

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

PROJECT DESCRIPTION REPORT FOR CONSTRUCTION OF THE INUVIK TO TUKTOYAKTUK HIGHWAY, NORTHWEST TERRITORIES

ISSUED FOR USE
February 2010

File: V23201098

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PROJECT DESCRIPTION REPORT
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EXECUTIVE SUMMARY

INTRODUCTION

Since the 1960s, the completion of the Inuvik to Tuktoyaktuk Highway (the Highway) has been a high priority goal of the Town of Inuvik, the Hamlet of Tuktoyaktuk and the residents of the Inuvialuit Settlement Region. The first initiative to bring the Highway Project to fruition 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, GNWT produced a comprehensive report entitled the “Proposed Inuvik to Tuktoyaktuk Road Environmental and Socio-Economic Baseline Report.” Further reports, including a Cost Benefit Analysis, were completed in 1999. The October 1999 GNWT Department of Transportation Highway Strategy described the completion of the Highway as a major policy objective of the GNWT.

Building upon the Highway Strategy, the GNWT included the Inuvik to Tuktoyaktuk Highway as a prominent component of succeeding proposals to Canada for infrastructure development including “Investing in Roads For People and Economy” (November 2000), “Corridors For Canada” (May 2002) and “Connecting Canada – Coast to Coast to Coast” (November 2005).

Recent interest from the Federal Government has reinvigorated the Highway Project. On August 20, 2009 the Town of Inuvik and Hamlet of Tuktoyaktuk received confirmation that the Canadian Northern Economic Development Agency (CanNor) would fund the completion of a Project Description Report for the Inuvik to Tuktoyaktuk Highway.

PROJECT PARTNERSHIP

After receiving funding approval by CanNor, the communities and the GNWT Department of Transportation developed a Memorandum of Understanding (MOU), which established a partnership to see the Project Description Report through to completion.

The purpose of the MOU was to describe the roles and responsibilities of the Project Partners – the Hamlet of Tuktoyaktuk, Town of Inuvik and GNWT Department of Transportation (also referred to as the Project Team). In particular, the MOU detailed the work that the Partners would undertake to prepare a Project Description Report for the construction of the Inuvik to Tuktoyaktuk Highway, how this work will be funded, and how overall project management will be implemented. Kiggiak-EBA Consulting Ltd. (Kiggiak-EBA) and its primary sub-consultant, FSC Architects and Engineers (FSC) were retained by the Partners to prepare the Project Description Report.

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. 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;
- Decrease 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 onshore oil and gas exploration and development and encourages 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 present economic downturn.

In summary, the construction of the Highway Project addresses 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 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, 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 2009 Route for submission to the EISC screening process and associated regulatory reviews. The two community meetings, held concurrently in Inuvik and Tuktoyaktuk on January 14, 2010, were well attended and the consensus arising from both meetings was that participants supported the 2009 Route.

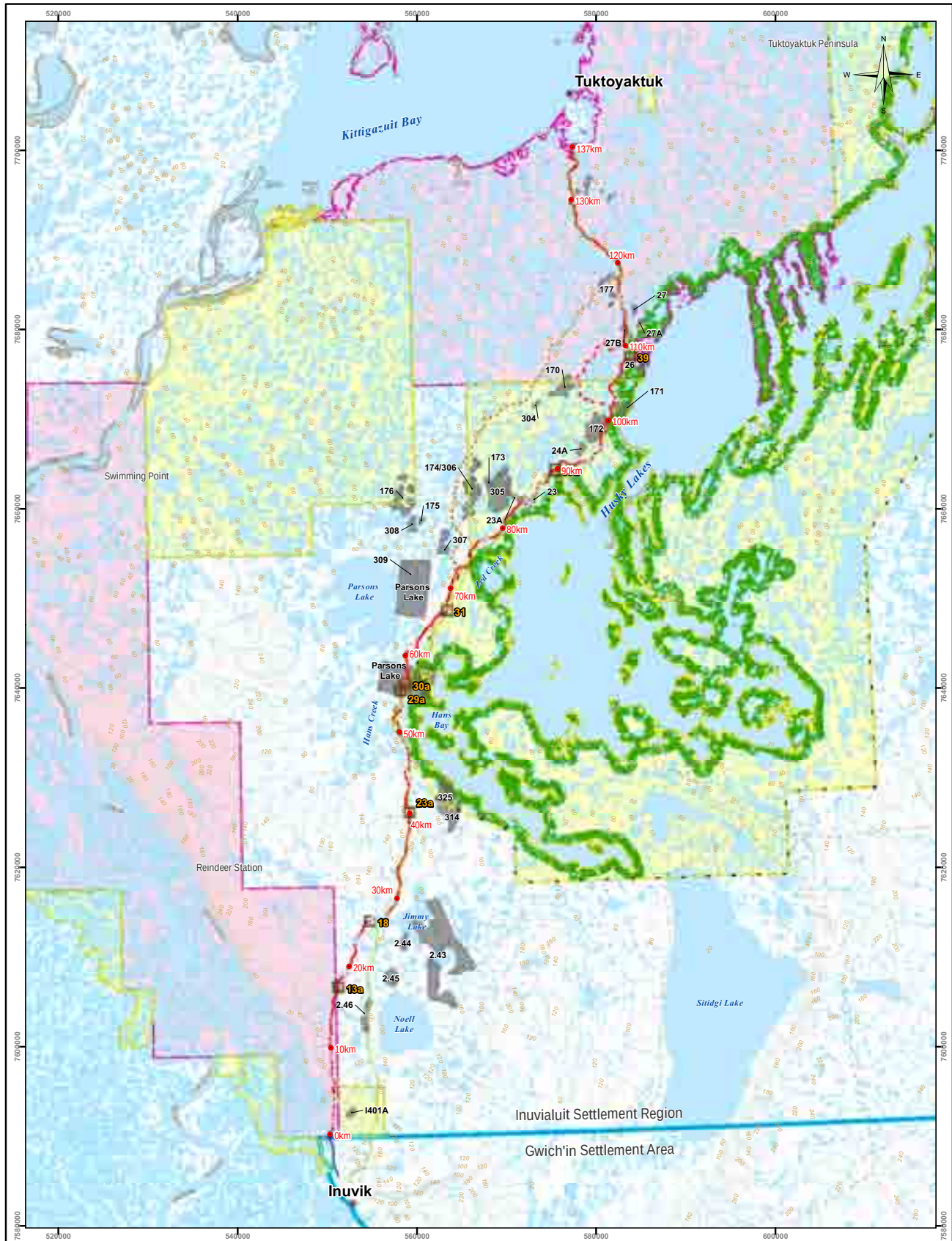
In overview, community members expressed general satisfaction that the Project Team had considered and are willing to implement reasonable mitigation measures to address their concerns. There was a general acknowledgement that the Project Team had made its best efforts to keep the proposed Highway alignment beyond the 1 km setback (with one minor encroachment of less than 2 km in length), as identified in the latest version of the Husky Lakes Management Plan. 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.

ROUTE ALIGNMENT ALTERNATIVES

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

- Preferred Alignment - the 2009 Route, which is an updated and refined version of the 1977 PWC alignment, but includes a minor encroachment on the Husky Lakes 1,000 m setback;
- Alternative #1 - a Minor Realignment of the 2009 Route to fully achieve the Husky Lakes 1,000 m setback requirements; and
- Alternative #2 - the Upland Route, which diverts west from the 2009 Route about 70 km north of Inuvik and rejoins the alignment near Source 177.

Borrow material quantities and cost estimates were based on the conceptual designs for the alignments considered. Table 1 summarizes the overall quantity and cost estimates for each alignment. The quantity estimates include upgrading the 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.



LEGEND

- Stream Crossing
- Stream Crossing - Potential Bridge
- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Borrow Sources
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

NOTES

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

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Preferred Inuvik to Tuktoyaktuk Alignment,
Other Alternatives Considered, Priority
Borrow Sites, and Proposed Bridges

PROJECTION
UTM Zone 8

DATUM
NAD83

Scale: 1:400,000

5 2.5 0 5 10
Kilometres

FILE NO.
V23201098_ES-Map001.mxd

PROJECT NO.
V23201098

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DATE
January 18, 2010

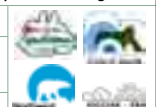


Figure 1

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TABLE 1: SUMMARY OF QUANTITY AND COST ESTIMATES FOR ALIGNMENTS CONSIDERED			
Element	2009 Route (with encroachment on Husky Lakes Setback)	2009 Route (with realignment to meet Husky Lakes Setback)	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 constructability and cost analysis conducted favour the 2009 Route. The encroachment on the Husky Lake setback area represents a road length of less than 2 km. The other two options presented above were compared to the 2009 Route base case.

The additional cost to undertake the Minor Realignment to accommodate the Husky Lakes setback requirements is approximately 5 to 6% (\$12 million) of the overall project cost. To avoid the Husky Lakes setback the realignment adds 5 km in total highway length.

Adoption of the Upland Route meets the Husky Lakes setback requirements, results in a 4 km reduction highway length and results in an increase of approximately 16 to 17% (\$37 million) in the overall project cost.

The Project Team's selection of the proposed 2009 Route for the Inuvik to Tuktoyaktuk Highway seeks to capitalize on the technical and economic advantages inherent to the alignment:

- lowest cost alternative for construction;
- requires the least borrow material to construct;
- closer to known borrow sources;
- reduced project footprint (less land disturbance);
- conforms to Husky Lakes Setback with a minor exception;
- 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

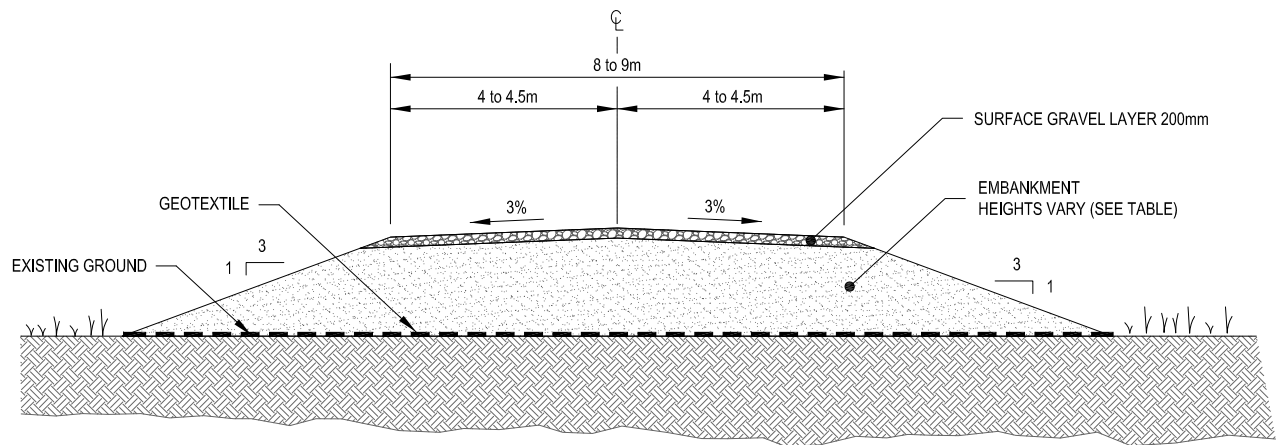
The proposed Inuvik to Tuktoyaktuk Highway will be 138 km long and will be located entirely within the ISR (Figure 1). Approximately 71 km or 51.5 % of the alignment will be located on Inuvialuit private lands which are regulated and administered by the Inuvialuit Lands Administration (ILA). Approximately 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 gravel and sand from selected borrow sources located in the vicinity of the Highway alignment.

The Inuvik to Tuktoyaktuk Highway will be constructed and operated in conformance with applicable highway standards. The Highway will be a public, all-weather highway under the management and operation of the Government of Northwest Territories Department of Transportation. 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 eight stream crossing locations will likely require a bridge. Culverts will be used in most other locations where appropriate and economical.

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 includes only fills. This approach will protect the permafrost layer below the road surface.

The geometric design parameters 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 illustrates the design parameters for a typical highway cross section. Geotextile fabric will be placed between the existing ground and the construction materials along the entire alignment.



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

TYPICAL HIGHWAY CROSS SECTION

PROJECTION

DATUM

Scale 1:150

1 0 1 3m

FILE NO.

V23201098-Consult01-Typical section.dwg

PROJECT NO.

V23201098

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DATE

JANUARY 19, 2010

Figure 2

The proposed Highway design parameters are presented in Table 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

Notwithstanding the work completed by the Project Team to date, it will be necessary to undertake further engineering, environmental and heritage resource studies during the late winter and summer of 2010 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 to permit construction of the Inuvik to Tuktoyaktuk Highway to proceed.

