF DEVELOPER COMMITMENTS	
COMMITMENTS	**PROJECT PHASE**
Environmental and wildlife monitoring will be carried out by third party monitors supplied by the ILA (environmental monitors) and the HTC (wildlife monitors), and will be funded by the Developer and/or Developer's contractor(s).	Construction
The Developer will conduct post-construction monitoring according to the extent, frequency and duration required by regulators to evaluate the success of mitigation measures and to identify required modifications, repairs, or maintenance.	Operations
The Developer will require that Project contractors work closely with the environmental and wildlife monitors during construction.	Construction
The Developer is committed to participating with other parties in a cumulative effects monitoring program.	Construction, Operations

1.0 INTRODUCTION

1.1 THE DEVELOPER

Mayor Merven Gruben
Hamlet of Tuktoyaktuk
Box 120
Tuktoyaktuk, NWT X0E 1C0
Phone: 867-977-2286
Fax: 867-977-2110
Email (Senior Administrative Officer): Bill Buckle c/o tuksao@netkaster.ca

Mayor Denny Rodgers
Town of Inuvik
Box 1160, #2 Firth Street
Inuvik, NWT X0E 0T0
Phone: 867-777-8600
Fax: 867-777-8601
E-mail Senior Administrative Officer): Grant Hood c/o sao@inuvik.ca

Jim Stevens
Government of the Northwest Territories
Department of Transportation
Lahm Ridge Tower, 2nd Floor, 4501 - 50 Ave
P.O. Box 1320
Yellowknife, NWT X1A 2L9
Telephone: (867) 920-6247
Fax: (867) 920-2565
Email: Jim_Stevens@gov.nt.ca

1.1.1 Consultants Involved in EIS Preparation

Kiggak – EBA Consulting Ltd.
Telephone: (604) 685-0017 x239
Fax: (604) 684-6241
Email: rhoos@eba.ca

1.1.2 Environmental Performance

The Project Partnership, generally referred to collectively as the Developer or Project Team, for the proposed Inuvik to Tuktoyaktuk Highway are the Hamlet of Tuktoyaktuk, the Town of Inuvik and the GNWT Department of Transportation (DOT). However, the actual design and construction of the Highway will be the responsibility of the GNWT DOT and thus the following discussion focuses on GNWT DOT's environmental performance.

Care for the natural environment has been promoted as a core corporate value since the creation of the DOT in 1989. This value has been advocated in a variety of internal and external documents that commit the DOT to conducting its work in a way that will conserve the beauty and health of the natural environment, for the enjoyment and benefit of current and future generations.

Since 1989, the DOT has engaged a number of national organizations to develop best practices for transportation works, specifically aimed at protecting the environment. These initiatives have resulted in the DOT's adoption of the best and most innovative practices for mitigating impacts, from a wide range of activities related to the DOT's mandate, including construction in permafrost regions, construction management in riparian zones, protection of navigability in northern waters, management of glycol and salt use, research into alternative de-icing and dust control products, reduction of wildlife collisions, among others. The DOT has also worked hard to ensure that the potential impacts and proposed mitigations from large scale projects are discussed with regulators, well in advance of any permit and/or licence applications. As a recent example in the Inuvialuit Settlement Region (ISR), this practice was evident in the construction of the Tuktoyaktuk Access Road to Source 177 and contributed to the success of this project. It is important to note, however, that this kind of discussion has been undertaken on a routine basis prior to the formation of the DOT.

In 2009, the DOT presented their Environmental Strategy entitled *Green Light – Signalling the Department of Transportation's Commitment to the Environment* (Appendix A). The main goal of *Green Light* is to highlight existing environmental practices and to further foster a corporate culture of environmental excellence, within both the DOT and the northern transportation industry. *Green Light* lays the groundwork for improving operations and demonstrates the DOT's commitment to environmental performance and to lead by example. The development of an Environmental Management System is one of the medium-term goals of *Green Light*.

In 2010, a draft environmental policy was prepared to institutionalize environmental priorities as an integral part of the decision-making process in all operations. The goal of this policy is to foster a corporate culture of environmental excellence at DOT and throughout the northern transportation industry. This will be accomplished by highlighting and celebrating environmental achievements and by systematically improving the sustainability of DOT's approach to developing, operating, and maintaining the transportation system. The policy also lays out a number of actions to achieve and evaluate for continuous improvement.

The following text, extracted from the Draft Environmental Policy (2010), highlights the principles and actions to be taken:

Principles:

The following principles will guide us in achieving our environmental goals:

- *We will continue to support other Northwest Territories Government policies and initiatives related to environmental protection, pollution prevention and sustainability.*
- *We will continue to address environmental issues in the development of policies, plans, programs, procedures, practices, standards and guidelines.*
- *We will regularly monitor and review our work processes.*
- *We will encourage our staff and contractors operating on our behalf to identify opportunities for improving our environmental performance.*
- *We will remain knowledgeable and improve our expertise in environmental practices related to our core business.*

Continuous Improvement

- *We will regularly review our environmental management policies and procedures, including QA/QC and auditing documents, to maintain their effectiveness in meeting our environmental performance goals.*
- *We are committed to seeking opportunities to improve our environmental performance and recognize the central role of our staff, clients and contractors operating on our behalf in achieving improvements.*
- *We will support our staff and contractors working on our behalf in the training and development necessary to meet our collective responsibilities to the environment, as these responsibilities are defined by legislation, professional requirements, and our Environmental Management System (to be developed) (GNWT DOT 2010b).*

The DOT's focus on improving and strengthening its environmental standards and practices will ensure the current transportation system and future changes to it will maintain the quality of the environment.

Environmental Management System

The GNWT DOT is in the process of developing and implementing an Environmental Management System (EMS), based on the EMS guide developed by the Transportation Association of Canada for the public transportation sector. The program will be implemented by an EMS Coordinator in the Planning, Policy, and Environment Division.

The EMS will complement programs already underway which include the GNWT Sustainable Development Policy, the NWT Greenhouse Gas Strategy, the Climate Change Adaptation Strategy and DOT's Drive Smart Program.

Project-specific Environmental Performance

Since its establishment, DOT has successfully undertaken hundreds of projects across the NWT with little to no negative effect on the environment. Wherever even the potential for unacceptable effects have been identified by project personnel, regulators, or residents, DOT has moved quickly and effectively to address the issue of concern. DOT is an experienced and highly-engaged project delivery department, whose commitment to environmental stewardship is not only a mandated requirement, but also informs all phases of its activities, from planning to implementation and post-construction monitoring.

Recently the GNWT DOT facilitated the development of the all-weather Access Road from Tuktoyaktuk to Source 177, a precursor to the present Highway development proposal.

Overall the project was generally considered to be a success, with only a few concerns raised that were resolved during the construction period. DFO, for example, had expressed reservations about the installed elevation of some culverts but this issue was resolved at the beginning of the next construction season.

1.2 DEVELOPMENT OVERVIEW

Project Context

Currently, surface transportation access to the Hamlet of Tuktoyaktuk is by a 187 km ice road from Inuvik, built annually by the GNWT DOT on the frozen channels of the Mackenzie River Delta and Kugmallit Bay. The ice road is open for three to four months, depending upon the weather, from mid to late December to mid to late April. Tuktoyaktuk has year-round access by air from Inuvik and barge service from Hay River during the summer.

As part of the early 1960s "Northern Vision" of Prime Minister John Diefenbaker, the federal government of Canada implemented an ambitious program of all-weather road construction in the Western Arctic.

As an ultimate goal, the federal all-weather road program had envisaged the eventual extension of the Mackenzie Highway to Inuvik and onwards to Tuktoyaktuk. The first route surveys for an Inuvik to Tuktoyaktuk all-weather road were undertaken by Public Works Canada (PWC) in 1974, which resulted in a 140 km all-weather road route (PWC 1975). Preliminary engineering and environmental studies were undertaken on this route in 1975-76, which became known as the PWC 1977 route (PWC 1976, 1977, 1981a, 1981b, 1982a, 1982b). However, road construction did not proceed due to changes in government policy and the declining pace of industry activity in the region. In the late 1980s, the existing Northwest Territories highway system was transferred to GNWT DOT.

The need and rationale for new all-weather road corridors in the Western Arctic (namely, the Inuvik to Tuktoyaktuk Highway, the extension of the Mackenzie Highway to Inuvik, and the Slave Province corridor), and the necessity of federal funding assistance, have figured prominently in various GNWT DOT reports since 1990. Reports include:

- *Northwest Territories, Transportation Strategy* (GNWT DOT 1990);
- *Northwest Territories, Transportation Strategy Update, 1994* (GNWT DOT 1995);
- *Investing in Roads for People and the Economy: A Highway Strategy for the Northwest Territories* (GNWT DOT 2000);
- *Corridors for Canada: An Investment in Canada's Economic Future: A Proposal for Funding Under the Strategic Infrastructure Fund Government of Canada* (GNWT 2002);
- *Corridors for Canada-II: Building on Our Success. A Strategic Infrastructure Proposal for Investment in Transportation Infrastructure* (GNWT 2005a);

- *Connecting Canada Coast to Coast to Coast: A Proposal to Complete the Mackenzie Valley Highway to the Arctic Coast* (GNWT 2005b); and
- *Northern Connections: A Multi-Modal Transportation Blueprint for the North* (GNWT DOT 2008b).

Recently, the federal government has re-engaged with the idea of developing road and other infrastructure in the Arctic under the Building Canada Fund. The first significant new road project in the Northwest Territories under this program is the 19 km all-weather Access Road from Tuktoyaktuk south to Source 177, along a horizontal alignment that will become part of the future all-weather Inuvik to Tuktoyaktuk Highway. Construction on this road began in 2009 and was completed in 2010.

Development Overview

More detailed construction information and methodologies are found in Section 2.0 and an overview of the development is provided within the executive summary, under the headings of 'Route Alignment Alternatives', 'Highway Design Considerations', and 'Highway Construction and Schedule'. The following is a brief summary of this information.

The proposed development will involve the construction of a 137 km stretch of two-lane, all-weather highway between Inuvik and Tuktoyaktuk (Figure 1.5-1). There have been several design iterations since the Highway was first proposed in 1960, but the currently proposed alignment is the Primary 2009 Route (Figure 1.5-2). This route is an updated and refined version of the 1977 PWC alignment, but includes a minor encroachment on the Husky Lakes 1 km setback.

The other route alignment options in the vicinity of the Husky Lakes are also continuing to be considered: Alternative 1 (2009 Minor Realignment) to avoid the encroachment on the Husky Lakes setback; Alternative 2 (Upland Route); and Alternative 3 (2010 Minor Realignment) recommended by Inuvialuit interests. In particular, Alternative 3 (2010 Minor Realignment) will be further considered and likely adopted in the detailed design stage based on the additional field information that needs to be gathered.

This public Highway will be constructed and operated in conformance with applicable highway standards. Highway construction will involve:

- Construction of a two lane gravel roadway 8 to 9 m wide with 3:1 side-slopes;
- Installation of approximately eight short span single lane bridges and numerous culverts;
- Surveying and staking of the Highway, snow clearing, and material stockpiling at the borrow sources;
- Use of 'fill' techniques, rather than 'cut and fill', so that permafrost is preserved as much as practicable;
- Construction of temporary ice/winter roads to borrow sources and a winter road along the Highway alignment;

- Placement of frozen borrow material directly onto frozen ground (with geotextile separation layer);
- Use of excavators, tractor-trailers and articulated trucks to load and transfer material from the borrow pits to the construction site, where the material will be end-dumped and spread using bulldozers.

Phases and Schedule

The main Highway construction program is currently scheduled to start in fall/winter 2012 and last for four years, until summer 2016. However, subject to completion of the EIRB review process, regulatory approvals and funding, initial upgrading of the Tuktoyaktuk to Source 177 Access Road to highway standards will commence in spring 2012. The Developer proposes to build the Highway concurrently from the north and south ends.

Factors that have the potential to influence Project schedule include:

- The availability and proximity of appropriate borrow sources, as the development progresses; and
- The timing/location of construction resource placement, such as equipment and crew camps, so that work will proceed smoothly from season to season.

See Section 2.0 for more detail on specific construction methodologies, schedule, strategies proposed, and a detailed list of equipment.

Workforce and Cost

The total anticipated workforce during the four years of construction will be approximately 670 Full Time Equivalents (FTE).

The estimated capital cost of the Project is $230 million. This does not include royalties or administrative fees associated with construction materials from sources on Inuvialuit owned lands.

1.3 DEVELOPMENT PURPOSE AND JUSTIFICATION

The Inuvik to Tuktoyaktuk Highway will be the first all-weather road connection in Canada to the Arctic Ocean, and will generate substantial benefits at the local, regional, and national levels. Information on the effects of the proposed Inuvik to Tuktoyaktuk Highway is located in Section 4.3. The primary purpose and justification for the Highway are below.

Cost of Living

The Highway is expected to reduce the cost of living and doing business in Tuktoyaktuk because goods could be shipped overland year-round, on an as-needed basis.

Cost of Government Program Service Delivery

The Highway is expected to reduce the cost of providing and accessing government services and programs delivered in Tuktoyaktuk and throughout the Region. It is anticipated that there will be a reduction in travel costs, operation and maintenance costs for health, education, social and recreational services, capital programs, and local municipal services and programs.

Social Aspects

The all-weather Highway will provide Tuktoyaktuk residents with cheaper, easier and safer access to regional services, such as health care, education and recreational facilities. The Highway will promote family, community, and sporting interactions by providing year-round access between communities.

Business Opportunities and Competition

The Highway will allow Inuvik- and Tuktoyaktuk-based businesses to compete more effectively for resource-related and government business opportunities. The construction of the Inuvik to Tuktoyaktuk Highway will also create various spin-off business opportunities for Tuktoyaktuk, Inuvik and other regional businesses, such as fuel and gas service stations and Highway maintenance services. The increase in tourism and the creation of new business opportunities will provide important year-round employment and training opportunities for local Inuvik and Tuktoyaktuk residents. Enhanced competition between businesses may lead to higher quality and lower cost services for government, resource development, and other goods and services sectors.

Tourism Development

The Highway will promote the tourism and hospitality industries in Inuvik and Tuktoyaktuk. A tourism campaign could capitalize on Tuktoyaktuk, the terminus of the all-weather Highway, as the point closest to the Arctic Ocean that can be reached by road from anywhere in Canada, continental USA and Mexico – appreciably closer than northern Alaska which has the only other points in North America on the Arctic Ocean with road access.

Pollution Prevention and Spill Response in the Arctic Ocean

The all-weather Highway may reduce the costs of the Canadian Coast Guard's Tuktoyaktuk-based Arctic pollution prevention and spill response planning and operations by allowing ground transport of response personnel, equipment, and materials during the summer/fall Arctic shipping season.

National Sovereignty and Security in the Arctic

In the past few years the issue of protecting Canadian sovereignty in the Arctic has received prominent national attention. Furthermore, commercial and non-commercial shipping into and through the Northwest Passage is now being assessed for viability based on changes to open-water patterns. The Inuvik to Tuktoyaktuk Highway would allow easier and cheaper

access for sovereignty and security related operations in the western Arctic Ocean, which could be based in Tuktoyaktuk and/or Inuvik.

Arctic Harbour and Port Development

With the potential increase in international marine traffic through the Northwest Passage and potential Beaufort Sea oil and gas development, there may be increased marine activity in the Arctic. At present, a deep water port is not available in the Western Arctic region (Canada or the United States) to support the existing and expected increase in marine traffic. The construction of the Inuvik to Tuktoyaktuk Highway would facilitate the efficient use of a new deep water port in terms of location and costs, which could have multiple economic benefits for the region.

Oil and Gas Exploration and Development

By providing all-weather access, the Highway can be expected to reduce the costs of onshore oil and gas exploration and development in the area. In addition, it could help reduce the cost of off-shore exploration and development in the Beaufort Sea, as equipment and supplies could be trucked to Tuktoyaktuk.

Quantification of Regional Economic Impacts

A study entitled Inuvik to Tuktoyaktuk All-Weather Road Economic Analysis was prepared for GNWT DOT in June 2010. The study concluded that the direct, indirect and induced effects in the NWT are:

- Constructing the Highway results in an estimated $135 million Gross Domestic Product (GDP), with 1,086 full time equivalent (FTE) positions being created and governments receiving $27 million in additional revenues;
- Operating the Highway results in an estimated $1.5 million GDP, with 19 FTE positions being created and governments receiving $250,000 in additional revenues;
- Not constructing the winter road results in $73,000 less in GDP, 0.6 less full FTE positions each year, and approximately $15,000 less in additional government revenues;
- Reducing the cost of living in Tuktoyaktuk is estimated to increase GDP by over $500,000, increases the number of positions by four FTE, and increases tax revenues by $100,000; and
- Increasing tourism spending to $2.7 million each year will generate an increase of over $1.2 million in GDP, create 22 FTE positions in the NWT, and increase government revenues by $200,000.

Overall, the Highway is anticipated to create the following effects in NWT and Canada: 2,000 one-time (i.e., construction-related) jobs, $270 million in GDP, and $47 million in government revenues.