HIGHWAY CONSTRUCTION AND SCHEDULE

A fundamental tenet of the Project's construction methodology is to use primarily winter construction techniques instead of more typical summer construction often use in southern Canada. 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 costly all-weather access roads.
- allows the placement of construction material directly onto frozen ground. This approach enables the establishment of a frozen core for the Highway and helps protect sensitive and ice-rich terrain.
- minimizes potential effects on vegetation and soils adjacent to the actual roadway that might occur if working under snow-free or wet conditions.
- promotes initial Highway stability through the placement of frozen borrow material directly onto frozen ground (with geotextile separation layer). In the first construction year, it is anticipated that most construction settlements 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 in the first few years, leading to greater Highway stability than has been the case with the placement of warm fill on thawed ground in summer construction in this area. This is also expected to reduce potential longer term maintenance problems.

Construction activities will be limited, to the extent possible, within the planned footprint of the Highway. A temporary winter road will run roughly parallel to the alignment and temporary winter road will provide access to borrow sources for the duration of winter construction periods. Before the commencement of construction, the route will be surveyed and staked, and temporary winter roads will be constructed to selected 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 to 200 mm higher than design to accommodate settlements.

Culvert and bridge installation will proceed concurrently with construction of the Highway. As the intended bridge structures are prefabricated single span bridges on binwall abutments, it is anticipated that access to bridge sites prior to Highway construction will not be necessary. 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. Access to opposite sides of the particular stream crossing will be required for ground preparation on binwall assembly before the installation of the bridge structure.

Stream crossings will be accommodated by temporary ice crossings on the adjacent seasonal winter road near the bridge site. Prefabricated bridge structures can be shipped to the individual bridge sites by truck along the constructed portions of the Highway or along the winter road. No specialized equipment will be required for the bridge installations. Specialized equipment is not required. Each year's roadway construction and installation of drainage structures will be carried out in a similar manner. Final compaction, adjustment of grade to correct settlements, and placement of surfacing materials will be undertaken in the year following construction of the Highway embankment.

The Tuktoyaktuk to Source 177 Access Road provides a practical model for how the Highway is anticipated to be constructed:

- the Highway is expected to 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 construction;
- construction will begin by placing geotextile and building forward in lifts of granular material;
- construction will continue each winter season until spring demobilization; and
- final shaping, compaction and placement of granular topping will take place in the summer.

Subject to funding and regulatory permitting, the generalized construction schedule for the Inuvik to Tuktoyaktuk Highway is outlined in Table 3.

TABLE 3: PROPOSED PROJECT SCHEDULE	
Schedule	Activities
August 2010	Pre-positioning of equipment at Source 177 Potentially commence construction at Inuvik end
October 2010	Strip and develop initial borrow source(s)
November-December 2010	Continue work at borrow sources, construct winter access and haul roads
January-April 2011	Transport, spread borrow material, construct road and install bridges and culverts
June-September 2011	Compact and grade Year 1 embankment
Fall 2011-April 2012	Repeat cycle of construction similar to Year 1
June-September 2012	Compact and grade embankment; substantial completion of Highway
Fall 2012-Fall 2013	Provision of surfacing material, final grading, Highway completion.

ENVIRONMENTAL CONSIDERATIONS AND MITIGATION MEASURES

Climate, Air Quality and Noise

Emissions from diesel engine combustion exhaust and dust generated during the construction phase are considered to be relatively minor. Construction-related 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, the activities that will take place under thawed conditions are the compaction and grading of the Highway. The GNWT *Guideline for Dust Suppression* will be effective in controlling dust created by summer activities.

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 can 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,
- controlling 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 built on it depend on maintaining ground temperatures to minimize the thickness of the active layer, and to impede thaw. The proposed Highway is located within the permafrost region and stability of the infrastructure will be dependent on maintaining the perennially frozen ground.

A risk-based approach for incorporating climate change into design of highway infrastructure on permafrost is now recommended practice. 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 take into account consideration of 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 between the existing ground and placed construction material, and maintaining appropriate surface elevation, based on terrain type, to mitigate heat gain that can result in thawing of the permafrost.

Other risk factors that are related to climate uncertainty are precipitation, including both summer rain and winter snow. Key mitigative measures that 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 include:

- thick embankments that insulate and stabilize the active layer and the use of non-woven geotextiles for reinforcement;
- where available, use of porous construction materials such as coarser gravels to reduce the risk of ponding along the toe of the embankment;
- where such material is not available, the use of culverts to balance surface flow has been included; 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.

Vegetation

The proposed Highway is located predominantly within the Southern Arctic Ecozone, with a small portion of the Highway alignment projecting into the Taiga Plains Ecozone, near Inuvik

The Tuktoyaktuk Peninsula lies within the Southern Arctic Ecozone. The topography is fairly level, rising from sea level to approximately 100 m in elevation at Granular Source 177. Numerous lakes, ponds, and streams are common across the Peninsula. Vegetation grows on a veneer of unfrozen organic or granular substrate overlying the permafrost. The dominant vegetation along the proposed Highway alignment is characterized by a continuous cover of shrubby tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, *Dryas* spp., and sedge tussocks. In wetter areas, sedges, cotton-grasses and sphagnum moss 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 2.5 km of the Taiga Plains Ecozone near Inuvik. This ecozone is dominated by Canada's largest river, the Mackenzie, and its tributaries. It is

characterised 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 Project Description Report, 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 preferred alignment, the total Highway footprint would directly impact approximately 329 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 impact the vegetation cover by direct removal at the borrow sites and the burial of vegetation beneath the embankment along the Highway right-of-way.

To minimize direct impacts on the vegetation cover, construction activities will be limited, to the extent possible, to the planned footprint of the Highway. Care will be taken during the operations to keep heavy equipment and trucks within the right-of-way or snow compacted and flooded accesses and turn-arounds. 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 impacts on terrain and associated vegetation.

As indicated previously, to reduce possible effects of dust on vegetation, 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 23 terrestrial mammal species that may use the proposed Highway corridor. Key mammal species of greatest interest for harvesting purposes include caribou, moose, grizzly bear, wolf 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 137 bird species have been recorded in the region of the Mackenzie Delta and Tuktoyaktuk Peninsula. Most of these bird species, including geese, ducks, swans, are migratory; however, 17 are year round residents, 101 nest and/or moult and remain during the summer and 19 are rare transients or visitors.

Caribou are an important terrestrial mammal species, and have traditionally been harvested by the residents of Tuktoyaktuk and Inuvik. Two caribou herds occur in the Tuktoyaktuk Peninsula area,

the Cape Bathurst herd and the Bluenose-West herd. The Cape Bathurst and Bluenose-West caribou herds' annual ranges overlap that of the proposed Highway alignment.

The proposed road 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 proposed road alignment occurs within the Bluenose-west Winter Range management area. This area provides important winter habitat for the Bluenose-West caribou herd, which are valued for subsistence harvesting year-round by Inuvialuit communities and other aboriginal communities outside the ISR.

Management decisions related to the protection of wildlife and wildlife habitat for the Inuvik to Tuktoyaktuk Highway are based on background information; field investigations; inputs from the Tuktoyaktuk and Inuvik Hunters and Trappers Committees; and the application of, appropriate best management practices. The primary wildlife species of concern to the operation of the proposed Highway are caribou, moose, wolves, wolverines, foxes, grizzly bears, and the high value fur-bearers, such as lynx and marten. 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 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 Project Description Report, 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 40 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. Generally, 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 due to complete freezing.

A preliminary fish habitat field reconnaissance was carried out in fall 2009. The survey involved low level helicopter flights over the proposed and alternate routes to permit visual observation of watershed conditions upstream and downstream of stream crossing sites. The field crew conducted preliminary ground-based assessments of most of the locations where bridge installations are anticipated. Further site investigations in the coming year will 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 September 2009 preliminary field reconnaissance, the project consultants assessed the majority of stream channels to be crossed by the proposed Highway as 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 culverts will be installed and sediment and erosion control best management practices will be employed to protect downstream aquatic resources.

At this time, it is also anticipated that for about eight of the larger streams, including Trail Valley Creek, Hans Creek and Zed Creek, single-span bridges are likely to be installed 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. 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 highway construction and associated aggregate borrow activities. It is proposed that water for these purposes will be extracted from lakes in proximity to the Highway corridor. Since construction will take place in winter, water will necessarily be pumped from water beneath ice cover. It is anticipated that water requirements will exceed 300 m³/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.

Heritage 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. The 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 ground reconnaissance surveys before the commencement of construction.

No previously recorded archaeological sites occur within the primary proposed Highway alignment. 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 in accordance with the terms and conditions of the Northwest Territories archaeological regulations.

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 PDR and PDR 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 contractors onsite 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 Inuvialuit Land Administration and Indian and Northern Affairs Canada Land Use and Quarry permits and authorizations that will be issues for the construction project; and
- implementation of spill reporting, containment and cleanup protocols in accordance with project-specific spill contingency plans that will be developed by the companies contracted to construct the Highway.

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

Next Steps Towards the 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 major policy objective of the Government of the Northwest Territories.

From the regional perspective, the Highway will mean a dramatic decrease in the cost of living in Tuktoyaktuk and other benefits for Inuvik. It will improve residents' access to healthcare professionals and educational opportunities. The Highway will support year-round social and recreational 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 to protecting Canadian sovereignty in the Arctic and providing diverse economic development opportunities for the future.

The Inuvik to Tuktoyaktuk Highway PDR demonstrates the viability and importance of the Highway. It describes how the anticipated effects of the Highway are manageable. This finding is derived from the scientific and engineering assessments conducted for this PDR and from the knowledge shared and views expressed by the communities of Inuvik and Tuktoyaktuk. Consultations revealed a general satisfaction with the approach and proposals contained within the PDR.

Based on consultation with the environmental screening and regulatory authorities, community organizations, and residents, the Project Partners have a high degree of confidence that that the proposed Highway can proceed efficiently through the regulatory process to permitting, construction, and responsible longterm operation and maintenance. From many perspectives, the proposed Highway will be a key component of the Northwest Territories future transportation system.

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1.0 TITLE

Project Description Report for Construction of the Inuvik to Tuktoyaktuk Highway, Northwest Territories.

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3.0 REGULATORY REVIEW AND APPROVALS

Through the Inuvialuit Final Agreement (IFA), settled 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 138 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 gravel and sand 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)

Subsection 11(3) of the IFA establishes the EISC to be comprised of permanent members appointed by Canada and the Inuvialuit. Additional members may be appointed from time to time.

In the fall of 2009, the EISC, ILA, territorial and federal regulatory agencies were consulted with the goal of identifying what their organizations consider to be the key issues related to the proposed Highway project. Regulatory and resource management agency representatives were also asked to describe their organization's anticipated role in screening of the proposed project and to suggest other agencies and organizations that should be consulted. These inquiries confirmed that the Highway would require a screening by the EISC and would also be subject to screening under the Canadian Environmental Assessment Act (CEAA). This Project Description Report has, therefore, been prepared in accordance with the *Environmental Impact Screening Committee – Operating Guidelines and Procedures* (EISC 2004) and contains supplemental information to meet the needs of the EISC and CEAA screening processes.

The EISC guidelines outline the requirements for the content and format of the Project Description Report in Section 4.4 of the Operating Guidelines and Procedures (EISC 2004). In respect of the guidelines, this Project Description Report includes a detailed description and schedule for the proposed development, describes community consultations, provides an environmental overview of the project area, evaluates potential

environmental effects of the proposed project and mitigation measures, and outlines spill contingency and reclamation plans.

After its review of a Project Description Report, with regard to IFA Subsections 11(17) and 11(18), the EISC will determine if the proposed development could have a significant negative environmental impact. Paraphrasing from the IFA, the EISC will then indicate one of the following views:

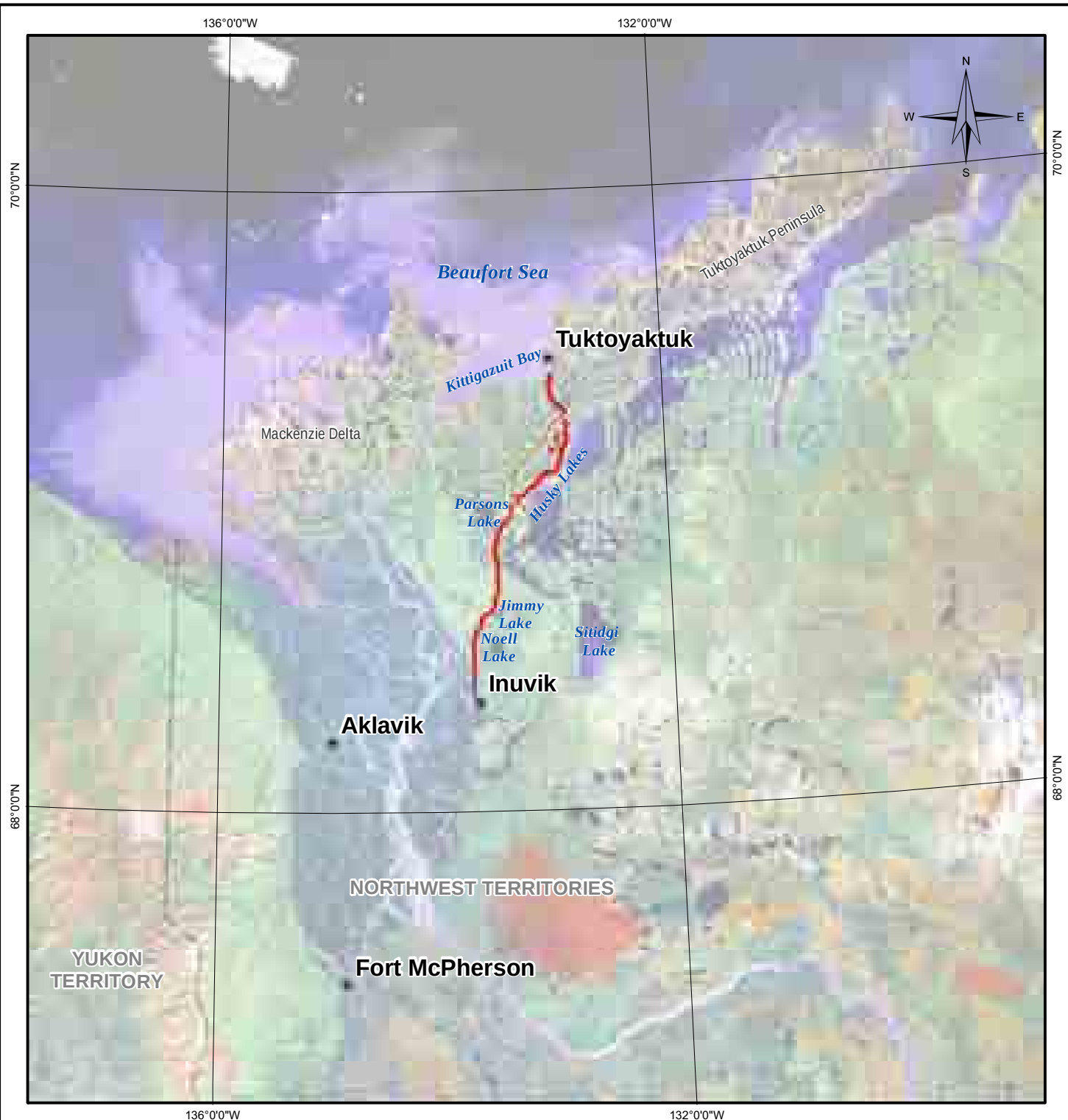
- the development will have no such significant negative impact and may proceed;
- the development, if authorized subject to EISC terms and conditions, will have no such significant negative impact and may proceed;
- the development could have significant negative impact and is subject to assessment and review; or
- the development proposal is insufficiently developed and is returned for clarification.

Following EISC and CEAA screening, Inuvialuit and federal permitting authorities will review the decision and associated recommendations from the screening and referral organizations. If the project recommendation is that there will be no significant negative impact and it may proceed, then the ILA and other regulatory agencies will issue permits and licences and prepare accompanying terms and conditions. For the portion of the road traversing Inuvialuit Lands, as part of the permitting process for access and use of Inuvialuit lands, an Access Agreement will be required. The Access Agreement will be between the Government of the Northwest Territories (GNWT) and the IRC and will be binding on the Partners.

Other Inuvialuit, territorial and federal agencies that will play a role 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).

Figure 3-1 depicts the location of the proposed Highway in the context of the Mackenzie Delta area. Figure 3-2 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 in the Northwest Territories are of particular relevance to screening and regulatory discussion that follows.

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LEGEND

- Communities
- Territorial Boundary
- 2009 Route
- - - Other Alignments Considered
- Upland Route
- Navy Road

NOTES

Base data source:
Base imagery, ESRI Data and Maps
Inuvialuit Land Administration - boundaries

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Proposed Project Location

PROJECTION UTM Zone 8	DATUM NAD83
Scale: 1:2,000,000	
10 5 0 10 20 30 40 50 60 70	
Kilometres	

FILE NO.
V23201098_PDR-Map018-Intro-PrjLoc.mxd

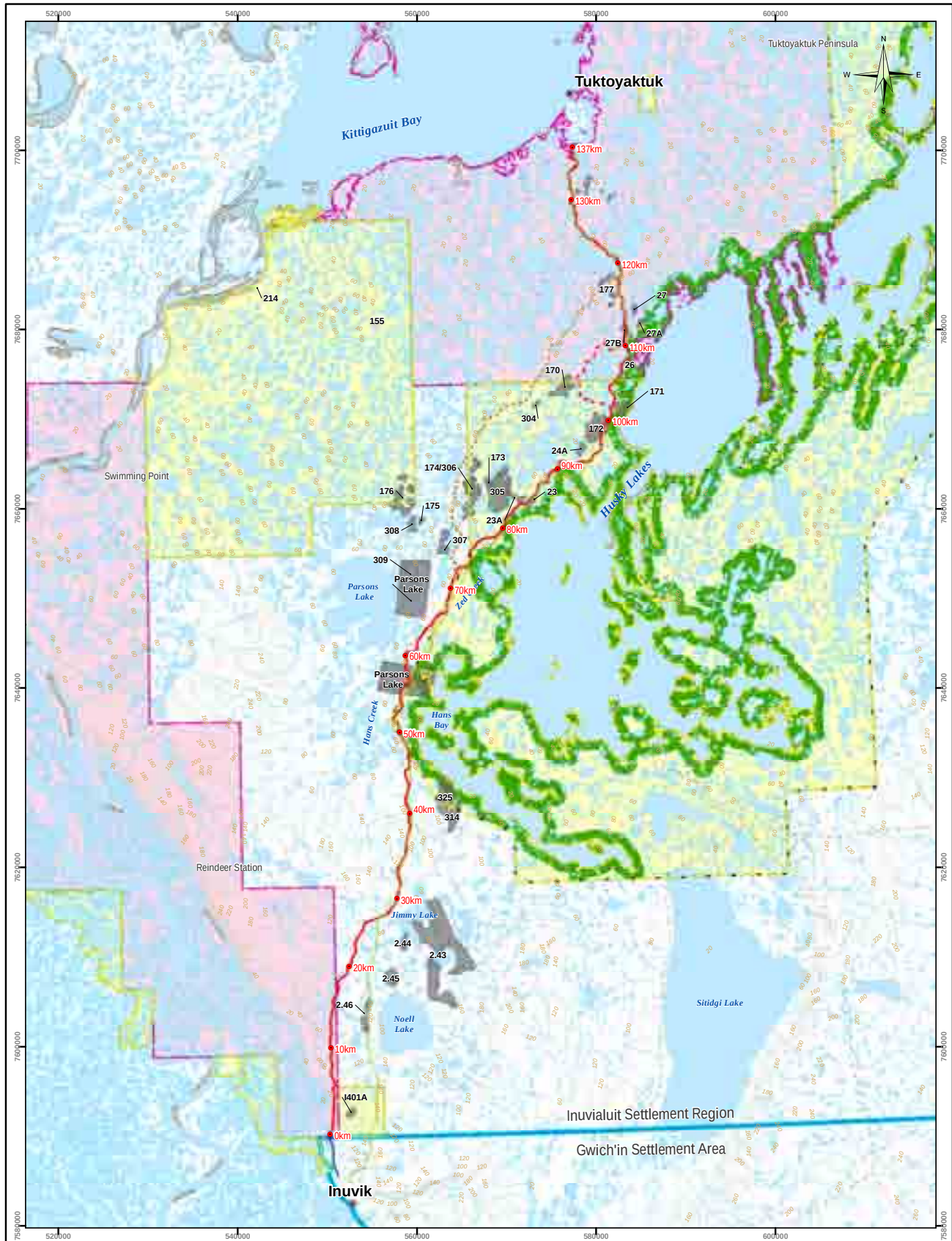
PROJECT NO. V23201098	DWN KWM	CKD XXX	REV 0

OFFICE EBA-VANC	DATE January 14, 2010



Figure 3-1

ISSUED FOR USE



LEGEND

- 2009 Route
- - Other Alignments Considered
- - Upland Route
- PWC 1977
- Navy Road

- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary

- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

- Borrow Sources

NOTES

Base data source: NTS 1:250,000
Borrow Sources: Inuvialuit Land Administration

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Potential Borrow Sources Along the 2009 Route

PROJECTION: UTM Zone 8

DATUM: NAD83

Scale: 1:400,000

5 2.5 0 5 10
Kilometres

FILE NO.: V23201098_PDR-Map004-Dev-GranProp.mxd

PROJECT NO.: V23201098

DATE: January 14, 2010

OFFICE: EBA-VANC

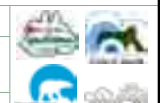


Figure 3-2

ISSUED FOR USE

3.1 PREVIOUS REGULATORY APPROVALS

Known previous approvals for road construction and/or quarrying in the project area are described below.

In 2000, the ILA granted an approval to E. Grubens Transport Ltd. (EGT) to remove approximately 30,000 m³ 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 Granular 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 Granular Source 177 Access Road. The Tuktoyaktuk to Granular Source 177 Access Road serves as a pilot project for the proposed Inuvik to Tuktoyaktuk Highway in regard to environmental review and permitting, cost, schedule, logistics, construction methods, and environmental protection and effects mitigation. The second year of access road construction will begin in 2010. It is, and will remain, the subject of dialogue, observation, and scientific investigation as it is a model of current good, appropriate practice in arctic all-weather infrastructure development.

Additional examples of land use and quarry permits issued in the Inuvik to Tuktoyaktuk corridor 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 Parsons Lake natural gas field east of the proposed Highway alignment. As well, Source 168 was quarried by E. Grubens Transport Ltd. (EGT) in the 1980s for shoreline erosion protection in the community of Tuktoyaktuk.

3.2 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 granular resources. Each of these activities requires a regulatory authorization.

This section provides an overview of the other environmental screenings, reviews, and approval processes that are anticipated for the proposed Highway project including Inuvialuit Land Administration authorizations, screening under the Canadian Environmental Assessment Act, NWTWB water licensing, Indian and Northern Affairs Canada authorizations, Fisheries and Oceans Canada authorizations, a permit for construction within Navigable Waters, and research authorizations for pre-construction field investigations.

The sections that follow seek to integrate regulatory interpretation and consultations with screening agencies and regulators in October 2009 and January 2010. Section 3.2 portrays

the Project Team's resultant understanding of the likely regulatory requirements current to the time of Project Description Report submission.

3.2.1 Inuvialuit Land Administration Authorizations

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

Consultations with the ILA have identified the authorizations that will be required to construct the Highway. The anticipated authorizations for the Highway alignment are 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 in order to fulfill the requirements of the land use and quarry applications. The Partners anticipate securing multi-year authorizations from the ILA to accommodate the duration of Highway construction. The project schedule is discussed in Section 5.9.4.

Along with the above-noted permits, the project will require an Access Agreement. The Access Agreement will be negotiated as part of the permitting process through the ILA.

After screening decisions are taken, the Partners anticipate continuing dialogue with the ILA and other Inuvialuit organizations and authorities. These discussions will include interpretation of project terms and conditions, completion of negotiated agreements, GNWT-Inuvialuit Regional Corporation (IRC) negotiation of permanent land tenure, and other implementation actions, as required.

3.2.2 Screening under the Canadian Environmental Assessment Act

The Canadian Environmental Assessment Act (CEAA) has been reviewed for its applicability to the proposed Highway project and federal agencies have provided input on the anticipated role of a CEAA screening. The basis for CEAA involvement is found in Section 5 of the Act, in relation to a project that is not otherwise excluded and is stated by the federal government (CEAA 2006) as follows:

The trigger occurs when a federal authority considers providing federal support allowing a project to proceed in whole or in part, by exercising one or more of the following duties, powers or functions:

- Proposes a project as its proponent.
- Grants money or other forms of financial assistance to the proponent for the purposes of enabling a project to be carried out.
- Grants an interest in land to enable a project to be carried out.

- Exercises a regulatory duty in relation to the project, such as issuing a permit, license, authorization or approval that is included in the Law List Regulations.

In October 2009 and January 2010, consultations with Inuvialuit and federal authorities in the Inuvialuit Settlement Region supported the Inuvialuit screening process as the first step in the environmental screening of the proposed Highway. Regulatory consultations have indicated that the federal screening process will be initiated concurrently with the Inuvialuit EISC screening process, and is anticipated to be completed after the Inuvialuit process. In practical terms, the CEAA process will receive the EISC's recommendation as one input into the CEAA screening decision.

Affirming the regulatory process that was envisioned in the Rescan (1999) *Proposed Inuvik-Tuktoyaktuk Road: Environmental/Socioeconomic Baseline Report* and the approach indicated in the EISC Operating Guidelines and Procedures, the coordination between the Inuvialuit and federal screenings is stated as follows:

"The Settlement Act applies in the event of a conflict or inconsistency between either the Settlement Legislation or the Inuvialuit Final Agreement and the provisions of any other federal, territorial, provincial or municipal law, by-law or regulation [IFA Subsection 3(3)]"

(EISC 2004)

The remainder of this section describes the goals of CEAA screening process in overview, followed by comments on how it will apply to the proposed Highway.