1.4 THE DEVELOPMENT SETTING

This section of the EIS is intended to introduce the development setting and to provide a general overview of the geographic, social, economic and cultural setting in which the development is proposed to take place. This section also provides similar information for all considered alternatives.

1.4.1 Proposed Alignment

Geographic Setting

As indicated in Section 2.0 of this Environmental Impact Statement, the proposed Highway will be 137 km long and will be located entirely within the ISR (Figure 1.5-1 and 1.5-2). The corridor between Inuvik and Tuktoyaktuk is situated within the geographic coordinates 68°30' to 69°50'N latitude and 132°45' to 134°0'W longitude. Granular resource requirements for the Highway will be met using material from selected borrow sources located in the vicinity of the Highway alignment (Figure 1.5-2). For the phases of work conducted during the winter, temporary winter access/haul roads will be used during the construction phase of this Project to access and transport borrow materials. For work conducted during the summer months, access and transport will be along the constructed embankment.

Inuvik is located on the East Channel of the Mackenzie River Delta. It is accessible by land, via the Dempster Highway, which originates in Yukon Territory, by air from Yellowknife, Whitehorse, Calgary, Edmonton, and regional communities, and by water during the summer months.

Tuktoyaktuk is located on Kugmallit Bay near the Mackenzie River Delta and is approximately 126 km northeast of Inuvik. It is accessible by air from Inuvik year-round, by water during the summer months, and by ice road during the winter.

To the south of the proposed Highway corridor is the Town of Inuvik and the Gwich'in Settlement Area. To the north, the Highway corridor terminates at the Hamlet of Tuktoyaktuk and Kugmallit Bay in the Beaufort Sea. To the east, a portion of the corridor is located near the western shores of Husky Lakes. Ranging in distance between 20 and 50 km to the west of the proposed Highway corridor is the Mackenzie River. The Mackenzie River is the location of the 187 km Inuvik to Tuktoyaktuk Ice Road, which is part of the Mackenzie Delta Ice Roads (Inuvik Area) component of the overall Northwest Territories Public Highway System. The seasonal ice road connects Inuvik and Tuktoyaktuk for approximately three months per year.

Social and Cultural Setting

Tuktoyaktuk

The Hamlet of Tuktoyaktuk had a population of 916 in 2010. The majority of the population is Inuvialuit, and approximately 84% of Hamlet residents are Aboriginal. The main languages spoken in Tuktoyaktuk are Inuvialuktun and English (GNWT Bureau of Statistics 2009a).

The Hamlet has a health centre and social services (BDHSS 3010b). Hamlet recreational facilities include Kitti Hall (a community centre), school gym, playground and golf course. There is one grade school, an Adult Education Centre through Aurora College, an RCMP detachment, and a volunteer fire department.

The total labour force in the Hamlet of Tuktoyaktuk is 345 persons. Of the total Tuktoyaktuk labour force, sales and services (29.0%), trades transport and equipment operators (24.6%), and social science, education, government service and religion (14.5%) were the three most commonly held occupation types (Statistics Canada 2006a, 2006b). In 2009, 46.1% of the population were high school graduates. The average annual income in 2008 was $49,810 (GNWT Bureau of Statistics 2009a).

Inuvik

Inuvik was established in 1953 and became a town in 1970. Inuvik is the regional government centre, and transportation and recreation hub for the Canadian Western Arctic. Due to its strategic location, Inuvik is also the main headquarters for the oil and gas industry operating in the Beaufort Sea and Mackenzie Delta (Town of Inuvik 2009). The airport, government services, recreational programs and hospitality industry attract residents from neighbouring communities, those traveling from other communities and tourists.

Inuvik had a population of 3,552 in 2010. Aboriginal people (Inuvialuit and Gwich'in) comprise 64% of Inuvik's population; the balance of the population consists of non-Aboriginal residents. The main languages spoken in Inuvik are English, Inuvialuktun and Gwich'in (GNWT Bureau of Statistics 2009b).

There are several regional health care and social service facilities located in Inuvik, including a regional hospital (BDHSS 2010c). Town recreational facilities including the Midnight Sun Recreation Centre Ice Arena (that also includes an indoor pool and fitness centre), the Midnight Sun Complex and Conference Centre, and over 20 outdoor recreational spaces consisting of parks and playgrounds, trails, a boat launch, and more (Town of Inuvik 2010e). There are four child care centres, two schools, a campus of Aurora College, an RCMP detachment, and a volunteer fire department.

The total labour force in the Town of Inuvik is 2,020 persons. Of the total Inuvik labour force, sales and services (23.0%), business finance and administration (18.6%), and trades transport and equipment operators (17.8%) were the three most commonly held occupation types (Statistics Canada 2006a, 2006b). In 2009, 68.6% of the population graduated from high school. The average annual income in 2008 was $49,810 (GNWT Bureau of Statistics 2009b).

Economic Setting

The Beaufort-Delta region accounts for about 16% of the NWT's population and about 12% of personal income. Over the past decade, the region's population has declined by about 400 residents or around 6%.

The Dempster Highway provides an all-weather road link between Inuvik and communities in the Yukon Territory and represents an alternative attraction for tourists from the Alaska Highway. The Beaufort-Delta region benefits from the direct air travel connections between Whitehorse and international destinations during the summer months.

Currently, the Dempster Highway connection only serves communities south of Inuvik. The development of the Ikhil gas project has provided the community of Inuvik with access to gas for electrical generation and heating. The region has abundant gas resources. However, development is dependent upon access to markets. An application to develop the Mackenzie Gas Project was recently approved. Project lead Imperial Oil Resources Ventures Limited has until the end of 2013 to indicate whether the Mackenzie Gas Project will be constructed in the near term.

Tourism is increasing, and there have been large investments made in accommodation facilities and attraction development. Physical attractions include the Mackenzie Mountains, the Beaufort Sea and the Arctic Ocean, the Mackenzie Delta and the midnight sun during summer months.

The region's base industries include public administration, petroleum exploration, transportation, tourism and furs. Tuktoyaktuk continues to rely on traditional game harvesting from the Delta and fishing from the Beaufort Sea and regional lakes as a large part of its economy.

1.4.2 Alternative Alignment

Because the selected and alternative routes only differ slightly, the same communities will be affected; therefore, a separate assessment of the routes, with respect to social, cultural, and economic setting is not necessary. Further discussion comparing the route alignments is found in Section 2.0.

1.5 REGULATORY APPROVALS AND NON-REGULATORY REQUIREMENTS

Through the *Inuvialuit Final Agreement* (IFA), signed in 1984, the Inuvialuit received title to approximately 20% of surface lands in the Inuvialuit Settlement Region (ISR), some of which includes ownership of subsurface minerals.

The proposed Highway will be 137 kilometres (km) long and will be located entirely within the ISR. Approximately 71 km or 51.5% of the alignment will be located on Inuvialuit private lands, which are regulated and administered by the Inuvialuit Lands Administration (ILA). Approximately 67 km or 48.5% of the route will be located on Crown lands, which are regulated and administered by Indian and Northern Affairs Canada (INAC). Granular resource requirements for the Highway will be met using material from selected borrow sources located in the vicinity of the Highway alignment.

The IFA, and its enabling legislation, the *Western Arctic (Inuvialuit) Claims Settlement Act,* requires:

> *"…the screening of developments of consequence to the Inuvialuit Settlement Region… that are likely to have a negative impact on the environment, or on present or future wildlife harvesting. It provides for the establishment of the EISC to carry out the preliminary environmental screening of onshore developments."*
>
> (EISC 2004 p.2)

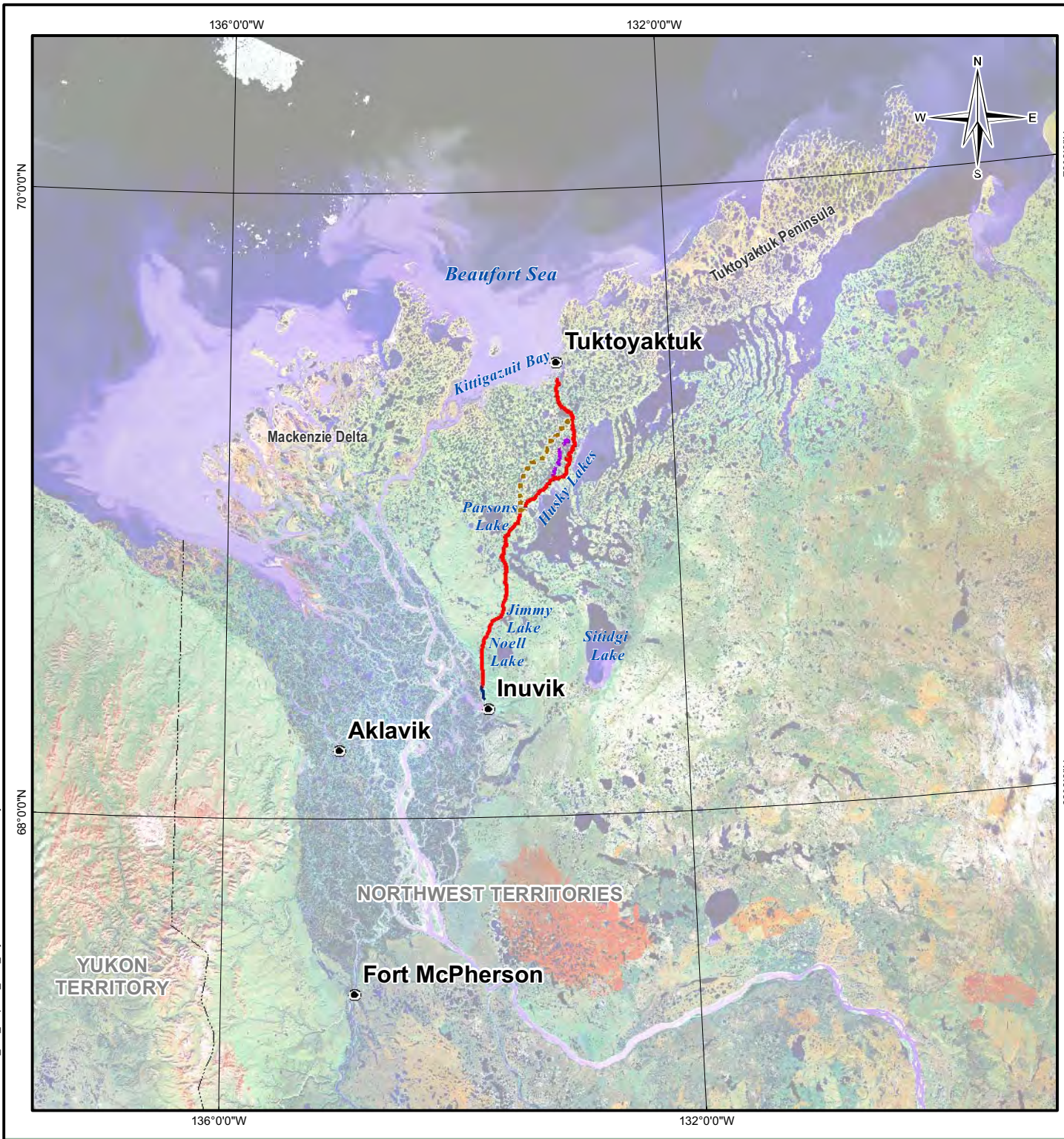
In the fall of 2009, the Project Team consulted the EISC, ILA, territorial and federal regulatory agencies with the goal of identifying key issues related to the proposed Highway. Regulatory and resource management agency representatives were asked to describe their organization's anticipated role in screening the proposed Project and to suggest other agencies and organizations that should be consulted. A Project Description Report was prepared in accordance with the *Environmental Impact Screening Committee – Operating Guidelines and Procedures* (EISC 2004).

After its review of the Project Description Report, with regard to IFA Subsections 11(17) and 11(18), the EISC determined that the proposed development could have a significant negative environmental impact and was, therefore, subject to further review by the Environmental Impact Review Board.

Upon review of this EIS, if the EIRB concludes that significant negative impacts can be mitigated to an acceptable level and, therefore, that the Project may proceed, then the ILA and other regulatory agencies can issue permits and licences and prepare accompanying terms and conditions. For the portion of the Highway traversing Inuvialuit lands, as part of the permitting process for access and use of Inuvialuit lands, a negotiated land tenure agreement will be required (Section 1.5.1.1).

Other Inuvialuit, territorial and federal agencies involved in the regulatory approval process will include, but may not be limited to the ILA, the Northwest Territories Water Board (NWTWB), Indian and Northern Affairs Canada (INAC), Fisheries and Oceans Canada (DFO), GNWT Environment and Natural Resources (ENR), Environment Canada (EC), Transport Canada, Aurora Research Institute, and the Prince of Wales Northern Heritage Centre (PWNHC).

Figures 1.5-1 and 1.5-2 show the location of the proposed Highway in the context of the Mackenzie Delta area. Figure 1.5-2 identifies the jurisdictional boundaries that indicate which agencies will screen, permit, licence, or otherwise issue decisions and authorizations for the construction of the Highway and associated activities. The location of the Project relative to the Inuvialuit Settlement Region, Inuvialuit 7(1)(a) and 7(1)(b) lands, and Crown Lands are of particular relevance to the assessment and regulatory discussion that follows.



LEGEND

- Communities
- Territorial Boundary
- Primary 2009 Route
- Alternative 1 (2009 Minor Realignment)
- Alternative 2 (Upland Route)
- Alternative 3 (2010 Minor Realignment)
- Navy Road

NOTES

Base imagery: ESRI Data and Maps

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY ENVIRONMENTAL IMPACT STATEMENT

Proposed Project Location

PROJECTION: UTM Zone 8	DATUM: NAD83

Scale: 1:2,000,000

20 10 0 20 40 60

Kilometres

FILE NO.: V23201322_EIS_Map018_Intro_PrjLoc.mxd

PROJECT NO.	DWN	CKD	REV
V23201322	SL	TS	0

OFFICE	DATE
EBA-VANC	May 2, 2011

Town of Inuvik

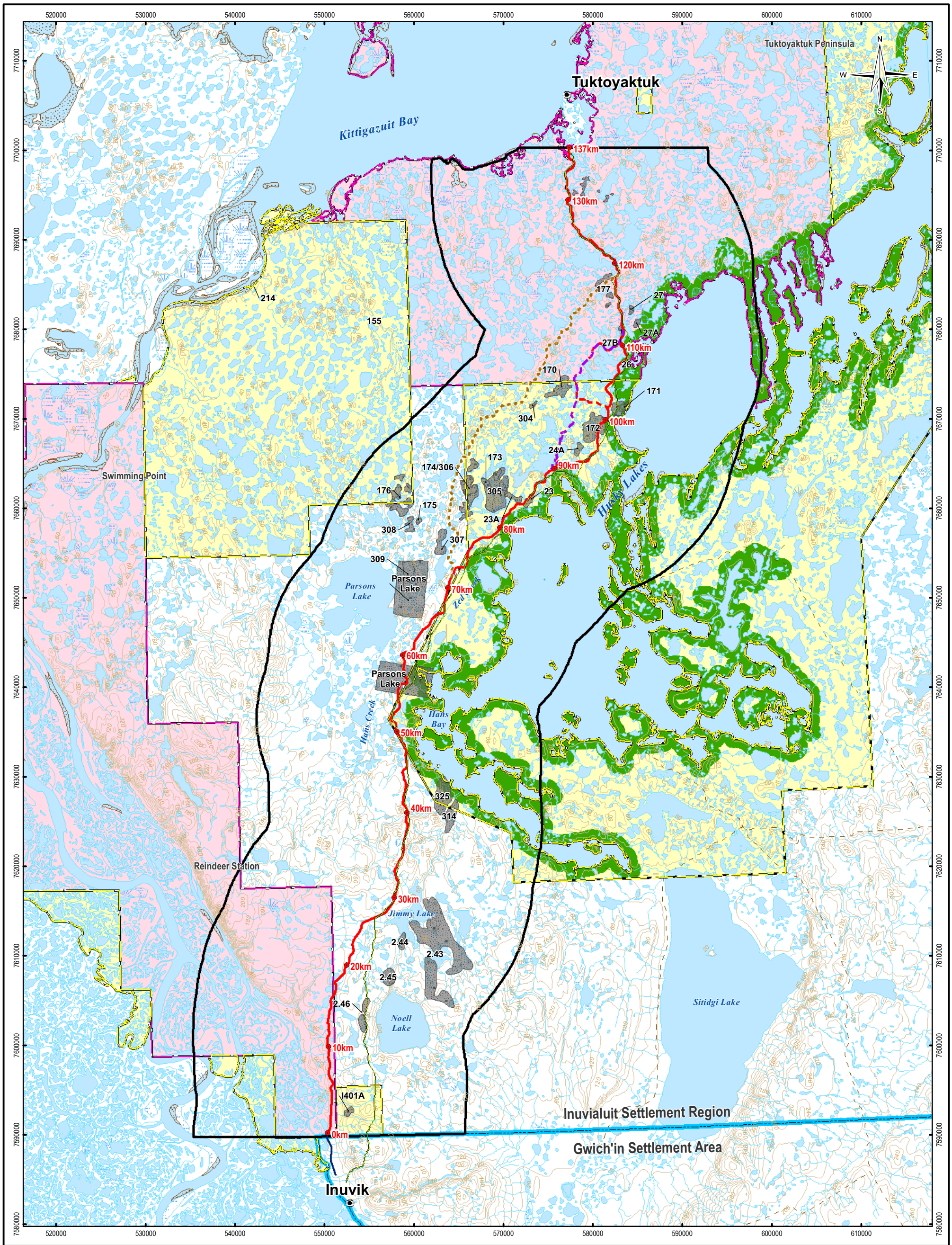
Northwest Territories

KIGGIAK - EBA

Figure 1.5-1

Q:\Vancouver\GIS\ENVIRONMENTAL\V232\V23201322_TukRoad_EIS\Maps\EIS\V23201322_EIS_Map018_Intro_PrjLoc.mxd modified 5/2/2011 by sleusink

Q:\Vancouver\GIS\ENVIRONMENTAL\V232\V23201322_TukRoad_EIS\Maps\EIS\V23201322_EIS_Map004_Dev_GranProp.mxd modified 5/2/2011 by sleusink



LEGEND

- Regional Study Area (15 km buffer)
- Primary 2009 Route
- Alternative 1 (2009 Minor Realignment)
- Alternative 2 (Upland Route)
- Alternative 3 (2010 Minor Realignment)
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Borrow Sources
- Husky Lakes 1000m Setback
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand

NOTES

Base data source: NTS 1:250,000
Borrow Sources, ILA Lands, Husky Lakes 1000m Setback: Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY ENVIRONMENTAL IMPACT STATEMENT

Inuvik to Tuktoyaktuk Route Options and Potential Borrow Source Locations

PROJECTION: UTM Zone 8	DATUM: NAD83
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)	
FILE NO.: V23201322_EIS_Map004_Dev_GranProp.mxd	
PROJECT NO.: V23201322	DWN: SL / CKD: TS / REV: 0
OFFICE: EBA-VANC	DATE: May 2, 2011

Figure 1.5-2

1.5.1 Previous Regulatory Approvals

Previous approvals known to have been obtained for road construction and/or quarrying in the Project area are described below.

In 2000, the ILA granted an approval to E. Gruben's Transport Ltd. (EGT) to remove approximately 30,000 m^3 of aggregate material from Source 177. Some of this material was placed on several kilometres of land in the vicinity of the proposed alignment, some of which is now part of the all-weather Tuktoyaktuk to Source 177 Access Road.

In 2009, the ILA granted approval to the Hamlet of Tuktoyaktuk and the GNWT Department of Transportation to construct the all-weather Tuktoyaktuk to Source 177 Access Road. This Access Road can be considered a pilot project for the currently proposed Inuvik to Tuktoyaktuk Highway in terms of environmental review and permitting, cost, schedule, logistics, construction methods, environmental protection, and effects mitigation. The Access Road was completed in 2010.

Other land use and quarry permits have been issued in the Inuvik to Tuktoyaktuk corridor, but they pre-date the IFA and the current environmental screening and regulatory regime. Notably, borrow sources were accessed by Gulf Canada Ltd. in the 1970s to create spring/summer well site leases at the Parsons Lake natural gas field east of the proposed Highway alignment. As well, Source 168 was quarried by E. Gruben's Transport Ltd. (EGT) in the 1980s for shoreline erosion protection for the community of Tuktoyaktuk.

1.5.1 Review and Approvals Processes

There are several aspects of the proposed Highway project that require regulatory authorizations. The proposed Highway traverses private Inuvialuit lands and Crown lands. It crosses over a number of watercourses. During some phases of construction, the project will require considerable volumes of water and the extraction of large quantities of material resources. Each of these activities may trigger a regulatory authorization.

1.5.1.1 Inuvialuit Land Administration Authorizations

Access to Inuvialuit lands, that is more than casual and individual in nature, requires permission from the ILA. Accordingly, the ILA issues rights to access both 7(1)(a) and 7(1)(b) lands (ILA 2009, IRC 1987). For the portions of the proposed development activities occurring on privately held parcels, the ILA will be the primary regulatory authority.

Consultations with the ILA have identified the required authorizations including: a Temporary Right-of-Way, a Land Use Permit, and combined Land Use Permit and Quarry Permits for borrow sources. Supplemental geotechnical and biophysical studies will be conducted to fulfill the requirements of the land use and quarry applications. The Developer anticipates securing multi-year authorizations from the ILA to accommodate the duration of Highway construction. The project schedule is discussed in Section 2.0.

The project will also require an Access Agreement. The Access Agreement will be negotiated as part of the ILA permitting process.

Upon regulatory approval, the Developer anticipates continuing dialogue with the ILA and other Inuvialuit organizations and authorities. These discussions will include interpretation of Project terms and conditions, and completion of negotiated agreements, including permanent land tenure.

The entire length of the Inuvik to Tuktoyaktuk Highway alignment is 137 km, of which 71 km, or 51.5%, will be located on Inuvialuit settlement lands which are regulated and administered by the Inuvialuit Lands Administration. As the goal is to have the Highway right-of-way (surface rights) under the authority of the GNWT as a public road, 71 km are to be transferred to the GNWT pursuant to the expropriation procedure as set out in the Inuvialuit Final Agreement in Section 7 "Inuvialuit and Crown Lands", Subsections 7(60) "Expropriation" and 7(64) "Public Road Right of Way," and Section 18 "Arbitration."

As the Highway project proceeds through regulatory approvals, funding, design, and construction, GNWT DOT will work with the ILA to affect the land transfer necessary for the right-of-way, pursuant to and subject to the provisions of the IFA.

1.5.1.2 Indian and Northern Affairs Canada Authorizations

Indian and Northern Affairs Canada (INAC), in the administration of the *Territorial Lands Act*, the *Territorial Lands Regulation*, the *Territorial Land Use Regulation*, and the *Territorial Quarrying Regulation,* holds jurisdiction over Crown lands in the Inuvialuit Settlement Region.

A land use permit will be required for the proposed Highway right-of-way, temporary borrow source access roads, and temporary camps occurring on Crown lands. Specifically, under the *Territorial Land Use Regulations*, a Class A Land Use Permit will be required to carry on any work or undertaking that involves the levelling, grading, clearing cutting or snowploughing of any line, trail or right-of-way exceeding 1.5 m in width and exceeding 4 ha in area.

The project will require quarry permits issued under the *Territorial Quarrying Regulation* for the extraction of borrow materials. INAC will consider requested volumes in the context of the resource requirements of other reasonably foreseeable community, industrial, and other demands for granular resources. At present, INAC permits borrow sources for a maximum duration of one year; therefore, successive annual permits may be required for some project sources.

Applicable application forms will be submitted for the Land Use Permits and Quarry Permits. Supplemental geotechnical and biophysical studies will be conducted as necessary to fulfill the requirements of the land use and quarry applications.

1.5.1.3 Northwest Territories Water Board Water Licensing

According to *Northwest Territories Waters Act* Section 12, the Northwest Territories Water Board (NWTWB) is responsible to provide for the conservation, development and utilization of waters in the Inuvialuit Settlement Region. The Developers will require Type A or Type B water licences for water crossings, construction camps and water use. There are different thresholds for Type A and Type B water licences under the *Northwest Territories Waters Regulations*.

A Type B Water Licence is required for the construction of a structure across a watercourse that is more than 5 metres wide at the ordinary high water mark at point of construction. The proposed Highway crosses more than one watercourse greater than five metres in width.

A Type B Water Licence will be required for camps of more than 50 persons. This project proposes a number of 15-20-person camps in the first year, and in the second year, at least one camp of greater than 50 persons may be added.

A Type A Water Licence is required for the direct use of 300 m^3 or more of water per day for industrial use. The construction of the proposed Highway is anticipated to use 1,000 m^3 or more of water per day during peak phases of construction, particularly when establishing temporary winter access roads and for dust control in summer months.

Under the *Northwest Territories Waters Act* Subsection 174(1), it is mandatory for the NWTWB to provide the opportunity for a public hearing for projects that require a Type A Water Licence. If, during the regulatory phase, the NWTWB determines the need for a Type A Water Licence for this project a public hearing will be held if an intervenor demonstrates an interest.

The EIS provides information about water crossings greater than five metres in width, identifies the need for crew accomodations, and provides a construction schedule and preliminary logistics plan. The detailed water requirement estimates, water source identification, construction camp siting, and the location of winter access and haul roads will be submitted in the regulatory applications.

The Project Team will conduct further assessment of the proposed water crossing locations and will provide information about watercourse characteristics and proposed crossing structure designs sufficient to meet the requirements of the *Northwest Territories Waters Regulations*. Furthermore, the DFO (2005) *Protocol for Winter Water Withdrawal in the Northwest Territories* will be followed. This will include identification of suitable water withdrawal sources (lakes and streams), assessment of allowable withdrawal quantities per sources, unique source identification, and water withdrawal volume tracking.

1.5.1.4 Fisheries and Oceans Canada Authorizations

Fisheries and Oceans Canada (DFO) administers the *Fisheries Act*, which includes provisions that potentially relate to aspects of the Highway Project. In particular, DFO will focus on the potential effects of construction activities on fish habitat, which is protected under Section 35 of the Act.

DFO may issue a Letter of Advice for components of the Project that are not expected to result in the harmful alteration, disruption or destruction (HADD) of fish habitat or an Authorization for HADD, under Sections 35(1) and 35(2), respectively. A Letter of Advice normally sets out or refers to guidelines and/or mitigation measures that, if followed, would prevent a HADD. An Authorization recognizes that a HADD is likely to occur, and therefore includes an agreement between the project proponent and DFO for compensation that will achieve No Net Loss (NNL) of fish habitat.

In addition, DFO has developed a series of Operational Statements that provide guidance to project proponents regarding specific types of projects. The intention of these Operational Statements is to relieve proponents of the need for an approval from DFO, provided that specified requirements and conditions are followed. In the Northwest Territories, DFO has published several Operational Statements that may be applicable to this project including clear-span bridges, culvert maintenance, ice bridges and snow fills, temporary stream crossings, and maintenance of riparian vegetation in existing rights-of-way.

The various stream crossings that will be necessary as part of the proposed Highway will be sited and designed to avoid or mitigate adverse effects on fish and fish habitat (i.e. HADD), wherever possible. As such, it is expected that most of the Project can be completed through the issuance of Letters of Advice by DFO, or by application of relevant Operational Statements. Where a HADD is unavoidable, DFO will be consulted to discuss and determine suitable compensation strategies so that the necessary application for Authorization pursuant to Section 35(2) of the *Fisheries Act* can be submitted. Such situations arise, for example, due to the installation of culverts in fish-bearing streams, where the culvert results in the direct loss of spawning or rearing habitat. Once the final route is determined, conceptual plans for each crossing will be provided to DFO (and other regulators), which will include assessments of habitat type, quality, and quantity. These assessments will form the basis for Authorizations and compensation plans.

Borrow sources will not be developed within 50 m of any watercourse and 1 km of the Husky Lakes. Where blasting is required, DFO guidelines for the use of explosives will be followed (Wright and Hopky 1998).

1.5.1.5 Permit for Construction within Navigable Waters

Under the *Navigable Waters Protection Act* and *Regulations*, the Project will require a permit for construction of bridges across navigable waterbodies. It is understood that some of the larger streams in the Husky Lakes area, in particular Hans Creek and Zed creek may

constitute navigable waters. Transport Canada is responsible for permits under the *Navigable Waters Protection Act*. An application will be made once the applicable bridge design information becomes available.

1.5.1.6 Research Authorizations

Pre-construction studies will include additional environmental, engineering, and archaeological investigations. Scientific activities are administered under the *Scientists Act* and are permitted with the issuance of a Scientific Research Licence by the Aurora Research Institute. In addition, Wildlife Research Permits are issued by the GNWT Department of Environment and Natural Resources (ENR), and several permits will be required from the Department of Fisheries and Oceans (i.e., Scientific Collection Permit and Animal Use Permit).

Archaeological investigations are permitted under the *Northwest Territories Archaeological Sites Regulations* made under the *Northwest Territories Act*, and are issued by the Prince of Wales Northern Heritage Centre. Such authorizations will be obtained on an annual basis, as needed, prior to the conduct of seasonal field activities. Local Hunters and Trappers Committees and Community Corporations will be notified of proposed work activities.

1.5.1.7 Non-Regulatory Requirements

Non-regulatory requirements are typically requirements or conditions recommended by local organizations, such as the HTCs, Community Corporations, and the general public. These types of requirements are typically conveyed to the regulatory bodies (e.g., ILA, INAC, NWTWB, etc.) and commonly become conditions associated with the regulatory approvals. In addition, during the consultations that were completed, the Developer took note of comments and concerns, and to the extent possible, have incorporated some of these in the Highway planning process.

1.5.2 Inuvialuit Settlement Region Consultation and Communication

"A well established system of co-management of resources is in place throughout the ISR… The communities, Hunters and Trappers Committees, co-management bodies, and government agencies are key elements of this system" (EISC 2004 p.6).

As the Developer intends to minimize or avoid disturbance to ISR land, traditional land use, and harvesting activities, the Developer has initiated consultations with the noted organizations and residents and will continue to provide notice of studies and construction activities.

Examples of consultation and communication occurring since the inception of this Project include:

- September 2009 Inuvialuit Land Administration, Inuvik and Tuktoyaktuk Hunters and Trappers Committees – Notice of the September 14-18, 2009 Field Study and Consent Form for submission to the Prince of Wales Northern Heritage Centre (in support of Archaeological Permit Issuance);

- September 2009 Aurora Research Institute – Telephone inquiry about the need for authorization to conduct the September 14-18, 2009 Field Study;
- October 2009 Inuvik to Tuktoyaktuk Highway Backgrounder (2-page Project introduction and map) emailed or faxed to community organizations and regulatory agencies;
- October 2009 Inuvik to Tuktoyaktuk Highway Community and Regulatory Consultations for information gathering purposes;
- November 2009 Notice of Intent to Inuvialuit Regional Corporation (IRC) Board, November 13, 2009; and
- January 2010 Inuvik to Tuktoyaktuk Highway follow-up community consultations to respond to questions raised in October 2009, update organizations and residents on progress made during Project Description Report preparations and to receive further input before finalizing the Project Description Report.

Input was also received during the EISC screening process and agency review of the Project Description Report. These comments have been reviewed and where possible, suggestions incorporated into this Environmental Impact Statement. Further discussion on consultation is located in Section 1.6.2.

1.6 STUDY STRATEGY AND METHODOLOGY

The following are the primary steps involved in the preparation of the EIS and the corresponding report Sections where more detailed information for each step is provided - many of these steps overlap temporally and some are ongoing (i.e. field studies and community consultations):

- Regulatory and Background Review (Section 1.5 and 3.0): Researched and reviewed applicable regulations; Compiled and reviewed available historical reports and data; Consulted regulators.
- Community Consultation (Section 1.6.2): Arranged meetings to obtain feedback from the public and affected communities about the development proposal.
- Environmental field work and studies (Section 2.7.7): Analyzed information gaps in existing data; prepared and conducted studies to supplement existing information.
- Route Design and Refinement (Section 2.0): Incorporated information from historical and new studies, regulatory requirements, and community feedback into designs; modified design to address regulatory, functional, environmental, and community concerns.
- Impact Effects Assessment (Section 4.0): Identified potential effects of the development proposal in relation to biophysical and human environmental components.

- Mitigation Planning (Sections 4.0 and 6.0): Developed strategies, using development standards, guidance documents, best management practices, regulatory feedback and professional experience, to design and deliver the Project in a manner that most adequately preserves biophysical and human environmental components.
- Cumulative Effects Assessment (Section 5.0): Assessed the potential cumulative effects of the Project in relation to other past, present and future projects in the region on biophysical and human environmental components.

All EIS steps were conducted in accordance with accepted EIRB standards and methodologies, as outlined in the EIRB's ToR.

Project goals, as specified by the EIRB ToR, are the basis for the EIS methodology and have been incorporated throughout this document. EIRB Project goals and the report sections where they are addressed are listed in Table 6-1 (Section 6.0).

1.6.1 Respect for and Use of Traditional Knowledge

The Developer acknowledges that traditional knowledge has been passed on between generations for centuries through a variety of means, including legends, stories, songs, dances and experience (ICC et al. 2006). The knowledge continues to be relevant today as the traditions and activities (such as hunting, trapping, and fishing) are still practiced. The Developer has incorporated traditional knowledge throughout the environmental assessment to ensure that the assessment is fair to resource users, by documenting the potential ways in which development location itself and associated activities may affect those who use the land for cultural or subsistence purposes.

Extensive traditional knowledge studies have been prepared in the Inuvialuit Settlement Region in the past decade. Traditional knowledge obtained during public consultation sessions and from the following studies has been incorporated into the Project design, construction and operational plans:

- Tuktoyaktuk Community Conservation Plan (TCCP) (Community of Tuktoyaktuk et al. 2000 and 2008);
- Inuvik Inuvialuit Community Conservation Plan (IICCP) (Community of Inuvik et al. 2000 and 2008); and
- Inuvialuit Settlement Region Traditional Knowledge Report (ICC et al. 2006).