The CEAA framework comprises a planning and decision-making tool that identifies environmental effects and mitigation, determines if significant adverse effects are likely, and assists federal agencies in deciding whether to support a project (CEAA 2006). The proposed Highway project involves multiple federal agencies. Federal Authorities (FAs) are federal agencies that may have expertise or a mandate relevant to the project. When an FA has the responsibility to exercise power or duty that requires the conduct of an environmental assessment (including a 'screening') that FA becomes a Responsible Authority (RA). The individual responsible for coordinating the involvement of various parties, including the facilitation of communication and cooperation, involved in project screening (or other types of environmental assessments) is the Federal Environmental Assessment Coordinator (FEAC) (CEAA 2006). Through consultation, regulatory agencies have indicated that these roles and the project-specific CEAA assessment will be determined after the potential FAs - INAC, DFO, NWTWB (and others) receive the project description (in this case the Project Description Report).

The following sections provide a brief description of the regulatory triggers for a water licence, land use permit, quarry licence, fisheries authorization, navigable waters permit, explosives authorization, and research authorizations that apply to this project. The Partners remain open to discussions with INAC, DFO, NWTWB, and other federal

agencies to discuss issues that arise and pursue resolution to overlapping Inuvialuit and CEAA requirements.

3.2.3 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 a manner that will provide the optimum benefit for all Canadians in general and, in particular, for the residents of any part of the Northwest Territories for which the Board is authorized to issue licences.”

The Project Team has reviewed the *Northwest Territories Water Act* and the *Northwest Territories Waters Regulations* for their applicability to the proposed Highway project. The proposed project was evaluated against Schedule II of the *Northwest Territories Waters Regulations*, to classify the undertaking as industrial, municipal, or miscellaneous. Based on this preliminary review, the miscellaneous classification appears to be the most appropriate classification. However, the NWTWB (M. Harlow, pers. comm. December 7, 2009) advised that the Board, upon its review of the project, would decide which classification is most appropriate for the project.

After consulting the NWTWB, the Project Team understands that the project will require one water licence to encompass the various project elements. The licence will authorize watercourse crossings that exceed five metres in width, the anticipated daily water use volumes, and the project construction camps. There are different thresholds for Type A and Type B water licences. The ‘triggers’ are described below with reference to the relevant regulatory thresholds:

- Water Crossings - The *Northwest Territories Waters Regulations* state that no licence will be required for the construction of a structure across a watercourse that is less 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. For municipal and industrial undertakings, these crossings would require a Type B water licence.
- Construction Camps - The *Northwest Territories Waters Regulations* indicate that camps of 50 persons or less do not require a water licence. 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 B water licence would be required to authorize the anticipated camps.
- Daily Water Use - the *Northwest Territories Waters Regulations* indicate that the direct use of 300 cubic metres (m³) or more per day for industrial undertakings requires a Type A licence and the direct use of 50 to 2,000 m³ for municipal undertakings requires a Type B licence. For the construction of the proposed Highway, the water use is anticipated to be 1,000 m³ or more per day during peak

phases of construction, particularly when establishing temporary winter access roads. As noted above, the NWTWB will classify the activity upon review of the Project Description Report.

The NWTWB has verified that under the *Northwest Territories Waters Act* Subsection 174(1) it is mandatory for the NWTWB to provide the opportunity for a public hearing about projects that require a Type A Water Licence. If the NWTWB determines the need for a Type A Water Licence for this project and there is an intervenor to the water licence application, a public hearing would be held.

In support of the NWTWB's deliberations, the Project Description Report provides information about the water crossings greater than five meters wide, identifies the need for crew accommodations, 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 subsequent to the Project Description Report. Under appropriate seasonal conditions, 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*. In addition, the *DFO 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.

3.2.4 Indian and Northern Affairs Canada Authorizations

Indian and Northern Affairs Canada (INAC), in the application 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 Northwest Territories. Consultations with INAC personnel indicate that a Project Description Report generated in accordance with EISC screening requirements and CEAA screening requirements will meet INAC's information needs. Applicable permit or licence application forms will be submitted, referencing the relevant sections of this Project Description Report.

- Quarry Permit - The project will require quarry permits issued under the *Territorial Quarrying Regulation* for the extraction of borrow materials. It is understood that INAC will review quarry permit applications in the context of INAC's responsibility to manage granular resources on Crown lands in the Northwest Territories. In keeping with this responsibility, 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 licenses borrow sources for a maximum duration of one year; therefore, successive annual licences may be required for some project sources.

- Land Use Permit - A land use permit will be required for the proposed Highway right-of-way and temporary borrow source access roads. 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.”

3.2.5 Fisheries and Oceans Canada Authorizations

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

- Section 35(1), prohibits the harmful alteration, disruption, or destruction (HADD) of fish habitat¹; and
- Section 35(2), which allows the Minister to Authorize a HADD of fish habitat.

To fulfill its responsibilities mandated by *Fisheries Act* Section 35, DFO in 1986 developed a Policy for the Management of Fish Habitat, which provides guidance to protect, conserve and develop Canada’s fish habitats. The Policy establishes a Guiding Principle of no net loss (NNL) of productive capacity of fish habitats, as a way of ensuring that developments do not result in a diminishment, in quality or quantity, of fish habitats that support fish production. This NNL principle, however, does provide discretion to the Minister by allowing for the replacement of habitat losses (authorized under Section 35(2)) through the provision of approved habitat compensation.

DFO does not issue permits for a project, as this is strictly a provincial or territorial responsibility. However, DFO may issue: a Letter of Advice for projects that are not expected to result in a HADD; or, an Authorization for HADD under Section 35(2). The 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 NNL. In both cases, these documents relieve the project proponent, developer, or owner of concerns over potential legal consequences prescribed in the *Fisheries Act*, provided that the outlined conditions are followed.

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

¹ The *Fisheries Act* defines fish habitat to mean “...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.”

Operational Statements is to relieve proponents of the need for an approval from DFO, provided that specified requirements and conditions are followed. For example, in the Northwest Territories, DFO has published the following Operational Statements that may be applicable to this project: 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 are necessary as part of this project 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. If there are circumstances 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.

3.2.6 Permit for Construction within Navigable Waters

Under the Navigable Waters Protection Act and Regulations, the project will require a permit for construction of bridges or culverts across or over navigable water bodies. Transport Canada is responsible for permits under the Navigable Waters Protection Act. An application will be made once the applicable bridge and/or culvert design information becomes available. 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.

3.2.7 Research Authorizations

Pre-construction studies will include additional environmental and engineering investigations. These scientific activities are administered under the *Scientists Act* and are allowed with the issuance of a research licence by the Aurora Research Institute.

Archaeological investigations are permitted under the *Northwest Territories Archaeological Sites Regulations* made under the *Northwest Territories Act* (Canada). Archaeological permits are issued by the Prince of Wales Northern Heritage Centre. These authorizations will be obtained prior to the conduct of field activities and local Hunters and Trappers Committees and Community Corporations will be notified of proposed work activities.

3.3 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 Partners intend to minimize disturbance to ISR land and the traditional land use and harvesting activities taking place in the ISR, the Partners have initiated consultations with the noted organizations and residents at large, and they intend to continue this consultative process to solicit additional input. Simultaneously,

the Partners intend to solicit the input of authorities, organizations and individuals in the project area. A number of groups have been, and will continue to be given advance notice of studies and construction activities. Examples 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) (see Appendix A);
- 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 Board, November 13, 2009; and
- January 2010 Inuvik to Tuktoyaktuk Highway follow-up Community consultations 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.

The Partners expect to receive additional input from community and regulatory agencies that do not issue specific project authorizations. This occurs through the EISC and CEAA screening processes, wherein organizations and agencies receive copies of the Project Description Report and are asked to review and comment on the proposed project. Organizations, agencies, and individuals have the opportunity to provide written input to the screening process. The EISC process, in particular, will append comments to the screening decision. The regulators may choose to incorporate these comments into project terms and conditions.

4.0 LOCATION

As indicated in Section 3.0 of this Project Description Report, the proposed Highway will be 138 km long and will be located entirely within the ISR (Figure 3-1 and 3-2). 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 gravel and sand from selected borrow sources located in the vicinity of the Highway alignment (Figure 3-2). Temporary winter access/haul roads will be used during the construction phase of this project to access and transport borrow materials.

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 the northernmost community on the Canadian mainland. Tuktoyaktuk is located 137 km north of Inuvik. It is accessible by air from Inuvik year-round, by water during the summer months, and by ice road during the winter.

The project area is entirely contained within the Inuvialuit Settlement Region of the Mackenzie Delta-Beaufort Sea Region. 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 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.

5.0 DEVELOPMENT SUMMARY

Currently the only surface transportation access to the community of Tuktoyaktuk is by a 187 km ice road from Inuvik built annually by the GNWT Department of Transportation 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 and barge service from Hay River during the summer.

As part of the early 1960s “Northern Vision” of the then prime minister John Diefenbaker for the development of Canada’s north, the federal government of Canada, which was then directly responsible for most government programs in the Northwest Territories, implemented an ambitious program of all-weather road construction in the Western Arctic. Achievements of the program included the construction of the Dempster Highway No. 8 connecting Whitehorse, Yukon, to Inuvik; the Mackenzie Highway No. 1 from the Alberta border to Fort Simpson; and the Liard Highway No. 7 connecting Fort Nelson, BC, to the Mackenzie Highway east of Fort Simpson; as well as improvements to the Yellowknife Highway No. 3, and Fort Smith Highway No. 5.

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. Spurred by oil and gas exploration in the Parsons Lake area south of Tuktoyaktuk, the first route surveys for the Inuvik to Tuktoyaktuk all-weather road were undertaken by Public Works Canada (PWC) in 1974, on the basis of which a 140 km all-weather road route was identified. Preliminary engineering and environmental studies were undertaken on this route in 1975-76, which became known as the PWC 1977 route (see Figure 3-2). However, road construction did not proceed due to changes in government policy and the declining pace of industry activity in the region.

Little additional road building was accomplished by PWC in the Western Arctic in the 1970s and 1980s. In the late 1980s, as part of a major devolution of federal programs and their related budgets to the GNWT, the existing Northwest Territories highway system was transferred to GNWT Department of Transportation. It is relevant to note that the roadbed for the Fort Simpson-Wrigley segment of the Mackenzie Highway was built by PWC before program devolution to GNWT; but the segment was completed and opened by GNWT Department of Transportation in the early 1990s. After the program devolution, a combination of economic, fiscal, political and other factors meant that construction of new road corridors in the Western Arctic did not receive the requisite financial support from the federal government.

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 Department of Transportation reports since 1990,

including the NWT Transportation Strategy (1990), the NWT Transportation Strategy Update (1994), Investing in Roads for People and the Economy (2000), Corridors for Canada (2002), Corridors for Canada-II (2005), Connecting Canada: Coast to Coast to Coast (2005), and Northern Connections (2008).

As part of the federal road programs (e.g. National Highway System Improvement Program and Infrastructure Canada Program, various INAC programs), the GNWT has received funding from these national programs for improvements on existing roads in the Northwest Territories (e.g. Highway 3, bridges on the Mackenzie Valley winter road, etc). However, these federal funds were not meant for new road corridors.

More recently, the federal government has shown a renewed interest in developing road and other infrastructure in the arctic with cost shared funding under the Building Canada Fund. The first major 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 is to become part of the future all-weather highway. Construction on this road began in 2009 and is expected to be completed in the winter of 2010.

5.1 RATIONALE

The Inuvik to Tuktoyaktuk Highway will be the first all-weather road connection in Canada to the Arctic Ocean, and will have substantial benefits at the national, regional and local levels. The main benefits are summarized below.

Cost of Living

The Highway will dramatically reduce the cost of living and doing business in Tuktoyaktuk because goods could be shipped overland year-round. To give an example: according to the latest figures published by NWT Bureau of Statistics (2004), the 2004 Food Price Index for Tuktoyaktuk is 206, compared to 140 for Inuvik (Yellowknife being 100). Thus, food in Tuktoyaktuk is 47% more expensive than in Inuvik. The Highway will allow year-round trucking of most of the items that are flown in most of the year.

Possible effects on the airline industry would be temporary, because the economic stimulus provided by roads to previously isolated communities is expected to help create more business for the airline industry. Changes in demand for service are expected to apply to the barge industry. Nevertheless, Tuktoyaktuk will continue to receive its annual fuel re-supply and other bulk shipments by barge even after the Highway is operating.

Cost of Government Program Service Delivery

The Highway will reduce the cost of providing 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 provide all weather access through the region for Tuktoyaktuk businesses and service providers. It will also allow the Inuvik and other regionally based businesses to compete more effectively for resource related and government business opportunities. This enhanced competition will lead to higher quality and lower cost services for government and resource development 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.

Creation of New 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.

Pollution Prevention and Spill Response in the Arctic Ocean

The all-weather Highway can potentially make the Canadian Coast Guard's Tuktoyaktuk-based arctic pollution prevention and spill response planning and operations cheaper and more effective. An all-weather Highway would allow transportation of equipment and materials required to respond to potential spills in the summer/fall Arctic shipping season; at present any emergency equipment and supplies must be flown to Tuktoyaktuk.