Traditional knowledge was obtained during open discussions and mapping exercises, as part of public consultation. The authors of the traditional knowledge studies that were used in this document include the Communities of Tuktoyaktuk and Inuvik, the Wildlife Management Advisory Council (NWT), The Joint Secretariat, and the Inuvik, Tuktoyaktuk and Aklavik Community Corporations. The methods used to gather and verify knowledge for these studies is outlined within each document.

Traditional knowledge was used in this environmental review process to:

- Contribute to biophysical and socio-economic understanding of the region;
- Contribute to overall Project design decisions;
- Improve the confidence in predicted biophysical and socio-economic impacts;
- Contribute to the development of mitigation strategies, and follow-up and monitoring programs;
- Assist in the ability to meet regulatory requirements; and
- Design a more culturally-acceptable development.

Traditional knowledge was incorporated during the assessment to:

- Identify potential concerns, issues and recommendations during the Highway design period;
- Provide baseline information on many topics, such as harvesting seasons and locations, wildlife migration patterns, camp locations, burial sites, traditional land use, and other resource use;
- Identify potential effects from various types of construction activities, such as increased employment, in-migration of workers, and the effect of the Highway on traditional harvesting; and
- Identify potential mitigation measures to the various effects described.

In the TK Studies, several values, issues and concerns are stated, many of which are relevant to the proposed Highway. Several themes that are discussed including:

- Protection of traditional land use and harvesting activities;
- Protection of resources;
- Protection of cultural sites and traditional activities;
- Protection of the environment; and
- Protection of culture.

These issues and concerns are addressed in more detail in the human environment baseline section of the report (Section 3.2), and the potential effects and proposed mitigation measures are identified in the human environment effects section (Section 4.3).

1.6.2 Involvement of Potentially Affected Communities and the Public

Public and regulatory meetings and consultation sessions for the proposed Highway were held in Inuvik and Tuktoyaktuk in October 2009 and January 2010. These meetings were an important opportunity to share information about the Project with the communities and to hear directly from residents about their interests, questions, and concerns. The October

consultations provided insights that the Project Team incorporated into Project planning and the development of the Project Description Report and Environmental Impact Statement. The following section provides a brief description of the meeting content and outcomes. Detail about the parties consulted, meeting dates, discussion highlights, questions asked, and responses provided appear in Appendix B.

1.6.2.1 October 2009 Consultations

Planning and scheduling for the October 26-30, 2009 consultations began in September 2009. Community organizations (e.g., Elders Committee and Hunter and Trapper Committees) were contacted to establish availability and to open communication about any questions or comments on the prospect of the Highway that needed to be considered during the upcoming gatherings. Once meeting dates were scheduled and confirmed, organizations were sent a Backgrounder that provided a preliminary overview of the proposed Project (see Appendix B).

The community meetings in Inuvik and Tuktoyaktuk were publicized using notices on bulletin boards and television advertising. The community meetings allowed approximately 1-2 hours before the presentation, and as much time as needed afterward for residents to view maps and posters and engage in discussion with the GNWT Department of Transportation and consultant representatives. Markers and maps were available to note harvesting areas; locations where traditional land use activities take place; heritage values; camps and cabin sites; recreation areas; route preferences; and any areas of concern. Usually, groups of three to five residents gathered around the maps and discussed areas and activities that are familiar and important to them. The presentation sessions lasted approximately two and three hours in Inuvik and Tuktoyaktuk, respectively. Questions and answers were encouraged throughout.

The first round of meetings and consultations were intended to provide the communities, organizations, and regulatory agencies with an introduction to the proposed Inuvik to Tuktoyaktuk Highway, to identify the Developer, to establish Project status, anticipated study and review schedule, answer preliminary questions, and receive advice, input and recommendations. The second round of meetings and consultations served to respond to questions from the October 2009 consultations, solicit community feedback on the updated Project information, and gauge acceptability of the 2009 preferred route to put forward for EISC screening and subsequent regulatory review.

Photo 1.6.2-1
Tuktoyaktuk Community Meeting, October 27, 2009

Photo 1.6.2-2
Tuktoyaktuk Community Meeting, October 27, 2009

Photo 1.6.2-3
Inuvik Community Meeting, October 28, 2009

Photo 1.6.2-4
Tuktoyaktuk Community Meeting, October 27, 2009

Photo 1.6.2-5
Inuvik Community Meeting, October 28, 2009

Photo 1.6.2-6
Project Team meeting with ILA in Tuktoyaktuk, October 27, 2009

In the summary provided in Appendix B, the main areas of interest discussed during community and regulatory consultations are broadly categorized as follows:

- Application of the *Inuvialuit Final Agreement* to the proposed Highway;
- Protection of special areas, in particular, the Husky Lakes area;
- Project-specific regulatory review and decision-making process;
- Possible subsequent developments;
- Route and route alternatives;
- Traditional land use and related cultural considerations;
- Project Partnership/ Developer;
- Project economics;
- Granular resource / borrows;
- Project schedule;
- Community social, economic, and cultural considerations;
- Associated infrastructure maintenance and allocation of responsibilities;
- Public safety;
- Reference to the Tuktoyaktuk to Source 177 Access Road;
- Consultation approach;
- Areas for further investigation;
- Land tenure;
- Protection of wildlife, birds, and fisheries resources and habitat;
- Environmental and socio-economic mitigation and management planning;
- Construction specifications; and
- Items for discussion in January 2010.

The October 2009 consultations expanded views held by the Developer's regarding various alignment options. The prospect of development near the Husky Lakes met with approval from some residents and concern from others. For the Project Team's consideration, the communities, organizations, and agencies brought forward specific references and data to help assess the proposed Project:

- The *Inuvialuit Final Agreement*, Sections 8, 13, and 14;
- The EIRB (2002; 2009) Husky Lakes Management Plan / Husky Lakes Criteria;
- Mapping data from the Inuvialuit Land Administration, including the 1 km Husky Lakes setback, granular resources data, and the location of registered cabins.

The follow-up items identified during the October 2009 sessions included the following:

- An invitation to the EISC to come to the January 2010 Highway meetings in Tuktoyaktuk;
- A report on further investigation into the volumes, cost, and construction considerations for Alternative 2 (Upland Route) alternative to enable reasonable comparison to the Primary 2009 Route. This work was completed in November and December 2009 to support the January 2010 consultations;
- Additional elaboration in the Project Description Report regarding the history of Inuvik to Tuktoyaktuk Highway proposals and studies;
- The provision of October 2009 consultation notes to the communities of Inuvik and Tuktoyaktuk prior to the January 2010 meetings;
- A video conference presentation to a joint meeting of the EISC and EIRB in November 2009, and teleconference presentation to WMAC (NWT) in December 2009; and
- A commitment for ongoing discussion with Inuvialuit and Federal regulatory agencies to establish the regulatory path for the Project review.

1.6.2.2 January 2010 Consultations

On December 18, 2009, community organizations were emailed advance notification that meetings would be held in Inuvik and Tuktoyaktuk during the week of January 11-15, 2010. On January 5, 2010, the dates were announced as concurrent evening meetings on Thursday, January 14, 2010. Bulletin board notices, television advertising and email notifications were sent out on January 5, 2010. As an additional awareness-raising measure, the meetings were advertised on CBC Radio and CKLB FM on the Tuesday, Wednesday, and Thursday prior to the meetings.

The second round of meetings and consultations served several functions: to respond to questions and issues raised in the October 2009 consultations, to solicit community feedback on the updated Project information, and to gauge acceptability of the Primary 2009 Route to put forward for EISC screening and subsequent regulatory review.

On January 13, 2010, Indian and Northern Affairs Canada (INAC) hosted a meeting between a group of federal regulatory agencies and the Project Team. The agencies represented were Indian and Northern Affairs Canada, Fisheries and Oceans Canada, the NWT Water Board, and the Inuvialuit Land Administration. At the beginning of the meeting, Mr. Russell Newmark provided a statement about the 30 year history of the proposed Inuvik to Tuktoyaktuk Highway. The Project Team presented a Project update and then responded to questions. The discussion addressed topics including sources of funding, water crossings, potential fisheries authorizations, the preferred and alternative alignments, the Project cost estimate, proposed borrow sources (volumes, quality, and ice content), the proposed use of geotextile fabric to help maintain the integrity of the Highway

embankment, Highway construction standards, a request for construction and maintenance phase sediment and erosion control plans, recommended additional studies, and a request for borrow source pit management plans.

The Developer was invited to meet with the Inuvik and Tuktoyaktuk Community Corporations, and the Inuvik and Tuktoyaktuk Hunters and Trappers Committees on January 13, 2010. The meeting provided an opportunity to discuss a variety of topics including the anticipated regulatory process, the alternative alignments, fisheries and water crossing concerns, the ban on caribou hunting, additional baseline information sources (e.g., fisheries data, potentially sensitive cultural sites), water sources, social concerns, existing camps and cabins at Husky Lakes, and traditional use.

Positive effects of the Project were also discussed. Community Corporation representatives identified contracts, employment, and training benefits that would spread over several years. Mayor Gruben reported that the Tuktoyaktuk to Source 177 Access Road is regarded as "The Happy Road" because people are happy to be working on it and excited to see it becoming a reality. The meeting ended with final comments from each participant. There was an expression of support for the Project to move forward to EISC screening and a commitment to on-going Project Team consultations with the Community Corporations and Hunters and Trappers Committees.

The two community meetings, held concurrently on January 14, 2010, were well attended and participants from both meetings were generally supportive of the Primary 2009 Route (Photo 1.6.2-7). Discussion points from the January meetings are presented in Appendix B. The outcomes of the meetings are summarized below.

Photo 1.6.2-7
Tuktoyaktuk Community Meeting, January 14, 2010

Tuktoyaktuk residents expressed general satisfaction that the new presentation materials incorporated and addressed the concerns raised at previous meetings by the community members. Residents of Tuktoyaktuk and Inuvik were generally supportive with the Project Team's efforts to keep the proposed Highway alignment beyond the 1 km setback (with one minor encroachment of less than 2 km) in accordance with ILA recommendations and the latest version of the Husky Lakes Management Plan. They also expressed a general confidence in the ability of the Inuvialuit co-management bodies and other agencies to protect their interests in relation to future implementation of the Highway. An Elder also highlighted a number of benefits if the Highway is constructed including increased safety, cheaper costs for Tuktoyaktuk residents, increased opportunities for the youth, and ability to travel year-round.

Inuvik residents generally indicated great interest in seeing the Project move forward. However, it must be noted that a few of the community members continued to favour Alternative 2 (Upland Route). Participants that stated a preference for Alternative 2 (Upland Route) spoke from two perspectives. One perspective was that Alternative 2 (Upland Route) would be several kilometres farther from Husky Lakes than the Primary 2009 Route and, with that separation, may pose less risk to Husky Lakes. The other perspective preferred Alternative 2 (Upland Route) because it would be a bigger project, it would employ more people, it might take longer to build, and it would require more borrow material.

The technical, economic, construction and maintenance advantages of the Primary 2009 Route were discussed as rationale for presenting the Primary 2009 Route for funding and regulatory screening. The discussion then turned to land use issues, environmental protection, Husky Lakes access, the regulatory review process, and management planning. Those present at the meeting expressed a strong interest in seeing an efficient regulatory process, encouraging one another to identify any concerns or possible issues now, rather than at the 'last minute', so as to avoid delaying approvals.

1.6.2.3 ILA Consultations – November 2010

The ILA held two public hearings on the proposed Inuvik-Tuktoyaktuk Highway in November 2010. Hearings were held in Inuvik on November 10, 2010 and Tuktoyaktuk on November 15, 2010. The meetings were attended by 30 people in Inuvik and 98 people in Tuktoyaktuk. A summary of the meetings is provided in Appendix B.

According to the consultation summary, the "vast majority of the Tuktoyaktuk beneficiaries who shared their opinion on the Highway were strong supporters of the Highway, in principle." However, it was noted that beneficiaries who opposed the Highway were not comfortable expressing their opinions in front of the assembly, but stated their opinion in one-on-one conversations with ILA staff. While some were concerned with the routing, environmental, and wildlife effects, the beneficiaries "overwhelmingly supported" the concept of a highway between Inuvik and Tuktoyaktuk (ILA 2010, p. 1).

The degree of support for the Highway was less evident in Inuvik, although it was clear that most beneficiaries who offered comments or questions were in support of the Highway. There were also a minority of Inuvik beneficiaries that felt the Highway would have too severe an impact and therefore should not be constructed.

Support for Alternative 2 (Upland Route) was almost unanimous in Tuktoyaktuk. The reason most commonly given for supporting Alternative 2 (Upland Route) was that it is the route most distant from the Husky Lakes. Keeping the Highway away from Husky Lakes was considered important for the following reasons: maintaining the traditional lifestyle and purposes for which Husky Lakes have been used for generations, preventing harvest loss at Husky Lakes (wildlife and fisheries), and protecting the Husky Lakes environment (water quality, vegetation, permafrost, tidiness). According to beneficiaries in Tuktoyaktuk, Alternative 1 (2009 Minor Realignment) in this EIS) and the proposed Primary 2009 Route are too close to the shores of Husky Lakes and would permanently and negatively affect the way Husky Lakes is used.

The Inuvik beneficiaries voiced less concern and spent less time discussing the routes as those in Tuktoyaktuk, and did not support one route over the other routes. A few beneficiaries in Inuvik stated their support for Alternative 1 (2009 Minor Realignment) as a good compromise between the Upland and the Primary 2009 Route (proposed route).

A few beneficiaries expressed concern that potential granular borrow sources were located too close to the Husky Lakes, potentially affecting the area's environment and tranquility.

Most Inuvialuit who expressed support for the Highway stated that it would not only reduce the cost of living in Tuktoyaktuk, but would provide many jobs and training opportunities for Inuvialuit. Ensuring that Inuvialuit are the primary benefactors of Highway construction jobs was also a common request.

If the Highway is constructed, beneficiaries stated that Highway inspections and management would be required to mitigate its effects. Some felt that cooperative management of the Highway will be required and should be enacted as early as possible, assuming the Highway is approved. Beneficiaries felt that the HTCs, DFO, FJMC, and ILA should be working together to the greatest extent possible. Questions were raised about the extent that the ILA and beneficiaries could control the use of the Highway, specifically related to tolls, speed limits, and periods of closure.

1.6.2.4 Consultations Summary

Most Inuvik and Tuktoyaktuk residents identified long-held community sentiments that a year-round road connection between Inuvik and Tuktoyaktuk would be beneficial to people from both communities, would provide construction and maintenance jobs, and would create business and employment opportunities between the communities. Residents expressed an urgency to build the Highway now because it sounds like the right time to apply for and obtain the funding. They also stated that local workers are available to construct the Highway now because there is currently very little other industrial activity.

The input received during the consultation meetings (see detailed summary of consultations in Appendix B) and subsequent discussions were considered during the development of the Project and route alternatives. The desire and interests brought forward by the communities, and the additional information that they provided, has been integrated into the Project plan and the preparation of the Environmental Impact Statement.

1.6.3 Recognition of the *Inuvialuit Final Agreement* and Community Conservation Plans

As discussed previously, the Developer acknowledges that the Project will be conducted in conformance with the *Inuvialuit Final Agreement* (IFA) and take into consideration the Tuktoyaktuk and Inuvik Inuvialuit Community Conservation Plans (CCPs), as outlined in the following sections.

In addition to the IFA and the CCPs, the Inuvialuit Settlement Region Traditional Knowledge Report, prepared by the Inuvik, Tuktoyaktuk and Aklavik Community Corporations in 2006, was used to supplement information from the CCPs.

Goals of the IFA and CCPs

The IFA is comprehensive land use agreement, between the Inuvialuit and the government of Canada. The guiding goals of the IFA are to:

- Preserve Inuvialuit cultural identity and values within a changing northern society.
- Enable Inuvialuit to be equal and meaningful participants in the northern and national economy and society.
- Protect and preserve the Arctic wildlife, environment and biological productivity.

CCPs reflect each community's values and strategies for achieving conservation and management of renewable resources within the community's planning area. Five goals were used to develop the 2000 and 2008 CCPs:

- Identify and Protect Important Habitats and Harvesting Areas - To identify important wildlife habitat, seasonal harvesting areas and cultural sites (for example, cabin sites) and make recommendations for their management.
- Develop Land Use Decisions - To describe the community process for making land use decisions and managing cumulative impacts which will help protect community values and conserve the resources on which priority lifestyles depend.
- Promote Education - To identify educational initiatives for the Inuvialuit and others interested in the area which will promote conservation, understanding and appreciation.
- Define Species Management - To describe a general system for wildlife management and conservation and identify population goals and conservation measures appropriate for each species of concern in the planning area. This will be done using the knowledge of the community and others with expertise.

- Enhance Economy - To enhance the local economy by adopting a cooperative and consistent approach to community decision making and resource management. This approach will help ensure economic stability and maintenance of all components of the Arctic ecosystem (Community of Tuktoyaktuk et al. 2008, Community of Inuvik et al. 2008).

In designating land management categories, the Inuvialuit have recognized priority land uses and activities, as well as areas of special ecological and cultural importance (Community of Tuktoyaktuk et al. 2008; Community of Inuvik et al. 2008). These areas are discussed primarily in the land use section (Section 3.2.9).

Review of IFA and CCPs with Communities

The IFA and the CCPs were discussed with community members during consultations. A brief summary of the IFA and CCP-related topics discussed include:

- Application of the *Inuvialuit Final Agreement* to the proposed Highway;
- Protection of special areas, in particular, the Husky Lakes area;
- Project-specific regulatory review and decision-making process;
- Traditional land use and related cultural considerations;
- Community social, economic, and cultural considerations;
- Consultation approach;
- Land tenure;
- Protection of wildlife, birds, and fisheries resources and habitat; and
- Environmental and socio-economic mitigation and management planning.

As previously discussed in Section 1.6.2, the communities, organizations, and agencies brought forward specific references and data during the October 2009 consultations to help assess the Highway Project, including:

- The *Inuvialuit Final Agreement*, Sections 8, 13, and 14;
- The EIRB (2002, 2009) Husky Lakes Management Plan/ Husky Lakes Criteria; and
- Mapping data from the Inuvialuit Land Administration, including the 1 km Husky Lakes setback, granular resources data, and the location of registered cabins.

Detailed information regarding the consultation proceedings is located in Section 1.6.2 and Appendix B.

Applying IFA and CPP's to the Development

Using the IFA and the CCPs, the Developer has identified mitigation measures and commitments to eliminate potential damage, destruction, and other effects to identified lands and waters (Section 6.0). In particular, the baseline and effects sections (Section 3.0

and 4.0, respectively) identify existing guidelines and plans with which the Development will comply.

The Developer has used the IFA and CPPs as a foundation for Project planning and environmental management.

1.6.4 Consideration of Sustainability Goals

This EIS reflects consideration of local, regional, territorial and national goals for sustainable development, and discusses the Project's ability to meet these goals.

The EIS demonstrates the Developer's consideration of sustainable development, through recognition and incorporation of the following sustainability indicators:

- The capacity of natural systems to maintain their structure and functions and to support indigenous biological diversity and productivity.
- Protection and conservation of wildlife and the environment, for present and future generations.
- The capacity of the social and economic systems of the human environment to achieve, maintain or enhance conditions of self-reliance and diversity.
- The capacity of human environments, including local and regional institutions, to respond to and manage externally induced change.
- The potential environmental effects of the development.
- The attainment and distribution of lasting and equitable social and economic benefits from projects.
- The rights of future generations to the sustainable use of renewable resources (EIRB 2010).

The EIS, as guided by the EIRB's Terms of Reference, is structured to report the extent to which the Developer has considered and can achieve the stated sustainability goals for the Project. In particular, the baseline section (Section 3.0) of the document identifies the current understanding of the biophysical and human environments, using accepted indicators.

Using the baseline conditions as part of the assessment, the capacity of the biophysical systems and human environment to maintain their structure, functions, self-reliance and diversity was assessed in relation to the Project planning and design components to identify potential effects. To mitigate potential negative effects, mitigation measures have been fully incorporated into the overall Project design.

The baseline, effects, mitigation and monitoring sections of the EIS document identify the methodology and list of indicators used in the assessment.

In particular, the Developer has considered the following during preparation of the EIS:

- How the public and communities have been given opportunity to participate in and contribute to the planning and design of the development and the degree to which their views have been considered in the review process.
- How the planning and design of the development affects the achievement of sustainable development.
- How monitoring, management and reporting systems have incorporated indicators of sustainability.
- The extent to which the development makes a positive overall contribution towards environmental, social, cultural and economic sustainability – locally, regionally, territorially, and nationally.

As discussed, in Section 1.6.2, the public, communities, and regulatory agencies were provided opportunity to participate in and contribute to the planning and design of the development. Specific information collected during this process is identified in Sections 1.6.2 and Appendix B. Incorporation of consultation-generated information, such as the minimum 1 km setback from Husky Lakes, is discussed in relevant sections of the document.

Through consultation and research, much effort has been put toward identifying and meeting the present needs of the biophysical and human environment. This EIS examines the potential effect of the proposed development on the ability of future generations to meet their needs. For example, a common theme expressed by community meeting attendees is the need to protect traditional harvesting activities, and therefore, wildlife populations and access to the land. The EIS examines and describes if/how the proposed Highway could affect traditional harvesting activities through potential effects on wildlife, their habitat, or on harvester's access to the land. Should effects be identified, mitigation measures are examined to determine if these effects can be mitigated, and, where they cannot be mitigated, residual effects are identified.

As previously mentioned, data from various indicators are reported in the baseline section. These indicators not only provide current information on the status of the component, but also provide a method to measure future change. Through evaluation of the changes over time, adaptive management may be used to further mitigate negative effects or to enhance positive effects. Further information regarding follow-up and monitoring are found in Section 7.0.

The effects and cumulative effects sections (Section 4.0 and 5.0) identify whether the Project makes a positive overall contribution towards environmental, social, cultural and economic sustainability. Effects are described as local, regional, territorial or national effects.

1.6.5 Precautionary Principle

According to the *Canadian Environmental Protection Act, 1999* (CEPA) the precautionary principle is defined as:

"where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

The precautionary principle, therefore, is an approach to risk management that reflects the need to take prudent action in the face of potentially serious risk without having to await the completion of further scientific research. This principle implies that there is a social responsibility to protect the public and the environment from exposure to harm, when scientific investigation has found a plausible risk. These protections can be relaxed only if further scientific findings emerge that provide sound evidence that no harm will result.

A precautionary approach may be relevant in circumstances where it is identified that a Project activity could cause serious or irreversible adverse effects on the environment and the cause and effect relationships cannot be clearly established.

The available research, including scientific and traditional knowledge, has been incorporated into the baseline and effects sections of this EIS to determine the potential effects from the proposed Highway on the biophysical and human environment.

Cause and effect relationships have been established for the biophysical aspects of this Project, but are more challenging to determine for the human environment. Several concerns were raised during the consultations regarding the public's use of the Highway and the potential for increased harvesting activities or access to harvesting areas. Although the Developer is sensitive to these issues, and has proposed mitigation measures to minimize such induced effects, ultimately, the responsibility for managing these issues rests with other agencies in the community, and with the residents of the ISR themselves.

During consultation, the overall response to the proposed Highway, and people's capacity to accept the changes that the Highway would bring, was positive. Details of the consultation results are found in Sections 1.6.2 and in Appendix B.

Based on the results of the effects assessment, found in Section 4.0 of this EIS report, the precautionary principle will be exercised by applying best management practices and exercising due diligence in the delivery of this Project. These principles are part of the Developer's operational practices and environmental policy.

2.0 PROJECT DESCRIPTION

2.1 ROUTE ALIGNMENT ALTERNATIVES

2.1.1 Brief History of Alternative Alignments Considered

During the 1980s, interest in the proposed Highway varied in relation to economic and political factors and two other possible highway alignments were considered as alternatives to the original PWC 1977 surveyed route alignment which is discussed in greater detail in the next section.

In 1985, the Inuvialuit Land Administration expressed its opposition to the PWC 1977 route partly because of its proximity to the Husky Lakes; and in 1986 suggested to Department of Indian and Northern Affairs (DIAND) a longer route which involved a major shift of the alignment to the west, towards Reindeer Station through the Caribou Hills, and along the East Channel of the Mackenzie River. This highway alignment would be located almost entirely within Inuvialuit lands, and was approximately 173 km long, or 33 km longer than the PWC 1977 route. Public Works Canada did not support this proposed alignment because of economic and geometric reasons, but put forward an alternative route that was 27 km longer than the original PWC 1977 route. However, this route was located without field data, and would have required completely new preliminary engineering studies, and because of its longer length, would have been considerably more costly to construct than the original PWC 1977 route.

As part of its Highway Strategy, GNWT Department of Transportation launched a $2 million initiative in May 1998 under which it conducted various planning, environmental, pre-engineering and related studies for each of the three new highway corridors that the Department had been promoting for federal funding: Slave Geological Province Transportation Corridor; Mackenzie Highway Extension from Wrigley to Inuvik; and Inuvik to Tuktoyaktuk Highway. The results of the studies were published in the "Summary Report of the Highway Strategy, October 1999, GNWT Department of Transportation".

Two of the several studies carried out for the Inuvik to Tuktoyaktuk Highway, as part of the Highway Strategy, dealt with the route alignment issues.

First, the route location was an important question posed and discussed at community consultation meetings held in January 1999 in Inuvik, Tuktoyaktuk, Aklavik, Fort McPherson, and Tsiigehtchic. In terms of the route alignment for the Inuvik to Tuktoyaktuk Highway, there was general agreement by the public with the PWC 1977 route, except that some residents, particularly from Tuktoyaktuk, expressed concern about the proximity of the proposed alignment to the shore of Husky Lakes. Three critical sites were identified where a preference was expressed to relocate the route 2.5 km or more from Husky Lakes (Rescan 1999a).

Second, the "Inuvik to Tuktoyaktuk Road Pre-Engineering Update, March 1999, prepared by Highways and Engineering Division, GNWT Department of Transportation" endorsed

the PWC 1977 alignment as the most logical route for an all-weather highway link between the two communities. This study also provided an update regarding design standards and costs for the Highway.

The move of the proposed route (Primary 2009 Route) farther from Husky Lakes, as suggested in the 1999 community meetings, and in the 2009 and 2010 community consultations, has been considered.

2.1.2 Alignments Considered in the Current Stage of Project Development

The specific evaluation and further development of alignments is based on historical studies, a better understanding of the development of transportation infrastructure in permafrost regions, and the management of risk that is associated with climatic warming or climate change. In addition, the first hand understanding gained during the September 2009 field work of the physical terrain, and the recent stakeholder and regulatory input, has been accounted for in the further development of alignments or alignment segments for comparison.

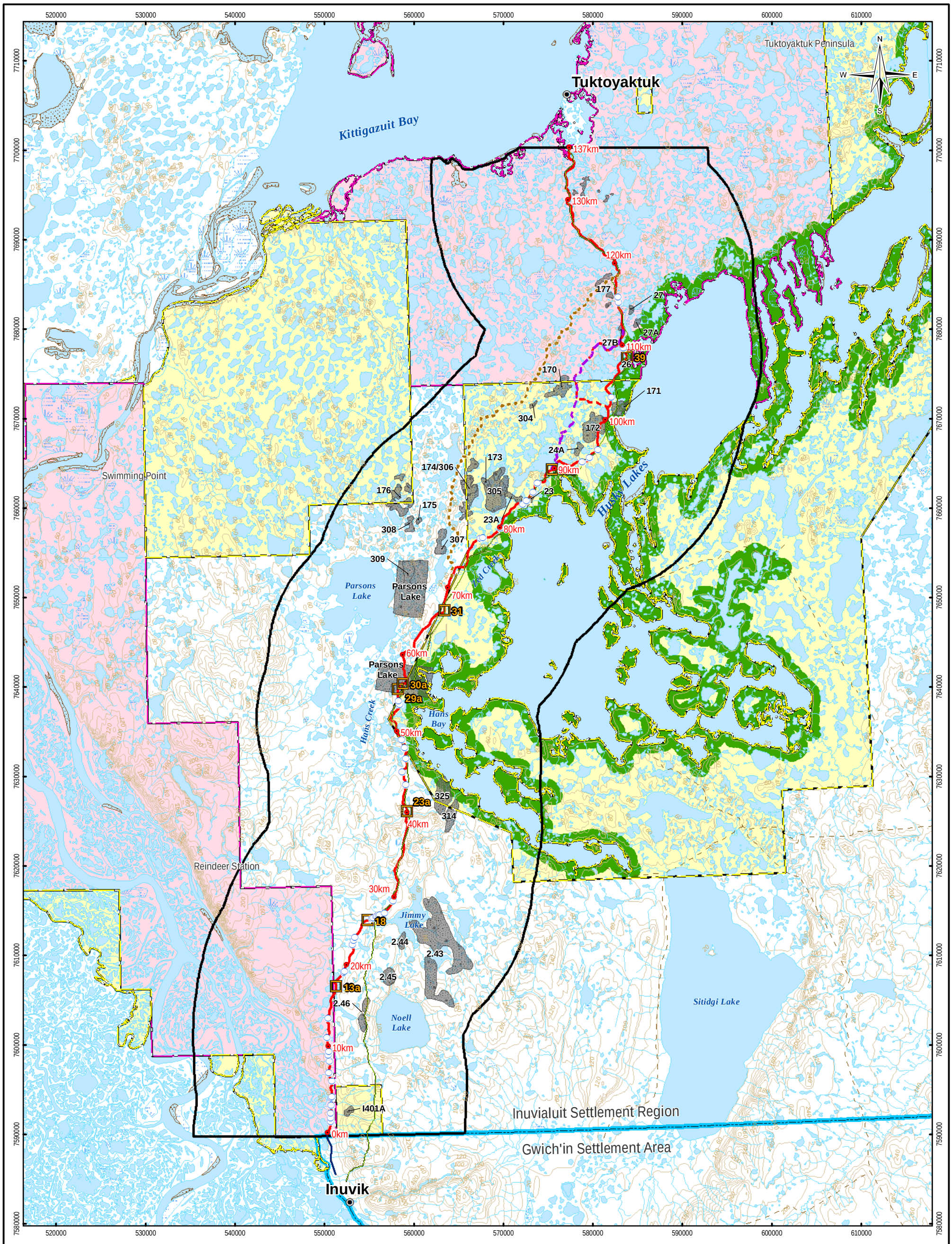
The alignments considered in the current stage of Project development are shown in Figure 2.1.2-1. The alignments include:

- **Primary Alignment** - the Primary 2009 Route, which is an updated and refined version of the 1977 Public Works Canada (PWC) alignment, with a minor encroachment on the Husky Lakes 1 km setback;
- **Alternative 1** - the 2009 Minor Realignment of the Primary 2009 Route to fully achieve the Husky Lakes 1 km setback requirements;
- **Alternative 2** - the Upland Route, which diverts west from the Primary 2009 Route about 70 km north of Inuvik and re-joins the alignment near Source 177. This route has been considered in response to requests in the 2009 consultations to consider a suitable alignment that is substantially further than 1 km away from the Husky Lakes; and
- **Alternative 3** - the 2010 Minor Realignment, recommended by Inuvialuit interests to modify Alternative 1 (2009 Minor Realignment) and to provide a more direct route. This information was presented to the Developer just prior to submission of the Project Description Report, and is identified as an option in this EIS.

  The Developer considers this alternative alignment in the Husky Lakes area to be a promising route option, but the engineering considerations related to this option in the field have yet to be assessed. However, the Developer feels that subject to Project approval, Alternative 3 would be further considered and likely adopted in the detailed design stage based on the additional field information that needs to be gathered.

A brief description and comparison of these alignments is described in the following subsections.

Q:\Vancouver\GIS\ENVIRONMENTAL\V232\V23201322_TukRoad_EIS\Maps\EIS\V23201322_EIS_Map054_Alignment.mxd modified 5/19/2011 by stephanie.leusink



LEGEND

- Stream Crossing
- 18 Stream Crossing - Potential Bridge
- Regional Study Area (15 km buffer)
- Primary 2009 Route
- Alternative 1 (2009 Minor Realignment)
- Alternative 2 (Upland Route)
- Alternative 3 (2010 Minor Realignment)
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Borrow Sources
- Husky Lakes 1000m Setback
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand

NOTES
Base data source: NTS 1:250,000
Borrow Sources, ILA Lands, Husky Lakes 1000m Setback: Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY ENVIRONMENTAL IMPACT STATEMENT

Primary 2009 Route and Other Alternative Alignments Considered

PROJECTION: UTM Zone 8	DATUM: NAD83		
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)			
FILE NO.: V23201322_EIS_Map054_Alignment.mxd			
PROJECT NO.: V23201322	DWN: SL	CKD: TS	REV: 0
OFFICE: EBA-VANC	DATE: May 19, 2011		

Figure 2.1.2-1

2.1.2.1 PWC 1977

The PWC 1977 alignment has been the starting point for further development and comparison of alignments at this stage in the Project development. Originally developed to a conceptual level by Public Works Canada in 1977, it has been the subject of further minor investigation and comparison with other more westerly alignment concepts through the Mackenzie Delta. The southern limit of the alignment is the northeast quadrant of the Town of Inuvik and the northern limit is the existing hamlet road network in Tuktoyaktuk. The original PWC alignment follows the shores of Husky Lakes and the design/construction approach at the time, considered a balance of cuts and fills. Today, this alignment would not be directly suitable as it encroaches on the 1 km setback as recommended by the ILA adjacent to Husky Lakes, traverses lakeshores which are generally softer, less stable ground, and relies on an undesirable approach of cutting into the permafrost to gain an advantage for vertical geometry (Photo 2.1.2-1).