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 and has become extremely important to Canadians. Construction of the Inuvik to Tuktoyaktuk Highway will establish a permanent transportation link to Canada's arctic coastline, demonstrating to the international community that Canada is prepared to make significant financial investments to protect Canadian sovereignty.

Furthermore, the expected thinning of the ice in the Canadian Arctic Ocean due to climate change could encourage foreign commercial and non-commercial shipping into and through the Northwest Passage. 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 north and the expected intensification of Beaufort oil and gas development, there will 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. A deep water arctic port will be required to support these activities. The construction of the Inuvik to Tuktoyaktuk Highway will facilitate the efficient use of the port in terms of location and costs, and make it more likely that this port will be established in Canada, instead of the United States, which would have multiple economic benefits for the region.

Oil and Gas Exploration and Development

By facilitating all-weather access, the Highway can be expected to reduce the costs of onshore oil and gas exploration and development in the area between Inuvik and Tuktoyaktuk. 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, and flown from there to the off-shore exploration sites.

Quantification of Regional Economic Impacts

A study titled “Benefit-Cost and Regional Economic Impact Analysis: Inuvik to Tuktoyaktuk Road” was conducted by Nichols Applied Management for GNWT Department of Transportation in March 1999. The GNWT has commissioned an update to the 1999 study that is scheduled for delivery in early 2010.

Nichols Applied Management (1999) concluded that local hiring of construction workers; spending on wages, materials and equipment during construction of the all-weather road; and increased tourism; would result in regional impacts of \$77 million of business and labour income, and 600 person-years of employment. Benefits from potential oil and gas exploration and development, and others listed above, were not quantified in the study. Over time, more opportunities for benefits have become available as prime construction and subsequent operations and maintenance contractors are now located in the region. Therefore, it is anticipated that the regional economic impact of this Project will be greater than \$200 million in business and labour income.

5.2 BACKGROUND

5.2.1 Brief History of Alternative Alignments Considered

During the 1980s, interest in the proposed road varied in relation to economic and political factors and two other possible road 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 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 road 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 road 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 Road. 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 Road as part of the Highway Strategy dealt with the route alignment issues.

First, the route location was an important question posed and discussed at the 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 Road, there was general agreement by the public with the PWC 1997 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 1999).

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 road link between the two communities. This study also provided an update regarding design standards and costs for the road.

The move of the proposed route farther from Husky Lakes as suggested in the 1999 community meetings, and in the 2009 and 2010 community consultations has been considered in the selection of the preferred alignment.

5.2.2 Alignments Considered in the Current Stage of Project Development

As noted above, 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 3-2. The alignments include:

- 2009 Route which is an update and improvement on the PWC 1977 alignment, but includes a minor encroachment on the Husky Lakes 1,000 m setback;
- Minor realignment of the 2009 Route to conform to the Husky Lakes 1,000 m setback requirements; and
- Upland Route which diverts west from the 2009 Route approximately 70 km north of Inuvik and rejoins 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 1,000 m away from Husky Lakes.

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

5.2.2.1 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 1,000 m 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 5.2-1).



Photo 5.2-1

Looking west from Husky Lakes to area where PWC 1977 alignment was considered

5.2.2.2 2009 Route

The 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);
- 1,000 m setback from Husky Lakes;
- optimum stream crossing locations based on initial field work;
- potential areas of wildlife and vegetation sensitivity;
- areas of archeological 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.

At the south end, the 2009 Route takes advantage of more suitable terrain north of Navy Road than the previous PWC 1977 alignment (Photo 5.2-2). At the north end, the 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 5.2-3). The horizontal alignment for this access road meets or exceeds the minimum design parameters for the future highway. Only the 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 Project Description Report.



Photo 5.2-2
Looking south along 2009 Route near Hans Creek

5.2.2.3 Minor Realignment of 2009 Route to Meet Husky Lakes Setback Requirements

There are two locations where the 2009 Route does not fully meet the 1,000 m Husky Lakes setback. The first is from KM 105+340 to 105+600 where, for a road length of approximately 260 m, the 2009 Route runs just along the 1,000 m setback boundary or has a slight encroachment of 14 m. The second is from KM 107+580 to 109+400, where the 1,000 m setback line runs through the east end of a large lake that is just west of the Husky Lakes system. The 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 5.2-1.

To avoid the encroachments on the Husky Lakes Setback, a minor realignment of the 2009 Route has been considered to the west of a large lake starting at KM 101+200 and rejoining the 2009 Route at KM 111+700. This realignment is also shown in Figure 5.2-1.

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LEGEND

- 2009 Route
- - - Other Alignments Considered
- - - Upland Route
-  Inuvialuit 7(1)(a) Lands
-  Inuvialuit 7(1)(b) Lands
-  Husky Lakes 1000m Setback

NOTES

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

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Minor Realignment - 2009 Route

PROJECTION
UTM Zone 8

DATUM
NAD83

Scale: 1:85,000



FILE NO.
V23201098_PDR-Map021-DevRealig.mxd

PROJECT NO.
V23201098

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Figure 5.2-1



Photo 5.2-3
Partially complete access road from Tuktoyaktuk to Source 177

5.2.2.4 Upland Route

The Upland Route diverts northwest from the 2009 Route at KM 71 and rejoins the 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 1,000 m away from Husky Lakes. Initial review of the Upland Route was based on the historical power line alignment and input from community members who frequently travel the route by snowmobile for recreational and harvesting activities. As a result of the consultations, the Upland Route has been developed to the same conceptual design level as the 2009 Route, accounting for the same factors as noted above. The Upland Route is found to be through more rugged terrain than the 2009 Route, which poses challenges in constructability, an increase in material quantities to meet the minimum design parameters, and higher fills that could result in maintenance and operational issues (Photos 5.2-4 and 5.2-5). More direct comparison of the alignments is presented in further sections of this Project Description Report.



Photo 5.2-4
Looking south along Upland Route at typical terrain.



Photo 5.2-5
Looking south along Upland Route at typical terrain

5.3 DESIGN PARAMETERS FOR THE ALL-WEATHER HIGHWAY

The Highway will be a public, all-weather highway under the management and operation of the Government of Northwest Territories Department of Transportation. 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 sideslopes) with short span single lane bridges at stream crossings that require protection of fisheries. Culverts will be used where appropriate and economical.

In southern areas of the Northwest Territories it is common for road designs to incorporate both 'cuts and fills' to level terrain along the road alignment. However, in permafrost areas, cutting into the surface vegetation can disturb the permafrost regime, resulting in thaw and unstable ground. It is not recommended. Therefore, the design includes only fills with heights based on terrain type. This will be sufficient to protect the permafrost layer below the road surface.

Design parameters for the Highway were developed based on the operational needs of the Highway and the need to protect the permafrost layer below the road surface. The design parameters are defined as follows:

5.3.1 Design Embankment

The embankment is the main component of the Highway to be constructed. Figure 5.3-1 shows a cross section of the Highway and indicates the embankment. Although the original work by PWC considered a balance of cuts and fills in the highway design and construction (PWC 1981a), the current Project Team recognizes that for this type of terrain there is a lack of suitable material for construction along the alignments considered. In addition, a design and construction approach that utilizes cuts could result in future stability concerns for the Highway and cut slopes, unless those cuts were in ice-poor materials or bedrock.

Similar to the access road that is currently being constructed from Tuktoyaktuk to Source 177, the approach for the Highway will focus on using fills to build the Highway on existing ground.

It is believed that a minimum embankment (or fill) height of 1.4 m will be required to construct the Highway using ice-poor, quality granular materials, to the level expected without incurring substantially higher operation and maintenance costs. Construction could use less fill, but maintenance effort will be greater and additional fill materials will ultimately be required.

When the Highway traverses over borrow areas and drier, ice-poor upland terrain, then the minimum embankment height should provide sufficient structural strength to carry the anticipated traffic loading. Increased embankment heights would be required through low

lying, wet areas and areas of ice-rich polygonal patterned ground (Photo 5.3-1) that cannot be avoided and would most likely be in the 1.8 m to 2.0 m range.



Photo 5.3-1
Ice-rich polygonal patterned ground along the 2009 Route

Some sensitive, slide prone locations were identified during the September 2009 field work along the alignments considered. The slides identified were described as retrogressive thaw flow slides. These occur in regions of high ice content soil, particularly where the active layer is thickening and slopes are over steepened. In this region the over steepened slopes develop around expanding thermokarst lakes, along hummocky terrain and along stream channels and terraces (Photo 5.3-2).



Photo 5.3-2
Thermokarst lakes and hummocky terrain along 2009 Route

Table 5.3-1 provides the design parameters for embankment fill thickness by terrain type for the alignments considered.

TABLE 5.3-1: DESIGN PARAMETERS FOR EMBANKMENT FILL THICKNESS		
Terrain Type	Terrain Description	Embankment Fill Thickness
1	Dry (Ice-poor) Till & Outwash Deposits (relatively dry, stable, upland till and outwash deposits, overlain by a thin organic cover)	1.4 m
2	Wet (Ice-medium to Ice-rich) Till & Outwash Deposits (relatively wet, with some expression of ice-rich permafrost conditions, overlain by a thin to moderate organic cover)	1.4 m - 1.6 m
3	Wet Silts & Clays (Ice-rich) (lacustrine, silt and clay, deposits with distinct expressions of ice-rich permafrost conditions, moderate organic cover)	1.6 m - 1.8 m
4	Thick Organic Peatlands & Ice-Rich Permafrost	1.8 m

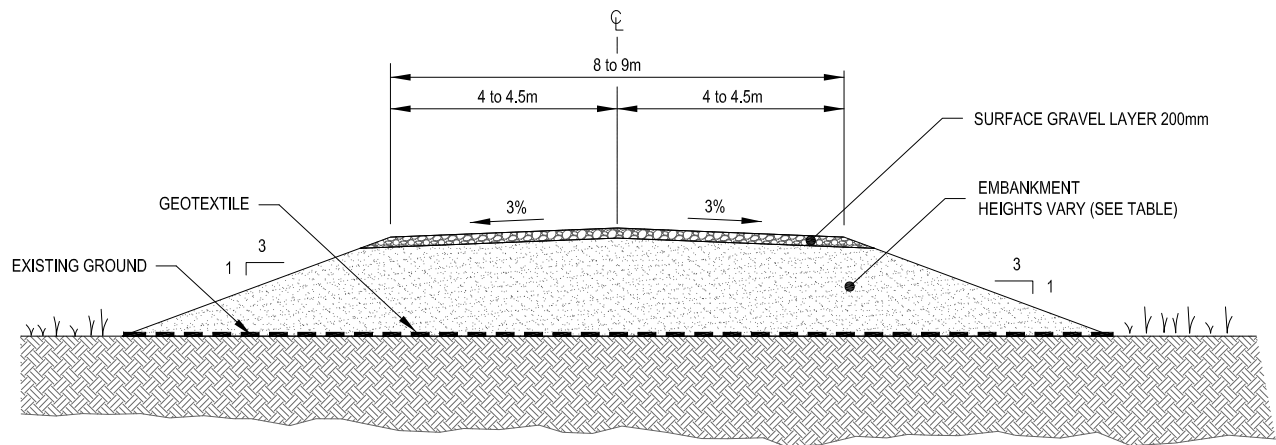
5.3.2 Geometric Design

Taking into account the operational needs for the Highway, desired and minimum geometric design parameters have been developed based on appropriate guidelines for public highways in the Northwest Territories. These parameters are presented in Table 5.3-2 and Figure 5.3-1 illustrates the design parameters in a typical highway cross

section. The figure shows geotextile between the existing ground and the embankment. This is a feature that will be included along the entire alignment.

TABLE 5.3-2: 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



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

TYPICAL HIGHWAY CROSS SECTION

PROJECTION

DATUM

Scale 1:150

1 0 1 3m

FILE NO.

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PROJECT NO.