Photo 2.1.2-1
Looking west from Husky Lakes to area where PWC 1977 alignment was considered

2.1.2.2 Primary 2009 Route

The Primary 2009 Route builds and improves on the original PWC 1977 alignment. Extending from the north end of Navy Road in the Town of Inuvik to the Hamlet of Tuktoyaktuk, it follows a similar alignment to that of PWC 1977 but has been developed to a conceptual design level - one to two iterations of vertical and horizontal alignment design based on:

- Minimum/desirable design parameters using a digital elevation model developed from available 1:30,000, 2 m resolution colour air photos);
- 1 km setback from Husky Lakes;
- Optimum stream crossing locations based on initial field work;
- Potential areas of wildlife and vegetation sensitivity;
- Areas of archaeological potential;
- Sensitive permafrost and ice-rich terrain;
- Location of potential borrow sources; and
- Topography suitable to meet minimum vertical and horizontal geometric requirements with a "fill only" construction approach.

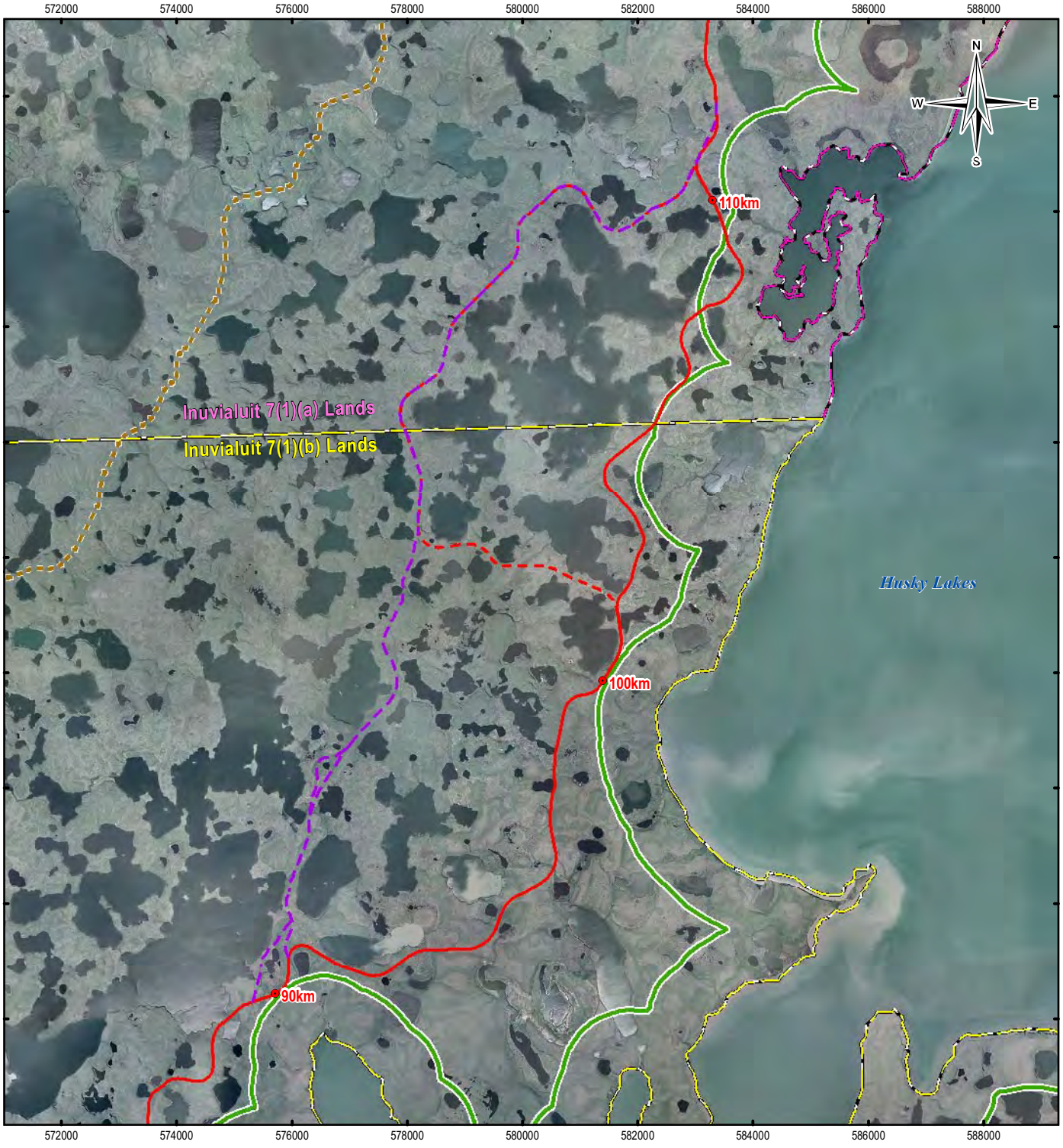
There are two locations where the Primary 2009 Route does not fully meet the 1 km Husky Lakes setback. The first encroachment is from KM 105+340 to 105+600 where, for a road length of approximately 260 m, the Primary 2009 Route runs just along the 1 km setback boundary or has a slight encroachment of 14 m. The second encroachment is from KM 107+580 to 109+400, where the 1 km setback boundary runs through the east end of a large lake that is just west of the Husky Lakes system. The Primary 2009 Route encroaches on the setback for a road length of approximately 1,820 m. Through this 1,820 m, the encroachment on the setback ranges from 0 m to 600 m east of the setback boundary. This is illustrated in Figure 2.1.2-2.

At the south end, the Primary 2009 Route takes advantage of more suitable terrain north of Navy Road than the previous PWC 1977 alignment (Photo 2.1.2-2). At the north end, the Primary 2009 Route takes advantage of the horizontal alignment of the 19.5 km access road that is currently under construction from Source 177 to Tuktoyaktuk (Photo 2.1.2-3). The horizontal alignment for this access road meets or exceeds the minimum design parameters for the future Highway. Only the access road cross section (i.e., width of driving surface) and the vertical profile will need to be upgraded to meet the requirements for the future Highway. Minimum and desirable design parameters are discussed in further detail in the next section of this Environmental Impact Statement.

Photo 2.1.2-2
Looking south along Primary 2009 Route near Hans Creek

2.1.2.3 Alternative 1 (2009 Minor Realignment)

To avoid the minor encroachments of the Primary 2009 Route on the Husky Lakes setback, Alternative 1 (2009 Minor Realignment) was developed inland, to the west of a large lake, starting at KM 101+200 of the Primary 2009 Route and re-joins the Primary 2009 Route at KM 111+700. This minor realignment traverses more upland terrain that the Primary 2009 Route, but was considered feasible by the Developer. More direct comparisons of the alignments are presented in further sections of the EIS. Alternative 1 (2009 Minor Realignment) is shown in Figure 2.1.2-2.



LEGEND

- Primary 2009 Route
- Alternative 1 (2009 Minor Realignment)
- Alternative 2 (Upland Route)
- Alternative 3 (2010 Minor Realignment)
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Husky Lakes 1000m Setback

NOTES

Base data source: NTS 1:250,000
ILA Lands, Husky Lakes 1000m Setback: Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY ENVIRONMENTAL IMPACT STATEMENT

Route Alternatives

PROJECTION: UTM Zone 8	DATUM: NAD83

Scale: 1:100,000

1 0.5 0 1 2 3

Kilometres

FILE NO.: V23201322_EIS_Map021_Dev_Realign.mxd

PROJECT NO.	DWN	CKD	REV
V23201322	SL	TS	0

OFFICE	DATE
EBA-VANC	May 2, 2011

Town of Inuvik
Northwest Territories
KIGGIAK - EBA

Figure 2.1.2-2

Q:\Vancouver\GIS\ENVIRONMENTAL\V232\V23201322_TukRoad_EIS\Maps\EIS\V23201322_EIS_Map021_Dev_Realign.mxd modified 5/2/2011 by slesuink

Photo 2.1.2-3
Partially complete access road from Tuktoyaktuk to Source 177

2.1.2.4 Alternative 2 (Upland Route)

Alternative 2 (Upland Route) diverts northwest from the Primary 2009 Route at KM 71 and re-joins the Primary 2009 Route at KM 118, near Source 177. The route has been considered in response to requests to find a suitable alignment that is substantially further than 1 km away from Husky Lakes. Initial review of Alternative 2 (Upland Route) was based on the historical power line alignment and input from community members who frequently travel the route by snowmachine for recreational and harvesting activities. As a result of the consultations, Alternative 2 (Upland Route) has been developed to the same conceptual design level as the Primary 2009 Route.

Alternative 2 (Upland Route) is found to be through more rugged terrain than the Primary 2009 Route. This poses challenges for constructability, resulting in an increase in material quantities to meet the minimum design parameters, and requires higher fills that could result in maintenance and operational issues (Photos 2.1.2-4 and 2.1.2-5). More direct comparison of the alignments is presented in further sections of this Environmental Impact Statement.

Photo 2.1.2-4
Looking south along Alternative 2 (Upland Route) at typical terrain

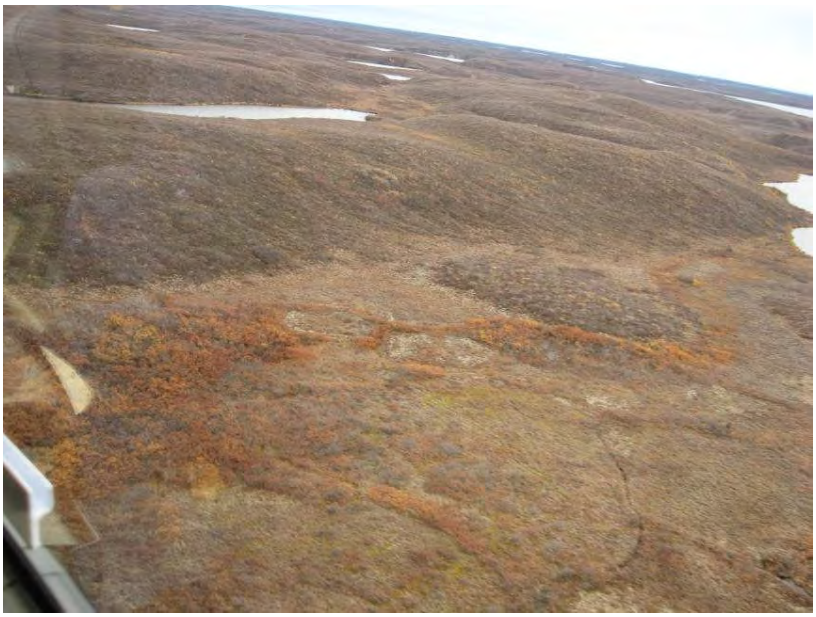


Photo 2.1.2-5
Looking south along Alternative 2 (Upland Route) at typical terrain

2.1.2.5 Alternative 3 (2010 Minor Realignment)

Inuvialuit interests recommended Alternative 3 (2010 Minor Realignment) as a proposed modification of Alternative 1 (2009 Minor Realignment)(Section 2.1.2.3). This modification creates a more direct route through suitable terrain, along a four to five kilometre segment. The entire route alignment is located outside of the 1 km Husky Lakes setback. Alternative 3 (2010 Minor Realignment) starts at approximately KM 90 of the Primary 2009 Route and re-joins the Primary 2009 Route at KM 111+700. Alternative 3 (2010 Minor Realignment) is shown in Figure 2.1.2-2.

2.2 COMPARISON OF ALIGNMENT OPTIONS

Of the four route alignments presented in this assessment, three alignment options have been considered in the conceptual design for the Inuvik to Tuktoyaktuk Highway. The alignments include:

- Primary 2009 Route (with encroachment on Husky Lakes setback);
- Alternative 1 (2009 Minor Realignment) to the Primary 2009 Route (to meet Husky Lakes setback); and
- Alternative 2 (Upland Route).

Alternative 3 (2010 Minor Realignment), recommended by Inuvialuit interests, is considered a viable route option, but has not yet been assessed in the field; therefore, modeling to identify accurate geometric design factors is not yet available. However, Alternative 3 (2010 Minor Realignment) is similar to Alternative 1 (2009 Minor Realignment), in that it does not encroach on the Husky Lakes setback, and it is shorter in length, at approximately 135 km. However, as stated previously, the Developer feels that subject to Project approval, Alternative 3 would be further considered and likely adopted in the detailed design stage based on the additional field information that needs to be gathered.

Table 2.2-1 presents a summary of the quantity and cost estimates for each alignment. The summaries are based on the full length of alignment (including common segments) from Inuvik to Tuktoyaktuk.

TABLE 2.2-1: COMPARISON OF ESTIMATED QUANTITY OF GRANULAR MATERIALS AND COSTS PER ROUTE OPTION

Element	Primary 2009 Route	Alternative 1 (2009 Minor Realignment)	Alternative 2 (Upland Route)
Estimated Highway Length	137 km	142 km	134 km
Estimated Embankment Quantity	4.5 million m^3	4.8 million m^3	5.4 million m^3
Estimated Surfacing Gravel Quantity	250,000 m^3	259,000 m^3	242,000 m^3
Estimated Capital Construction Cost	$221,000,000	$233,000,000	$258,000,000

The three options share a common alignment from KM 0 (North end of Navy Road, near Inuvik) to KM 71, and again from KM 118 to KM 137 (near Granular Source 177, by Tuktoyaktuk).

2.2.1 Evaluation Process

Each option was evaluated for environmental, economic, social, and technical factors that are further divided into sub-indicators. In some cases (i.e., cost) these factors are specifically quantified, but it should be noted that when quantified differences between options are small (say within 5 to 6%), then for that factor the options could be considered equal.

Scientific and economic factors are only part of the development decision. The technical teams who assessed the options maintained an awareness of the values, particularly for the Husky Lakes, held by the communities. These values and interests were discussed in the October 2009 and January 2010 consultation meetings, and were also provided during the initial EISC assessment process. The intent has been to integrate those values, while delivering key technical information to decision makers and stakeholders to review and to draw their own conclusions about the acceptability of the proposed Highway.

2.2.2 Environmental Factor

Sub-indicators for the Environmental Factor are described in the following subsections.

Footprint Area

An effective design and a well planned construction approach will minimize the footprint area of the Highway development. Minimizing the footprint area is desirable and the alignment option with the least footprint area is favoured. Footprint area is a function of highway length and the volume of material required for construction. Volume of material is a good representation of embankment width, as well as number and size of material sources required for construction.

As previously discussed, Table 2.2-1 shows the estimated quantity of granular materials and costs based on the Highway route. When considering length, the three options are considered equal; however, when considering volume of material, Alternative 2 (Upland Route) is considered to have a larger footprint and is therefore less favourable. Alternative 2 (Upland Route) requires a larger volume of embankment material and, therefore, greater borrow source/ quarry development, due to the more rugged terrain traversed.

Potential Effects on Fish and Fish Habitat

Potential effects to fish can be minimized in all three options by considering appropriate structures at stream crossings to avoid net loss of fish habitat and respecting the Husky Lakes setback. The Primary 2009 Route (with encroachment on the Husky Lakes setback) is least favourable even though the encroachment is very minor. Alternative 1 (2009 Minor Realignment) and Alternative 3 (2010 Minor Realignment) are considered to be more favourable than the Primary 2009 Route as both alignment options meet the Husky Lakes

setback. However, Alternative 2 (Upland Route) is considered to be most favourable with respect to fish and fish habitat issues because of its increased distance from the Husky Lakes.

Potential Effects on Wildlife and Vegetation

At this stage in the development of the Highway, the footprint area is the most effective measure of potential effects on wildlife, and vegetation. Overall, development of the Highway is expected to have minimal effects on wildlife, and vegetation. As noted above, Alternative 2 (Upland Route) is considered to have a larger footprint and is therefore less favourable.

Potential for Dust Generation during Operation

Dust control measures will be implemented as necessary to minimize dust generation. An alignment option that has a lesser potential to generate dust is a more favourable option. The amount of dust generated is a function of traffic volume, travel speed and length of highway. Since all three alignment options are estimated to have the same traffic volume and travel speed (on average), length of highway is the factor considered in the potential for dust generation. The Highway length for each of the three options is within 5 to 6%; therefore, they are considered equal relative to the potential for dust generation during operation.

2.2.3 Economic Factor

Sub-indicators for the Economic Factor are:

- Estimated cost of design and construction; and
- Estimated cost of maintenance and operations.

Estimated Cost of Design and Construction

The estimated cost of design and construction for each of the three options is provided in Table 2.2-1. The Primary 2009 Route is the lowest cost option and is most favourable in terms of estimated cost of design and construction. Alternative 2 (Upland Route), although shorter, requires a greater volume of fill material to meet the minimum design requirements and is, therefore, the highest cost of the three options. Alternative 2 (Upland Route) is the least favourable in terms of estimated cost of design and construction.

The difference in cost between the Primary 2009 Route and Alternative 1 (2009 Minor Realignment) is between 5 and 6%; therefore, these two options are rated equally with respect to estimated cost of design and construction.

Estimated Cost of Maintenance and Operations

Quantitative annual costs of maintenance and operations for the future Highway have not been estimated. However, qualitatively, Alternative 2 (Upland Route) is expected to have a higher level of blowing snow, drifting and white-out conditions based on the topography and the vertical alignment, than the Primary 2009 Route. This is expected to result in a

higher frequency of winter Highway patrols, greater efforts in ploughing and snow removal, and higher frequency of Highway closures due to poor weather. The maintenance and operations costs for Alternative 2 (Upland Route) are expected to be higher than the other routes, therefore making it the least favourable in terms of estimated cost of maintenance and operations.

2.2.4 Social Factor

Sub-indicators for the Social Factor are:

- Public safety;
- Economic advantages to the local communities;
- Local job creation and diversity;
- Quality of life; and
- Cultural heritage.

Public Safety

The potential adverse effects on public safety are specifically defined by the risk of collision. The design incorporates minimum requirements for vertical and horizontal curvature (i.e., how steep the grades can be, how tight the curves can be and how far ahead a driver must be able to see, etc.). All three routes meet or exceed the minimum design criteria or requirements established based on the future operation of the Highway. However, a designer's job is to balance risk with economics and, where economically practical, the designer will provide a highway that is better than the minimum requirements to reduce the risk of collisions in the future.

All highways have a potential for collisions. Specific geometric features of alignment options can be compared to identify which might have a higher potential for collisions and therefore a higher potential for negative or adverse effects on public safety. Information on specific geometric elements for each alignment option from KM 71 to KM 118 is presented in the Table 2.2.4-1.

TABLE 2.2.4-1: COMPARISON OF GEOMETRIC FEATURES PER ROUTE OPTION

Geometric Feature	Primary 2009 Route	Alternative 1 (2009 Minor Realignment)	Alternative 2 (Upland Route)
Number of horizontal curves with radius less than 350 m	27	32	89
Number of segments with vertical grades greater than 4%	39	44	55
Total length of segments with vertical grades greater than 4%	5.39 km	5.95 km	7.59 km
Maximum Grade	8%	8%	8%

For each geometric feature presented, a lower number represents a highway alignment that exceeds the minimum safety requirements more often and by a greater degree, and therefore, has a lower risk of collision. A higher number for each feature represents a highway alignment that just meets the minimum requirements, and therefore, has a higher risk of collision. A lower risk of collision is more favourable when it comes to public safety.

The Primary 2009 Route is the most favourable of the three alignment options relative to geometric design requirements.

Economic Advantages to the Local Communities

Economic benefits to the local communities are realized through an increase in trade and local business, such as supply of materials, expediting and transport of persons and goods during both construction and the future operation of the Highway. There is little difference between the three operations relative to the opportunities for local businesses and the development of new businesses. The three alignment options are considered equal for this sub-indicator.

Local Job Creation and Diversity

Job creation and diversity includes creation of training and employment opportunities. Employment opportunities are available during the construction and operation phases of the Highway, including support services and businesses and spin-off opportunities such as access management and tourism. The three alignment options are considered equal for this sub-indicator.

Quality of Life

Quality of life includes both benefits and adverse effects on the daily life of community members. Examples of expected benefits include new infrastructure, and better access to healthcare, education and training. Examples of potential adverse effects include increases in vehicular accidents, noise, dust, traffic, or Highway closures. All three alignment options provide equal benefits relative to use of the new infrastructure, employment opportunities, and improved access to healthcare, education and training. Most adverse effects to quality of life are equal across the three alignment options with the exception of the potential to generate dust, the potential for Highway closures and the risks to public safety.

As described previously, the potential to generate dust is a function of the length of a highway; therefore, since Alternative 2 (Upland Route) is shortest in length, it is more favourable. However, Alternative 2 (Upland Route) has a higher potential for Highway closures due to poor weather conditions and has a higher risk of collisions given the design challenges presented by the topography. Alternative 2 (Upland Route) is, therefore, the least favourable when considering quality of life.

Cultural Heritage

Cultural Heritage includes overall effects of the option on the cultural attributes of the alignment and the surrounding land (i.e., historical, preservation, archaeological, access for

hunting and fishing, etc.). All three highway alignment options consider and avoid known locations of heritage or archaeological significance.

Husky Lakes is a very important area. The concern expressed during consultation is that this is an area of traditional use that calls for minimizing potential effects (i.e., restricting development, access and use); however, it is also considered a valuable fishery and recreational area that is difficult to access.

As a sub-indicator, Cultural Heritage can be viewed from two perspectives. One that minimizes or eliminates the potential for access to Husky Lakes through physical distance and one that may improve access but still does not provide direct access to Husky Lakes. In considering these two perspectives, Alternative 1 (2009 Minor Realignment) and Alternative 2 (Upland Route) are considered equal because they both fully respect the 1 km Husky Lakes setback.

2.2.5 Technical Factor

The sub-indicators for Technical Factor are:

- Footprint area;
- Geometric design requirements;
- Potential for geotechnical challenges;
- Permitting risk; and
- Construction risk.

Footprint Area

The sub-indicator of Footprint has been discussed and evaluated under the Environmental Factor above. The same information is considered when viewing footprint as a technical sub-indicator and Alternative 2 (Upland Route) is considered the least favourable.

Geometric Design Requirements;

The geometric design requirements have been discussed in the sub-indicator of public safety previously. When viewed as a sub-indicator of the Technical Factor, the same discussion prevails. An alignment option that exceeds the minimum design requirements for the operation of the Highway more often is more favourable. The Primary 2009 Route is the most favourable of the three alignment options relative to geometric design requirements.

Potential for Geotechnical Challenges

The potential for geotechnical challenges is based on the limited terrain assessment. The routing for each Highway alignment option has been largely developed based on terrain observations in an effort to select reasonable topography and avoid ice rich and other sensitive soils that are likely to result in geotechnical challenges. Such challenges can be mitigated through modification of horizontal alignment to avoid ice rich terrain and

considering an overall embankment fill design (rather than balancing cut and fill) with minimum embankment height defined based on the nature of the terrain type. For example, fill over bedrock could be as little as 0.5 m whereas fill over ice-rich permafrost would be 1.8 m or greater to provide an insulating layer and prevent thaw of the permafrost below the active layer.

There is a greater potential for ice-rich terrain along the Primary 2009 Route than Alternative 2 (Upland Route), although mitigative measures during the design and construction will be incorporated such that it is anticipated that both would perform in a similar manner. Subsequent to completion of this initial evaluation of route alternatives, INAC (2010) reported that approximately 10% (or 14 km of 137 km) of the Primary 2009 Route was determined to be located on confirmed or suspected ice-rich terrain and approximately 8% (or 4 km of 45 km) of the Alternative 2 (Upland Route) was located on similar terrain.

Permitting Risk

All three alignment options carry a risk of not receiving the appropriate permits and approvals to proceed with construction and operation. An alignment option that does not meet currently established development guidelines will carry a higher risk of not receiving approval. Any alignment option that encroaches on the 1 km Husky Lakes setback does not meet the currently established development guidelines. Therefore, the Primary 2009 Route (with encroachment on the Husky Lakes setback) is less favourable than the other two options.

Construction Risk

Although there are risks in construction relative to safety of workers and preservation of the environment, there is also risk associated with unforeseen circumstances that will increase costs and delay completion. Such circumstances include lack of borrow material that is of sufficient quality and type suitable for Highway construction, increased number of bridges rather than culvert crossings and unforeseen geotechnical conditions along the Highway alignment that require thicker embankment fills, modification of the Highway alignment, and longer/more complex bridge structures and foundations.

The three alignment options (i.e., Primary 2009 Route, Alternatives 1 and 2) have been developed to the same level of conceptual or preliminary design and quantity estimates and any of the three will require further environmental surveys and geotechnical investigations in potential borrow sources and along the alignment to support detailed design and construction. However, the available information upon which the conceptual designs and quantity estimates were based is different for each of these three alignment options, particularly with respect to the stream crossings, the geotechnical conditions and the available material sources. There is less of this type of information available for Alternative 2 (Upland Route) than for the other two alignment options. Where there is less information available, there is greater risk of unforeseen circumstances during design and construction, increasing the potential for increased costs and longer construction time.

During the initial development of the conceptual designs, the Primary 2009 Route had the most reliable information available and is therefore most favourable when considering construction risk in this manner. Alternative 1 (2009 Minor Realignment) has a similar level of information as the Primary 2009 Route, but could benefit from additional high level review relative to the specific routing. Virtually no information exists at this time about the availability of suitable material sources along Alternative 2 (Upland Route). Therefore, Alternative 2 (Upland Route) has the greatest risk of encountering circumstances that are unforeseen at the present time, and is thus the least favourable when considering construction risk.

2.2.6 Summary of Evaluation

Table 2.2.6-1 presents a summary of the evaluation based on factors and sub-indicators discussed above.

TABLE 2.2.6-1: SUMMARY OF EVALUATION

Factor	Sub-indicator	Primary 2009 Route	Alternative 1 (2009 Minor Realignment)	Alternative 2 (Upland Route)
Environment	Footprint Area	Most favourable	Most favourable	Least favourable
	Wildlife and vegetation effects	Most favourable	Most favourable	Least favourable
	Fish and fish habitat effects	Least favourable	Favourable	Most favourable
	Potential for dust generation during operation	Equal	Equal	Equal
Economic	Estimated cost of design and construction	Most favourable	Most favourable	Least favourable
	Estimated cost of maintenance and operations	Most favourable	Most favourable	Least favourable
Social	Public Safety	Most favourable	Favourable	Least favourable
	Economic Advantages to the Local Communities	Equal	Equal	Equal
	Local Job Creation and Diversity	Equal	Equal	Equal
	Quality of Life	Favourable	Favourable	Least Favourable
	Cultural Heritage	Favourable	Most Favourable	Favourable
Technical	Footprint Area	Most favourable	Most favourable	Least favourable
	Geometric Design Requirements	Most favourable	Favourable	Least favourable
	Potential for geotechnical hazards	Equal	Equal	Equal
	Permitting Risk	Least favourable	Favourable	Favourable
	Construction Risk	Most favourable	Favourable	Least favourable

Of the 16 sub-indicators presented, the three alignment options were considered equal for four of the sub-indicators.

This evaluation presents a simplified multiple accounts analysis where all sub-indicators are considered with equal weight or importance. The summary of favourability for each of the three alignment options is presented in Table 2.2.6-2.

TABLE 2.2.6-2: SUMMARY OF FAVOURABILITY

	Primary 2009 Route	Alternative 1 (2009 Minor Realignment)	Alternative 2 (Upland Route)
Most Favourable	8	6	1
Favourable	2	6	2
Least Favourable	2	0	9
Equal	4	4	4

2.2.7 Conclusion on Preferred Alignment

The Project Team has reviewed the previous Project studies, the 2009-2010 assessment, the current opportunities to fund and construct the Highway, the route evaluations, and the community views presented during the October 2009 and January 2010 consultation proceedings. After considering these factors, the Primary 2009 Route was reconfirmed as the preferred primary alignment.

In the vicinity of the Husky Lakes, the Project Team recognized that other minor realignments needed to be considered to fully respect the Husky Lakes setback. As a result, Alternative 1 (2009 Minor Realignment) was proposed and considered along with Alternative 2 (Upland Route). Subsequent to the initial evaluation, Alternative 3 (2010 Minor Realignment) was recommended by Inuvialuit interests in an effort to provide a more direct route through suitable terrain.

The Project Team considers this alternative alignment in the Husky Lakes area to be a promising route realignment, but has not yet assessed the engineering considerations related to this option in the field. However, the Project Team feels that subject to Project approval, Alternative 3 would be further considered and likely adopted in the detailed design stage based on the additional field information that needs to be gathered.

2.3 TERRAIN CONDITIONS ALONG PREFERRED ALIGNMENT

Terrain conditions observed along the Primary 2009 Route, beginning at the north terminus of Navy Road (KM 0) and traveling north to Source 177 (KM 118) are described in Table 2.3-1 below. A detailed discussion of the surficial geology landforms is presented in Section 3.1.1. Construction of the access road from Tuktoyaktuk to Source 177 commenced in 2009 and was completed in the summer of 2010.

The surficial geology and landforms along the proposed Highway corridor are primarily the result of glacial activity in the region. The main glacial deposits along the corridor are glacial moraine, glaciofluvial and lacustrine in origin. Fluvial, colluvial, organic and aeolian

units are the result of ongoing and sometimes active processes subsequent to deposition by glaciers.

The proposed alignment crosses two distinct physiographic regions between Inuvik and Tuktoyaktuk. From Inuvik to south of Husky Lakes, the alignment crosses the eastern extension of the Caribou Hills on the edge of the Anderson Plain, consisting of mostly unconsolidated materials with varying amounts of ground ice overlying relatively shallow bedrock. Much of the topographic relief is a direct reflection of the bedrock surface, but bedrock is rarely exposed. North of this area to Tuktoyaktuk, the alignment enters onto the Pleistocene Coastal Plain, consisting of thick unconsolidated sediments, moraines, ice-contact, glaciofluvial and organic lacustrine deposits (Rampton 1987; Rampton 1979). The area also contains varying quantities of ground ice and massive ice layers. Bedrock is not near surface in the Pleistocene Plain.

The terrain conditions presented in the Table 2.3-1 are specific to the Primary 2009 Route (with minor encroachments on the Husky Lakes setback). When the Project is approved, further terrain and geotechnical investigation will be undertaken as part of the detailed design steps. At that time, the specific terrain conditions of Alternative 1 (2009 Minor Realignment) and Alternative 3 (2010 Minor Realignment) will be investigated and documented to support the detailed design. The ultimate alignment will respect the 1 km Husky Lakes setback. In the meantime, there is sufficient preliminary information available to anticipate that the terrain conditions along Alternative 1 (2009 Minor Realignment) and Alternative 3 (2010 Minor Realignment) are similar to those conditions described in Table 2.3-1.

TABLE 2.3-1: TERRAIN CONDITIONS ALONG PRIMARY 2009 ROUTE

Kilometre		Description of Terrain Conditions
0	4	The proposed route departs Inuvik from the terminus of Navy Road traveling north along subtle coalescing alluvial fans that slope toward the Mackenzie River. The route crosses several drainage channels supporting fish habitat that will require culverts.
4	10	The route ascends onto an elevated rolling moraine plain (late Wisconsinan stage) and crosses a series of drainage channels that will require culverts, but do not appear to support fish habitat (Kiggiak-EBA 2010b).
10	27	The route crosses onto a morainal blanket (early Wisconsinan stage), travels along a narrow strip of ice-rich polygonal patterned ground between two lakes and parallels along the east side of a chain of lakes from KM 13 to KM 19, about 2 km to 3 km east of Douglas Creek. The soils appear to be clayey/silty tills. At about KM 25, the route descends in elevation toward the lowlands adjacent to Jimmy Lake and crosses several drainage channels along the way.
27		At about KM 27 the alignment crosses the abandoned NCPC (Northern Canadian Power Commission) power transmission line and an overland winter road cutline.
27	34	The alignment travels 1 to 2 km west of Jimmy Lake for 1 to 2 km crossing wet, polygonal ground and numerous drainage channels that drain to the lake. The route then begins ascending in elevation onto relatively dry terrain from about KM 29 to KM 34, and further climbs a section of steep terrain from KM 32 to KM 34.

TABLE 2.3-1: TERRAIN CONDITIONS ALONG PRIMARY 2009 ROUTE

Kilometre		Description of Terrain Conditions
34	39	The alignment continues along a section of irregular, hummocky ground on a morainal blanket for about 1 km, and then from KM 35 to KM 38 the route crosses a relatively smooth moraine veneer, before approaching the first major stream crossing at KM 39 (unnamed Crossing 23A in the field map book). The crossing is incised and mapped as having colluvial slopes along its banks.
39	52	Surficial mapping shows the alignment to transition away from the unnamed creek and associated colluvial materials at KM 40 and back onto a rolling moraine plain with patterned polygonal ground to KM 52. From about KM 40 to KM 46, the route descends the east extension of the Caribou Hills toward the south end of Husky Lakes. Between KM 46 and KM 51, the alignment crosses ice-contact transitional terrain between the moraine plain to the west and Husky Lakes to the east. The ice contact terrain is irregular and hummocky with kame and kettle complexes and thermokarst modified outwash plains. The route crosses drainage channels through this section and ice-rich polygonal patterned ground. There are signs of thermokarst activity and associated slumping.
52	56	The route leaves the hummocky ice-contact terrain and crosses a glaciofluvial outwash plain with little relief for a few kilometres before approaching Hans Creek at about KM 56.
56		Hans Creek is a major stream on the route containing extensive deposits of alluvial outwash sands and gravels along the south-facing (north) terrace. This material source has been investigated and reported by others (RKL 1972). Hans Creek discharges water from East Hans Lake and associated tributaries into Husky Lakes. The terraces have historically slumped, particularly the north facing terrace, and are clearly sensitive to disturbance, but there are no signs of recent instability.
57	67	North of Hans Creek the route climbs onto a north-east trending ice-contact deposits and crosses through an area of higher ground with lakes on either side. The Highway parallels a series of thermokarst lake beds and, on a geologic time scale, pingos are developing in the area.
67		The route crosses Zed Creek which is the outlet to Parson Lake discharging into Husky Lakes. The local area is characterized by thermokarst lakebeds and evidence of sensitive terrain.
67	90	North of Zed Creek the route climbs onto a north-east trending glaciofluvial outwash plain that appears reasonably well-drained and at about KM 76 crosses a wet, ice-rich, lowland area at the north end of Zed Lake. Along this section, the route skirts the eastern limits of an ice contact deposit and alternates between the ice contact deposit and a glaciofluvial outwash deposit to the east. The terrain is irregular and hummocky at times. The route crosses areas of ice-rich polygonal patterned ground and overall the terrain is characterized as poorly drained.
90	95	The route crosses a complex geologic intersection of ice-contact, glacial outwash, moraine and lacustrine deposits. Overall the area is characterized as being wet and ice-rich containing numerous lakes and occasional pingos. A description of deposits along this section based on the mapping by Rampton (1987) is as follows: KM 87 to KM 90 ice contact deposit, KM 90 to KM 91 lacustrine, KM 91 to KM 92 moraine, KM 92 to KM 93 lacustrine, KM 93 to KM 95 moraine.
95	114	At KM 95 the route moves onto lowland lacustrine deposits along Husky Lakes. The terrain is smooth, but wet and ice-rich. This section of the alignment comprises lacustrine sediments most likely deposited in a proglacial or glacially dammed basin environment. There are sections of relatively good terrain to cross, but for the most part the terrain is wet and ice-rich polygonal terrain is common.