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DATE

DECEMBER 14, 2009

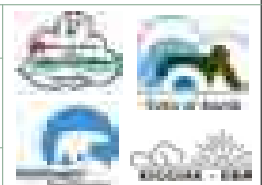


Figure 5.3-1

5.3.3 Stream Crossing Design Considerations

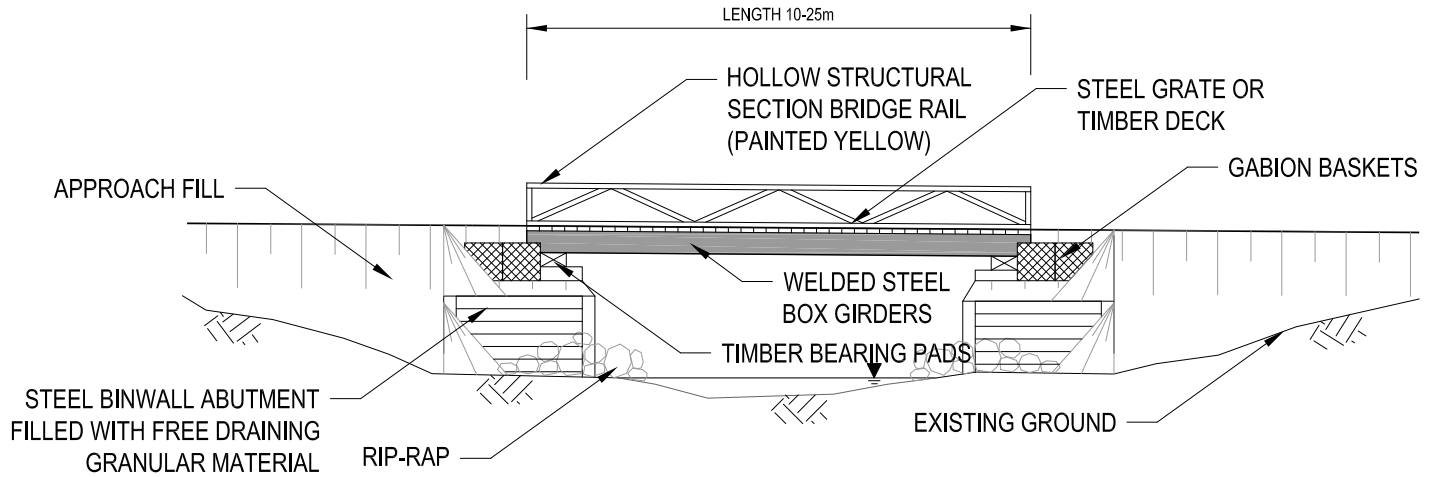
The preferred 2009 Route crosses many minor diffuse drainage paths and many are ephemeral (dry) for most of the year. Defined but still minor stream crossings that do not comprise fish habitat will be accommodated using culverts. In the case of known or potential fish-bearing streams, simple prefabricated bridges will be considered. The specific locations and bridge spans are discussed in a later section which introduces the preferred alignment.

The concept for culvert installation is similar to that currently being used on the Tuktoyaktuk to Source 177 access road. Culverts of appropriate size are laid in place with little disturbance to the existing ground, at locations where drainage paths have been identified in the detailed design. Fill material is placed around and over the culverts in the continuation of the construction. In some cases, multiple smaller diameter culverts may be used instead of single large diameter to avoid having to cut into the existing ground to maintain the vertical grade or creating a crest curve in the roadway where the embankment is constructed over the culvert. Appropriate culvert sizing and location will be confirmed in the detailed design stages of the work.

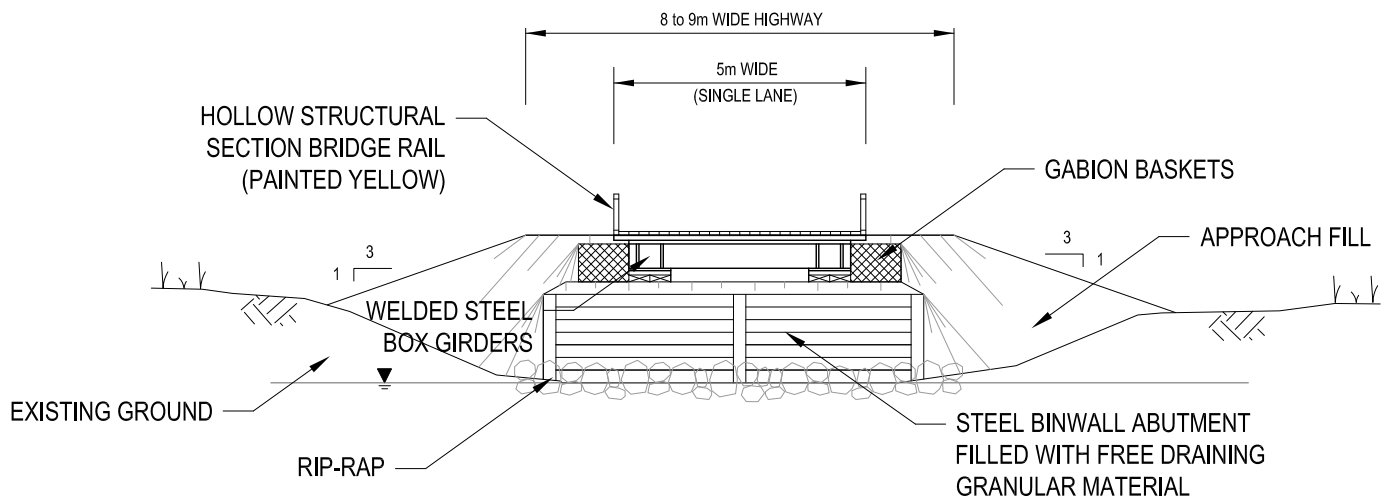
The concept for the bridges, ranging from 10 to 25 m in length, is illustrated in Figure 5.3-2 and Photo 5.3-3.



Photo 5.3-3
Single span, prefabricated bridge on gravel filled binwall abutments.



BRIDGE ELEVATION



ABUTMENT ELEVATION

LEGEND

PROPOSED INUVIK - TUKTOYAKTUK HIGHWAY

GENERAL ARRANGEMENT
PRE-FABRICATED STEEL BOX GIRDER BRIDGE

PROJECTION		DATUM			
Scale: NTS					
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PROJECT NO. V23201098		DWN SM	CKD RM	REV 0	Figure 5.3-2
OFFICE EBA-VANC		DATE DECEMBER 15, 2009			

Figure 5.3-2

Such bridges are used extensively throughout the Northwest Territories and Nunavut for both permanent and temporary installation.

The bridge concept includes:

- Single lane bridge (5 to 6 m wide);
- Prefabricated welded steel box girder with timber or steel grade deck;
- Placed on timber bearing pads on gravel filled corrugated steel binwall abutments;
- Shipped by road to Inuvik or by barge to Inuvik or Tuktoyaktuk then transported by truck or even dragged (on skids) to site;
- Installed using typical construction equipment and local labour; and
- Spans stream width but for some crossings may encroach on wetted width (to minimize length) with approach fill construction.

Section 10.6 of this Project Description Report discusses the fish and fish habitat issues that have and will continue to be considered to ensure that the appropriate stream crossing structures are selected for each of the streams to be crossed by the Highway.

To minimize risk of travel over single lane bridges, site selection and approach grades will be managed to assure appropriate site distance requirements.

5.4 COMPARISON OF ALIGNMENT OPTIONS

The following comparison of options was based on the conceptual designs for the alignments. The quantity and cost estimates are summarized and presented in Table 5.4-1.

The quantities are estimated design volumes based on conceptual design without factors for bulking or shrinkage. The quantities are estimated for construction of the new Highway alignment and the upgrade of the Tuktoyaktuk to Source 177 Access Road to the Highway design. Estimated Capital Construction Costs presented in the table for each alignment option include:

- Pit development, material production and load, haul, place, compact and grade embankment and surfacing gravel materials;
- Supply and place non-woven geotextile between the embankment and natural ground, along the entire alignment;
- Fabricate and install pre-fabricated bridge structures ranging from 10 to 25 m in length on gravel-filled steel binwall abutments;
- Supply and install culverts at defined stream crossings (non fish bearing), ephemeral streams and at frequent locations to balance seasonal surface flows;
- Mobilization;

- Contingency; and
- Engineering (including preliminary survey, detailed geotechnical investigation, environmental studies, detailed design, and construction administration.

Proportional and unit rates for individual items are based on experience, engineering judgment, published industry guidelines, and historical costs for similar construction projects in northern Canada. Rates for mobilization, contingency and engineering are as follows:

- Mobilization is 10% of construction costs not including contingency;
- Contingency is 20% of construction costs (including mobilization); and
- Engineering (as described above) is 4.6% of construction costs including contingency.

The Estimated Capital Construction Costs shown do not include royalties or administrative fees associated with materials borrowed from sources that are on Inuvialuit owned lands. This is discussed in a section below.

TABLE 5.4-1: SUMMARY OF QUANTITY AND COST ESTIMATES FOR ALIGNMENTS CONSIDERED

Element	2009 Route (with encroachment on Husky Lakes Setback)	2009 Route (with realignment to meet Husky Lakes Setback)	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 (See description above)	\$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 constructability and cost analysis conducted favour the 2009 Route. The encroachment on the Husky Lake setback area represents a road length of less than 2 km. The other two options presented above were compared to the 2009 Route base case.

The additional cost to undertake the Minor Realignment to accommodate the Husky Lakes setback requirements is approximately 5 to 6% (\$12 million) of the overall project cost. To avoid the Husky Lakes setback the realignment adds 5 km in total highway length.

The Upland Route meets the Husky Lakes setback requirements, results in a 4 km reduction highway length and an increase of approximately 16 to 17% (\$37 million) in the overall project cost.

5.4.1 Identification of Preferred Alignment

The constructability and cost analysis conducted for this Project Description Report favours the 2009 Route (with encroachment on Husky Lakes Setback) as shown in the table above. The encroachment on the Husky Lake setback area is for a road length of less than 2 km.

Of the three options considered, the preferred 2009 Route (with encroachment on Husky Lakes Setback) is not the shortest route, but it requires the least material and is estimated at a lower cost to construct. From a strictly technical perspective, the 2009 Route (with encroachment on Husky Lakes Setback) is also a stronger option for meeting several key transportation criteria. These criteria include more accessible borrow sources, a reduced project footprint, a reduced environmental impact as a result of lower embankment heights and lesser volumes of materials, and easier operations and maintenance.

In reality, scientific and economic factors are only part of a development decision. The technical teams who assessed the options maintained an awareness of the values held by the community about Husky Lakes, as described in Sections 7.4 and 7.5. These values and interests were discussed in the October 2009 and January 2010 consultation meetings. Those that were brought forward for consideration are summarized in Section 8.0 and Appendix A. 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 project.

The Highway proponents have reviewed the previous project studies, the 2009-2010 assessment, the current opportunity to fund and construct the Highway, and the community views presented during the October 2009 and January 2010 consultation proceedings. After reviewing these factors, the 2009 Route (with encroachment on Husky Lakes Setback) was selected as the preferred alignment. The next sections of this Project Description Report describe the preferred alignment in greater detail.

5.5 TERRAIN CONDITIONS ALONG PREFERRED ALIGNMENT

Terrain conditions observed along the preferred alignment, beginning at the north end of Navy Road (KM 0) and traveling north to Source 177 (KM 118) are described in Table 5.5-1 below. A detailed discussion of the surficial geology landforms is presented in Section 9.2.2. Construction of the access road from Tuktoyaktuk to Source 177 commenced in 2009 and is ongoing.

TABLE 5.5-1: TERRAIN CONDITIONS ALONG PREFERRED ALIGNMENT

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 requiring 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.
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.
34	39	The alignment continues along a section of irregular, hummocky ground on a morainal blanket for about 1 km, then from KM 35 to KM 38 the route crosses a relatively smooth moraine veneer, before thickening again and approaching the first significant creek 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 pingos are developing in the area.

TABLE 5.5-1: TERRAIN CONDITIONS ALONG PREFERRED ALIGNMENT

Kilometre		Description of Terrain Conditions
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 deposits lain down during high water phases of Husky Lakes or 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 polygonal terrain is common.
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	138	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.

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. Fill thicknesses are typically greatest over lacustrine sediments and

thick organic terrain. 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 to 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 of small volume, and are mostly unmapped, so they should not be relied upon as significant material sources.

5.6 KEY HIGHWAY GEOTECHNICAL ISSUES

5.6.1 Permafrost

Permafrost occurs throughout the Project area. Melting of 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, retrogressive 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 and can result in significant thaw settlement and instability.

5.6.2 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 route for both the PWC 1977 route and the 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.

5.6.2.1 Polygons

Polygons are recognizable as a type of patterned ground found primarily in low-lying poorly drained areas (i.e. drained lakebeds). These features are commonly classified as high or low centered. Low centered polygons consist of central flat terrain enclosed by relatively dry ridges. During the winter, water that has filled the cracks in the ice wedges cracks in the ice wedges. In this manner ice wedges grow progressively. 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.

5.6.2.2 Thick Organics (Peatland)

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 on the other hand support nutrient rich waters that originate from mineral soil. Thick organic terrain identified during the field reconnaissance and from orthophotos has been avoided.

5.6.2.3 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 if not cautious. As ground ice thaws and the resulting water can not drain away and contributes to further degradation of the permafrost, the result is the creation of small ponds and lakes, expressing in the numerous kettle lake topography seen 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. Ice content is generally high in these fine-grained, organic materials. These areas often exhibit thermokarst subsidence with erosion along ice wedge cracks and pingos are commonly associated with this environment. These areas have been avoided when possible.

5.6.2.4 Retrogressive Thaw Flow Slides

These are characterized by unique 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 is reduced by purposely routing away from existing slides and steeper slopes that would be susceptible to failure.

5.6.2.5 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 Delta Area. Several particularly 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.

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. Particularly careful design and construction will be undertaken in these areas.

5.7 DETAILED QUANTITY ESTIMATES FOR THE PREFERRED ALIGNMENT

Quantity estimates have been developed for the 2009 Route based on the conceptual design. The estimated fill quantities by topography and terrain are presented in Table 5.7-1.