TABLE 2.3-1: TERRAIN CONDITIONS ALONG PRIMARY 2009 ROUTE		
Kilometre		Description of Terrain Conditions
114	118	Near KM 114 the alignment moves off the abandoned lake-bed of Husky Lakes onto thermokarst modified ice-contact and moraine terrain to KM 118 (Source 177). The landscape is marked by pot-hole lakes and abrupt elevation changes. The till subsoil generally contains extensive and erratic massive ground ice.
118	137	The route from Source 177 to Tuktoyaktuk continues on outwash hills and ridges. Northward of Source 177 the terrain becomes more subdued. The area has many thermokarst lakes and pingos. The route in this section meanders around the frequent lakes following favourable terrain.

Morainal materials generally provide suitable foundation conditions to construct a road. These materials are typically moderately well drained and comprise a fraction of sand, gravels and cobbles. They present few limitations to road construction except in areas with steep slopes or where drainage is poor and ice-rich.

Most glacial outwash materials provide a suitable foundation for roads as drainage is generally considered to be good. In addition, some outwash deposits provide good construction material sources. Ice-contact deposits also provide suitable foundation conditions for roads but the irregular and hummocky terrain can be a challenge and require higher fill volumes to construct a road.

Lacustrine sediments present limitations for road construction and maintenance due to their fine-textured nature; these sediment types are generally found in lowland adjacent to existing lakes such as Husky Lakes. Their limitations are due to their wetness and high settlement potential. Thick organic deposits and ice-rich patterned ground was avoided as much as possible as disturbance to these accumulations can result in significant rutting, compaction and alterations to hydrologic conditions.

Alluvial and colluvial deposits comprise a small percentage of the materials that will be encountered along route. These materials are transported and deposited by streams and gravity and are found along water courses and steeper slopes. From an engineering perspective, alluvial deposits represent potential borrow sources, however, these materials are often located in sensitive areas near waterbodies, are variable and of small/limited volume, and are mostly unmapped, so they will not be relied upon as significant material sources.

2.4 KEY HIGHWAY GEOTECHNICAL ISSUES

2.4.1 Permafrost

Permafrost is continuous throughout the Project area. Melting of ice-rich permafrost can result in substantial thaw settlement, the loss of the soil structural integrity, and potentially affect the Highway foundation. Minimizing disturbance to permafrost is important. Common permafrost-related features in the Project area include ice-rich polygonal ground, thaw-flow slides, thermokarst and peatland.

The term "permafrost" describes a ground thermal condition where the soil or rock remains below 0°C for two or more years, without consideration of material type, ground ice distribution, or thermal stability. The Inuvik to Tuktoyaktuk corridor is located entirely within the continuous permafrost zone of the Northwest Territories. Ground temperatures are within the range of minus 2 to 5.

Frozen ground can contain excess ice, where the amount of water contained in the soil matrix in a frozen state is higher than would be retained in the soil in an unfrozen state. The excess ice can be found mixed (disseminated, non-visible) within the soil matrix, or can be in the form of pure ice, ice lenses or ice wedges. These ice-rich soils are sensitive to thermal disturbance, which can result in thaw settlement and instability.

2.4.2 Sensitive Terrain

The majority of the proposed alignment is located in the Mackenzie Delta of the Pleistocene Plain, a region of limited topographic relief. The southern portion of the route is located on the Caribou Hills, with rolling terrain and steeper slopes. There are various landforms and specific areas along the alignment identified that would be sensitive to construction activities along the Primary 2009 Route and the Alternative 2 (Upland Route). A major routing design consideration was to avoid problematic or sensitive areas and to design accordingly to mitigate impact. Also, construction over ice rich permafrost terrain requires substantial quantities of materials to maintain a grade with continuous thick fill over thaw sensitive terrain.

The following subsections describe the landforms identified as being sensitive to construction activities and disturbance.

2.4.2.1 Polygons

Polygons are recognizable as a type of patterned ground, which are characteristically ice-rich and found primarily in low-lying poorly drained areas (i.e. drained lakebeds). These features are commonly classified as high- or low-centered polygons. Low-centered polygons consist of central flat terrain enclosed by relatively dry ridges. Ice wedges grow progressively and ice wedge growth pushes up the surface soil to form linear ridges. Intersecting ridges give the surface of the ground a polygonal appearance. Over time low-centered polygons can become high-centered polygons. This ice-rich patterned ground was avoided when possible.

2.4.2.2 Thick Organics (Peatlands)

Generally these deposits occur as peat or fen, peat-fen complexes, usually as cover over the underlying mineral soil, typically on flat terrain. Peatlands are wetlands with massive deposits of peat that are typically greater than 0.5 m thick and may be several metres thick. There are many classes of peatland, but most in the Mackenzie Valley are bogs and fens. Bogs are a form of peatland, having a water table at or near the surface, where the waters are virtually unaffected by nutrient rich groundwater from the surrounding terrain. Most bogs are affected by permafrost and take the form of peat plateaus, polygonal peat

plateaus and plazas (Tarnocai et al. 2003). Fens support nutrient rich waters (flowing water) that originate from mineral soil. Thick organic terrain identified during the field reconnaissance and from orthophotos has been avoided in route planning.

2.4.2.3 Thermokarst

Thermokarst refers to surface subsidence and expression resulting from the melting of ice rich permafrost, particularly massive ice lenses. Thermokarst is a slow natural process that can be aggravated and accelerated by land use activities if not cautious. As ground ice thaws and the resulting water cannot drain away, it contributes to degradation of permafrost. The result is the creation of small ponds and lakes, as expressed in the numerous lakes observed along the route. Old thermokarst lake beds occur where fine-grained clay, silt, peat, and local sand deposited in low, flat areas previously occupied by lakes/ponds become exposed. These lake beds often support an organic cover and the areas tend to be very wet and ice-rich. Ice content is generally high is these fine-grained, organic materials. These areas often exhibit thermokarst subsidence with erosion along ice wedge cracks and pingos. These areas have been avoided when possible.

2.4.2.4 Thaw Flow Slides

Thaw flow slides are characterized by landslides that occur only in ice-rich soils in permafrost regions. Retrogressive thaw flows develop in ice-rich, fine-grained sediments and result from the thawing and subsequent flow of water-saturated ground. These failures can occur on very gentle slopes and hundreds of these features line the river banks and tundra lakes in the Project area. These landslides are typically relatively small, but over time can retreat some distance back from the rim and from the escarpment. These slides would have a significant impact on a road if one were to occur. The likelihood of a retrogressive thaw slide impacting the Highway has been reduced by carefully avoiding existing slides and steeper slopes that would be susceptible to failure.

The class and types of landslides characteristic to the regions are identified by Aylsworth et al. (2000) in *The Physical Environment of the Mackenzie Valley, Northwest Territories: A Base Line for the Assessment of Environmental Change.* In addition, an inventory of 3400 landslides has been compiled for the Mackenzie Delta and Tuktoyaktuk Peninsula, Mackenzie Valley and adjacent mountainous regions and is presented in Figure 3.1.1-4 (Aylsworth et al. 2001).

2.4.2.5 Pingos

Pingos are ice-cored hills that are forced up by the hydrostatic pressure in a wet area underlain by permafrost. Pingos may be up to 50 m high and have a base of up to 600 m in diameter. Mackay (1963) reported the existence of some 1,400 pingos in the Mackenzie Delta Area. Several large pingos are located near Tuktoyaktuk and to the west of the proposed Highway alignment near the Beaufort coastline. Pingos are cultural and heritage resources that have been avoided entirely. It is also understood that INAC generally recommends a 150 m setback for any activities near a pingo, which will be respected during final route alignment optimization prior to construction.

The drainages of Hans Creek and Zed Creek, and the wetland north of Zed Lake have been identified as being particularly sensitive to disturbance and construction activities given their environmental settings. Careful design and construction will be undertaken in these areas.

2.5 DETAILED QUANTITY ESTIMATES FOR THE PREFERRED ALIGNMENT

Fill quantity estimates have been developed for the Primary 2009 Route based on the conceptual design. The estimated fill quantities by topography and terrain are presented in Table 2.5-1.

The quantity estimates presented in the Table 2.5-1 are specific to the Primary 2009 Route (with minor encroachments on the Husky Lakes setback). When the Project is approved, further terrain and geotechnical investigation will be undertaken as part of the detailed design steps. At that time, the specific conditions of Alternative 1 (2009 Minor Realignment) and Alternative 3 (2010 Minor Realignment) will be investigated and documented to support the detailed design. The ultimate alignment will respect the 1 km Husky Lakes setback. In the meantime, there is sufficient preliminary information available to anticipate that the quantity estimates along Alternative 1 (2009 Minor Realignment) and Alternative 3 (2010 Minor Realignment) are similar to those conditions described in Table 2.5-1.

TABLE 2.5-1: ESTIMATED FILL QUANTITY BY TOPOGRAPHY AND TERRAIN

Alignment Segment	Length	Surfacing Gravel (m^3)	Embankment (m^3)	Average Embankment Fill Estimated per km (m^3)	Remarks on Topography and Terrain
KM 0 - KM 10	10	19,000	391,000	37,767	Elevation climb out of Inuvik
KM 10 - KM 44	34	62,000	969,000	28,416	Higher ground with drops to creeks
KM 44 - KM 90	46	82,200	1,801,000	39,275	Lower ground twisting around Husky Lakes
KM 90 - KM 118	28	52,300	863,000	30,648	Flatter terrain
KM 118 – KM 137 (Tuktoyaktuk)	19	33,800	476,000	25,677	Upgrade access road to the Highway

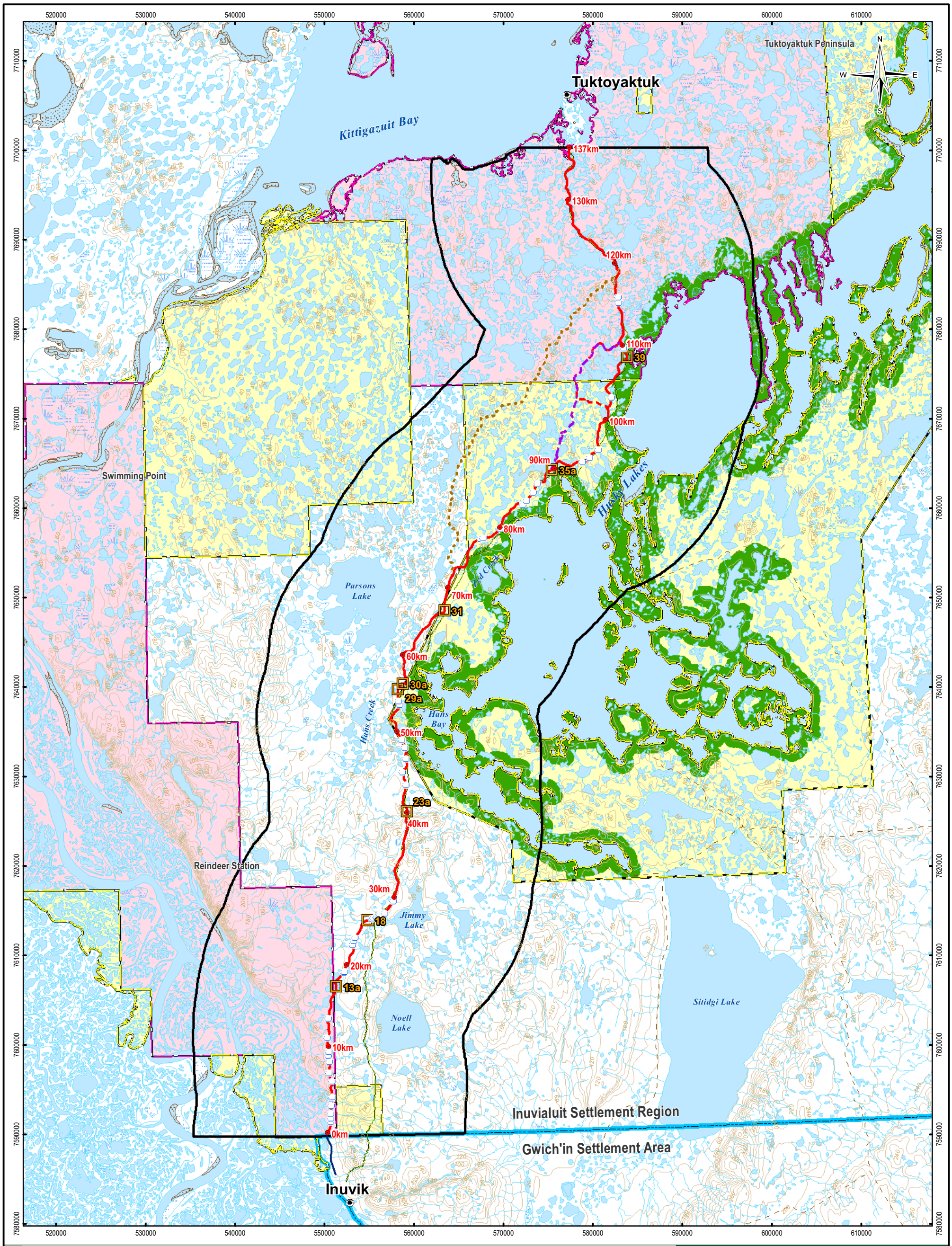
There are many stream crossings identified along the Primary 2009 Route. It is anticipated that most will be served by culverts and select locations will be crossed using bridges. The specific design of drainage structure (i.e., bridge or culverts) will be confirmed in future field investigations and during detailed design.

Based on preliminary engineering considerations and input from fisheries field investigations, a minimum of eight bridge crossings will likely be needed. The estimated lengths for these eight potential bridge crossings are presented in Table 2.5-2, and locations are illustrated in Figure 2.5-1.

TABLE 2.5-2: ESTIMATED LENGTHS FOR POTENTIAL SINGLE SPAN, PRE-FABRICATED BRIDGES			
Location	**Stream Crossing No.**	**Estimated Length (m)**	**Remarks**
KM 17	13a	15	Potential Bridge Crossing, Fish Habitat to be Confirmed
KM 26	18	20	Jimmy Creek
KM 40	23a	20	Trail Valley Creek, Potential Bridge Crossing, Fish Habitat to be Confirmed
KM 55.5	29a	20	Hans Creek tributary, Potential Bridge Crossing, Fish Habitat to be Confirmed
KM 56.5	30a	25	Hans Creek
KM 67.5	31	25	Zed Creek
KM 89.5	35a	10	Potential Bridge Crossing, Fish Habitat to be Confirmed
KM 109	39	10	Potential Bridge Crossing, Fish Habitat to be Confirmed

Culverts will be required at numerous locations along the Primary 2009 Route. Specific sites and estimated lengths based on the conceptual design have been identified where ephemeral creeks were identified in the 2009 field work (see Sections 3.1.7 and 4.2.5). Additional nominal quantities of culvert length have been included in the construction cost estimates to account for culverts that may be incorporated in the detailed design to equalize surface flow from one side of the Highway to the other, and including proposed culvert extensions for the Tuktoyaktuk to Source 177 Access Road upgrade.

Q:\Vancouver\GIS\ENVIRONMENTAL\V232\V23201322_TukRoad_EIS\Maps\EIS\V23201322_EIS_Map026_BridgeX.mxd modified 5/2/2011 by sleusink



LEGEND

- Stream Crossing
- Stream Crossing - Potential Bridge
- Regional Study Area (15 km buffer)
- Primary 2009 Route
- Alternative 1 (2009 Minor Realignment)
- Alternative 2 (Upland Route)
- Alternative 3 (2010 Minor Realignment)
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Husky Lakes 1000m Setback
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand

NOTES
Base data source: NTS 1:250,000
ILA Lands, Husky Lakes 1000m Setback: Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY ENVIRONMENTAL IMPACT STATEMENT

Potential Bridge Locations

PROJECTION	DATUM
UTM Zone 8	NAD83

Scale: 1:400,000
5 2.5 0 5 10
Kilometres

FILE NO. V23201322_EIS_Map026_BridgeX.mxd

PROJECT NO.	DWN	CKD	REV
V23201322	SL	TS	0

OFFICE	DATE
EBA-VANC	May 2, 2011

Town of Inuvik
Northwest Territories
KIGGIAK - EBA

Figure 2.5-1