TABLE 5.7-1: 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 Highway

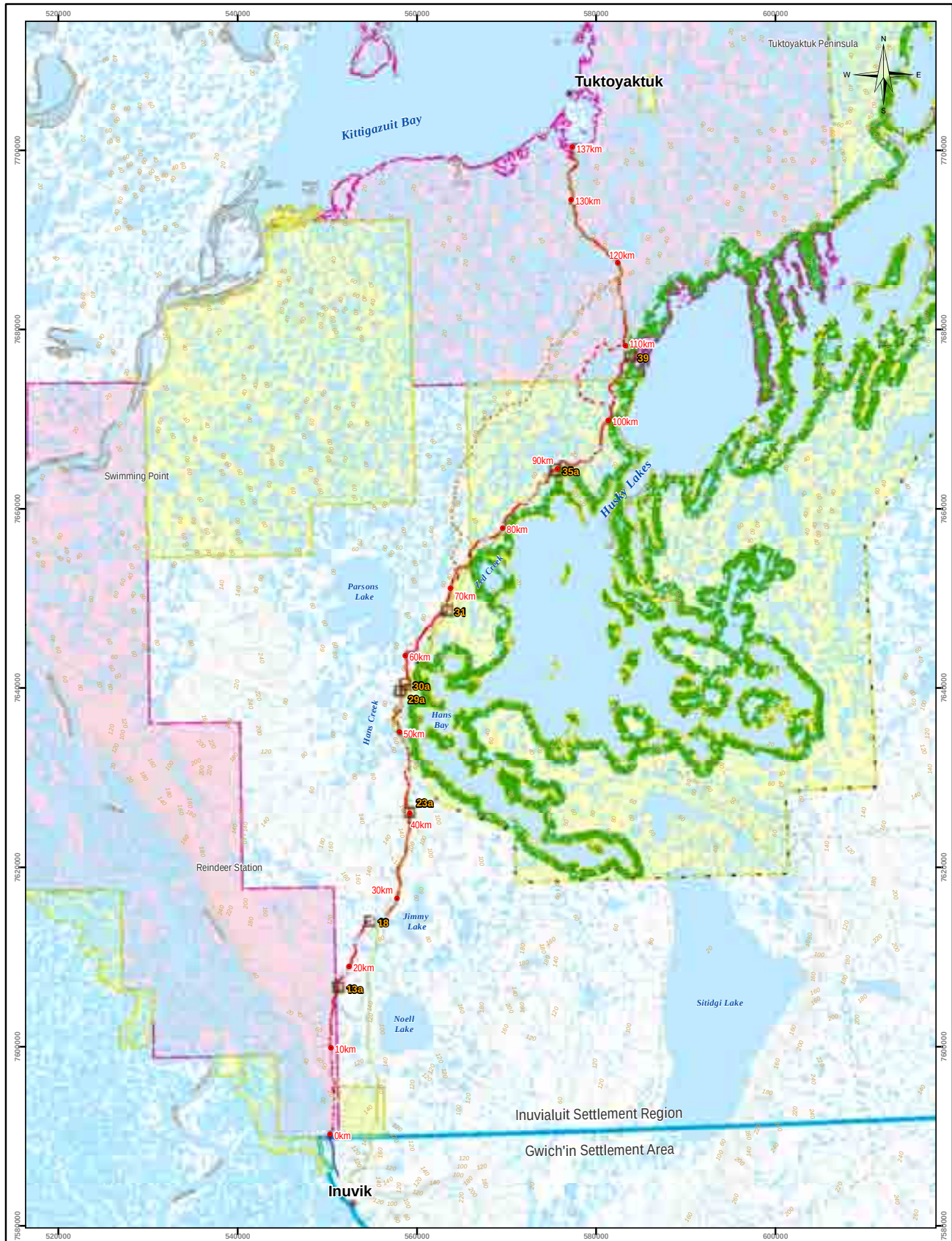
There are many stream crossings identified along the 2009 Route. It is anticipated that most will be served by culverts and select locations will be crossed using bridges. At the time of Project Description Report preparation, and prior to summer 2010 field surveys,

eight locations have been identified as potential bridge crossings. This is based on the preliminary field investigation completed in September 2009 and the conceptual design completed to date. The specific design of drainage structure (i.e., bridge or culverts) will be confirmed in the next steps of field investigation and detailed design.

The estimated lengths for the eight potential bridge crossings are presented in Table 5.7-2, and locations are illustrated in Figure 5.7-1.

TABLE 5.7-2: 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 are required at many locations along the 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. 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.



LEGEND

- Stream Crossing
- Stream Crossing - Potential Bridge

- 2009 Route
- Other Alignments
- Considered
- Upland Route
- PWC 1977
- Navy Road

- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary

- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

NOTES

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

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Potential Bridge Locations

PROJECTION UTM Zone 8		DATUM NAD83		 	
Scale: 1:400,000					
					
FILE NO. V23201098_PDR-Map026-BridgeX.mxd					
PROJECT NO. V23201098		DWN KWM	CKD DM	REV 0	 
OFFICE EBA-VANC		DATE January 18, 2010			

Figure 5.7-1

Figure 5.7-1

ISSUED FOR USE

5.8 BORROW SOURCES

5.8.1 General Information on Borrow Sources in the Area

The early work in the investigation and evaluation of granular material resources in the Mackenzie Delta Region was carried out by Roger Brown and Hank Johnston of the National Research Council (NRC) during the planning, development and construction of the new town of Inuvik and its related infrastructure in the 1950s (Fujino 1993).

Beginning in the 1960s, generic sources of granular materials were identified in the Mackenzie Delta Region as part of the surficial geology and terrain mapping activities by the Geological Survey of Canada (GSC). This mapping work served as a foundation for future studies and investigations for granular materials conducted by industry and government agencies. The most recent surficial geology mapping of the project study area, and the one used to perform this work, was prepared by Rampton (1987).

In the 1970s and early 1980s, numerous, extensive granular material investigations were undertaken by private industry resource development groups and government agencies, primarily under the direction of the Department of Indian and Northern Affairs (DIAND). Many industry groups had significant interests in the development of energy resources in the Mackenzie Delta Region with parallel demands for granular materials.

Granular material investigations carried out by Ripley Klohn Leonoff International Ltd. (RKL) in 1972-73 for INAC has served as a comprehensive data base for more recent granular material investigations by numerous groups. Subsequent investigations by EBA Engineering Consultants Ltd., Hardy Associates (1978) Ltd., Terrain Analysis and Associates Ltd., Northern Engineering Services Ltd., Public Works Canada, and Hardy BBT have provided further ground-truthing and confirmation of selected granular material sources and quarry sites in the Mackenzie Delta Region.

During the 1980s and early 1990s, the focus of the various studies and investigations of granular materials was directed to issues dealing with aboriginal land claims. In this regard, the work in the Mackenzie Delta Region was primarily directed to the Inuvialuit Final Agreement (IFA). The granular materials inventory work completed by EBA Engineering Ltd. (EBA) in 1987 for Indian and Northern Affairs Canada (INAC) formed part of the Inuvialuit Final Agreement (IFA). The comprehensive granular materials inventory was assembled for resources within the Inuvialuit Settlement Region (ISR) using the available information collected over the years.

Under the Inuvialuit Final Agreement (IFA), signed between the Government of Canada and the Inuvialuit in 1984, ownership of most of the accessible granular deposits in the Western Arctic Region was transferred to the Inuvialuit (IRC 1987). Management of this resource is now the responsibility of the Inuvialuit Land Administration (ILA) in consultation with local groups such as the Community Corporations and Hunters and Trappers Committees. Several studies of granular resources in the Inuvialuit Settlement

Region have been conducted over the years to refine the database/inventory of the resource.

The comprehensive inventory of granular materials for the Inuvialuit Settlement Region (ISR) was provided to the Project Team by the ILA. The inventory includes granular resources in the settlement region including areas outside of the Project area and the Mackenzie Delta Region. The material sources within proximity to the Project area are summarized in figures and tables herein and form the basis of the borrow areas identified for construction of the proposed Highway.

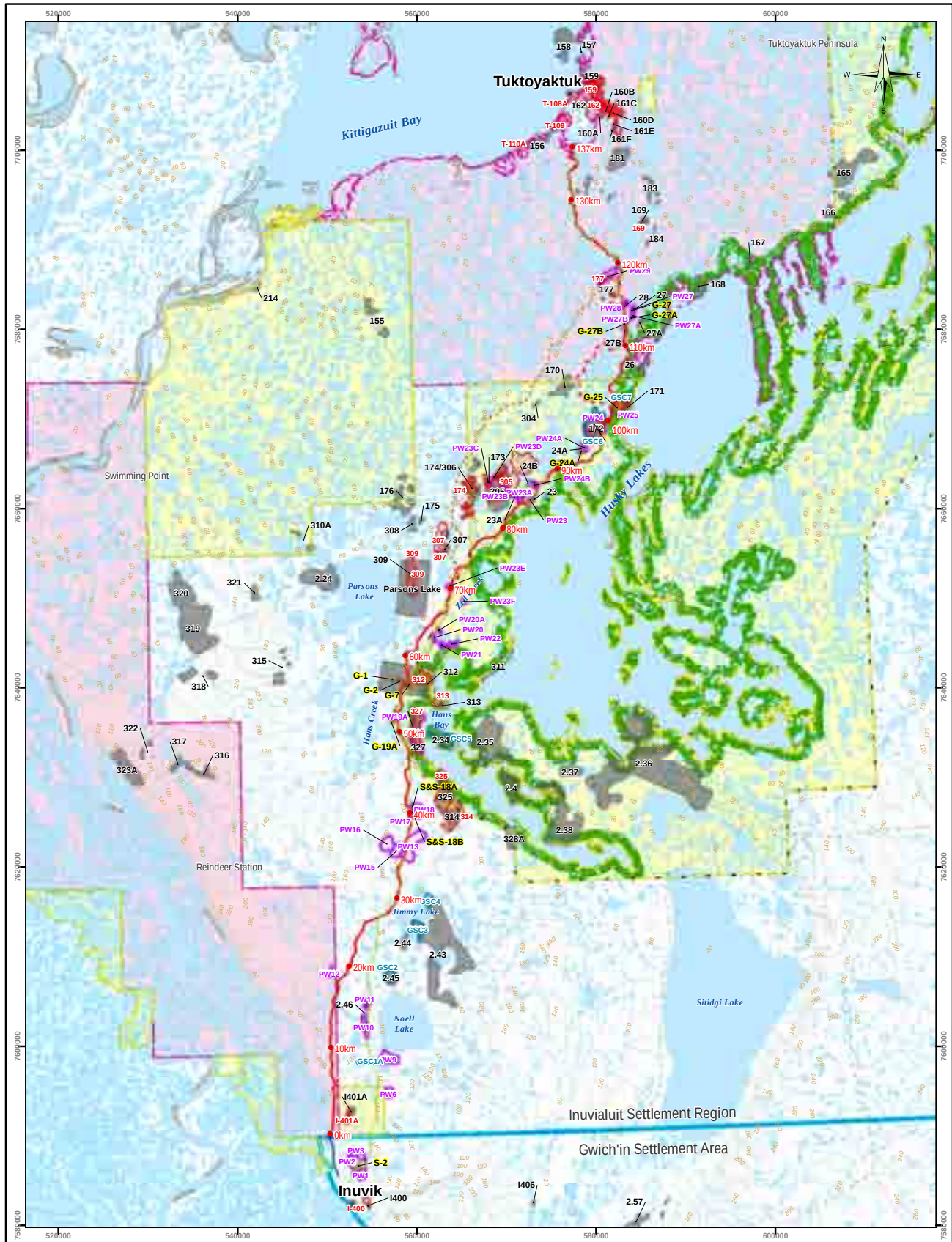
5.8.2 Available Information on Borrow Sources in the Area

Figure 5.8-1 shows all known borrow sources in the general area between Inuvik and Tuktoyaktuk.

Many of the borrow sources listed below were identified by PWC between 1976 and 1980 specifically along the 2009 Route and could be selected as potential borrow areas for constructing a Highway along the current preferred alignment. These borrow sources were previously assessed by PWC (1981a; 1981b) and were deemed to be suitable and available. The materials identified for embankment construction were judged to be of generally fair to poor quality. Most of the materials contain high ice content that might be above the liquid limit of the soil, and could require select harvesting to obtain the best available material for use in construction. Thirty years later, these sources have not been further investigated. Except for a few sources in close proximity to Husky Lakes (which are not available for use), the borrow sources identified by PWC are assumed to still be acceptable.

The 2009 field program did not include further examination of the proposed borrow source areas that PWC had identified, but fly-overs were completed to confirm that the areas appeared to be viable borrow sources.

Table 5.8-1 summarizes available information on borrow sources along the proposed 2009 Route.



LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road

- INAC Borrow Sources
- Geological Survey Borrow Sources
- Public Works Borrow Sources
- Highway Borrow Sources
- Borrow Sources

- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary

- Trail
- Contour
- Watercourse
- Sand
- Wetland
- Waterbody
- Husky Lakes 1000m Setback

NOTES

Base data source: NTS 1:250,000
Borrow Source: ILA, Public Works, GSC, INAC

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Available and Potential Borrow Sources Along the Proposed Route

PROJECTION UTM Zone 8	DATUM NAD83	
Scale: 1:400,000		
5 2.5 0 5 10 Kilometres		
FILE NO. V23201098_PDR-Map019-Dev-AllGranular.mxd		
PROJECT NO. V23201098	DWN KWM	CKD XXX
OFFICE EBA-VANC	DATE January 14, 2010	REV 0

Figure 5.8-1

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TABLE 5.8-1: INFORMATION ON BORROW SOURCES ALONG 2009 ROUTE						
Source Name	Land Owner	Location	Geo-morphologic Setting	Landform	Approximate Area (km ²)	Recoverable Volume (m ³) from ILA Inventory
2.43	Crown	28 km NE of Inuvik	Unknown	Outwash plain	12	180,000,000
2.44	Crown	30 km NE of Inuvik	Unknown	Glaciofluvial outwash	0.17	0
2.45	Crown	25 km NE of Inuvik	Unknown	Glaciofluvial outwash	2	0
2.46	Crown	20 km NE of Inuvik	Unknown	Kames/crevasse filling	0.0125	0
I401A	Crown	10 km N of Inuvik	Hillblocks bisected by streams	Kame field	1.1	1,020,000
170	Inuvialuit	32 km S of Tuktoyaktuk	Hummocky, thermokarst	Glaciofluvial outwash plain	2	4,580,000
171	Inuvialuit	35 km S of Tuktoyaktuk	Hummocky, near Husky Lake	Glaciofluvial outwash/kames	2	1,520,000
172	Inuvialuit	37 km S of Tuktoyaktuk	Hummocky, near Husky Lake	Glaciofluvial outwash/kames	2	918,000
173	Inuvialuit	45 km S of Tuktoyaktuk	Hummocky plain	Kame complex	2	688,000
174	Inuvialuit	48 km S of Tuktoyaktuk	Hummocky, rough terrain	Kame complex/outwash	2	3,280,000
175	Inuvialuit	50 km SW of Tuktoyaktuk	Hummocky, rolling terrain	Glaciofluvial outwash	1	1,530,000
176	Inuvialuit	50 km SW of Tuktoyaktuk	Thermokarst plain	Glaciofluvial outwash plain	2	6,100,000
177	Inuvialuit	22 km S of Tuktoyaktuk	Hummocky thermokarst plain	Glaciofluvial outwash	1	1,902,000
23	Inuvialuit	42 km S of Tuktoyaktuk	Hummocky plain	Kames, outwash plain	0.115	350,000
23A	Inuvialuit	42 km S of Tuktoyaktuk	Hummocky plain	Kame field	1.2	1,900,000
24A	Inuvialuit	37 km S of Tuktoyaktuk	Hummocky plain	Kames, outwash plain	0.72	150,000
27	Inuvialuit	42 km S of Tuktoyaktuk	Flat plain, polygonal	Glaciofluvial outwash	0.225	40,000
27A	Inuvialuit	24 km S of Tuktoyaktuk	Flat plain, polygonal	Glaciofluvial outwash	0.18	190,000

TABLE 5.8-1: INFORMATION ON BORROW SOURCES ALONG 2009 ROUTE

Source Name	Land Owner	Location	Geo-morphologic Setting	Landform	Approximate Area (km ²)	Recoverable Volume (m ³) from ILA Inventory
27B	Inuvialuit	24 km S of Tuktoyaktuk	Flat plain, polygonal	Glaciofluvial outwash	0.23	40,000
304	Crown	35 km S of Tuktoyaktuk	Thermokarst plain	Esker remnants	0.018	46,000
305	Inuvialuit	42 km S of Tuktoyaktuk	Hummocky with many ponds	Kames on outwash plain	20	230,000
306	Inuvialuit	42 km S of Tuktoyaktuk	Thermokarst plain	Kame field	11.5	115,000
307	Crown	55 km S of Tuktoyaktuk	Hillocks, small ponds	Kame field	5	115,000
308	Crown	50 km S of Tuktoyaktuk	Outwash plain	Terrace remnants and kames	0.55	15,000
309	Crown	56 km S of Tuktoyaktuk	Ponds, low lying	Kame field	7.5	1,500,000
314	Inuvialuit	79 km S of Tuktoyaktuk	Terrace adjacent to stream	Post-glacial fluvial terraces	1.1	2,300,000
325	Inuvialuit	76 km S of Tuktoyaktuk	Lake shore deposit	Glaciofluvial terrace	7.5	750,000
Parsons Lake 1	Inuvialuit	60 km S of Tuktoyaktuk	Riverbanks	River terrace	0.25	1,000,000
Parsons Lake 10	Inuvialuit	60 km S of Tuktoyaktuk	Low lying plain	Kame/outwash plain	0.02	135,000
Parsons Lake 2	Inuvialuit	60 km S of Tuktoyaktuk	Low terrace	River terrace	0.1	230,000
Parsons Lake 3	Inuvialuit	60 km S of Tuktoyaktuk	Low lying terrace	River terrace	0.2	400,000
Parsons Lake 4	Inuvialuit	60 km S of Tuktoyaktuk	Flat lying terrace	River terrace	0.05	150,000
Parsons Lake 5	Inuvialuit	60 km from Tuktoyaktuk	Lake shoreline	Small kame	0.0225	30,000
Parsons Lake 6	Inuvialuit	60 km S of Tuktoyaktuk	Lake shoreline	Small kame	0.03	7,500
Parsons Lake 7	Inuvialuit	60 km S of Tuktoyaktuk	Flat lying terrace	River terrace	0.28	20,000
Parsons Lake 8	Inuvialuit	60 km S of Tuktoyaktuk	Flat-lying terrace	River terrace	0.7	75,000
Parsons Lake 9	Inuvialuit	60 km S of Tuktoyaktuk	High river terrace	River terrace	0.045	38,000

5.8.3 Borrow Material Requirements

These preliminary material volume estimates are based on preliminary horizontal and vertical geometric designs using the embankment cross section presented in Figure 5.3-1.

Figure 5.8-1 shows all known potential borrow sources in the general area between Inuvik and Tuktoyaktuk. Many sources that are not near the preferred alignment will not be considered for use in the construction as they are inefficient to haul from due to the distance that they are away from the alignment. Borrow sources proposed for construction of the Highway are highlighted in Figure 5.8-2 and estimated quantities from each source based on the conceptual design are presented in Table 5.8-2.

TABLE 5.8-2: ESTIMATED QUANTITIES FROM POTENTIAL BORROW SOURCES

Highway Segment	Estimated Borrow Quantity (rounded to nearest 1,000 m ³)	Potential Borrow Source (Land Owner)
KM 0 - KM 5	198,000	I401A (Crown)
KM 5 - KM 10	198,000	2.46 (Crown)
KM 10 - KM 21	351,000	2.45 (Crown)
KM 21 - KM 34	351,000	2.43 (Crown)
KM 34 - KM 45	329,000	325 Outside of Husky Lakes Setback (Crown)
KM 45 - KM 56	445,000	Parsons Lake - West of alignment only (Crown)
KM 56 - KM 69	671,000	309 (Crown)
KM 69 - KM 83	516,000	307 (Crown)
KM 83 - KM 100	563,000	173/305 and 174/306 (Inuvialuit)
KM 100 - KM 112	363,000	172 and 170 (Inuvialuit)
KM 112 - KM 118	244,000	27B (Inuvialuit)
KM 118 - KM 137 (Tuktoyaktuk)	510,000	177 (Inuvialuit)

Sources of competent borrow materials that can be used at in-situ ice contents are limited along the alignments and as a whole throughout the project area.

The project area has been extensively studied over the years and the likelihood of locating additional sources of quality granular material near the alignment is considered to be limited. Efforts will be undertaken in early 2010 to collect additional information, qualitative and quantitative, from the known borrow areas to confirm material volumes and quality and importantly ground ice conditions to confirm that the material can be used as planned.

The estimated construction costs presented earlier, in this section of the Project Description Report, do not include royalties or administrative fees paid on materials extracted from borrow sources on Inuvialuit owned lands.

Ongoing discussions regarding Inuvialuit owned lands will include discussion of royalties and administrative fees.

5.8.4 Further Investigation of Borrow Sources

Borrow sources are required to provide materials needed to construct the proposed Highway. The sources would be developed during the winter months when the ground is frozen. Temporary winter access roads and work pads would be used. Drill and blast methods may be used to excavate the required volumes of material for construction from frozen borrow sources.

Potential borrow sources have been identified along the 2009 Route based on the granular material studies and investigations that have been undertaken over the years by industry and government agencies discussed in the previous Section.

The resources near the communities of Inuvik and Tuktoyaktuk have been ground-truthed and proven to a spatial extent. Many of the resources along the 2009 Route are not proven and are described as probable or prospective - material resources whose existence and extent have been inferred or speculated. The use of these materials will need to be proved up through additional site investigation (Figure 5.8-2).

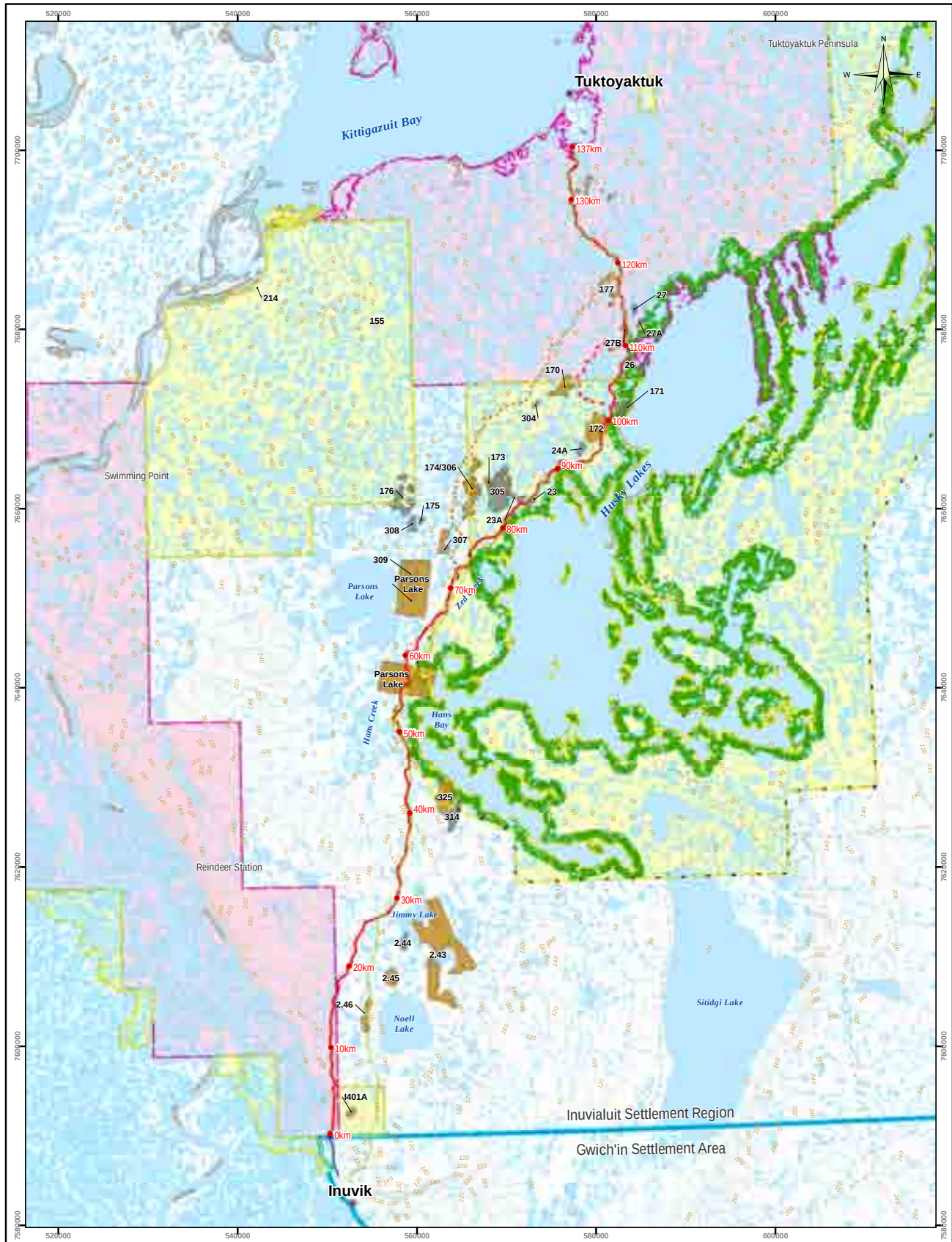
The 2009 Route is preferred because the flatter topography will result in less terrain disturbance and reduced borrow material volumes, thereby also reducing construction costs. Also, more borrow sources are identified along the 2009 alignment than have been identified elsewhere.

5.8.5 Site Evaluation Criteria

Criteria used to identify borrow sources included the following:

- Proximity to the proposed alignment
- Quantity, quality and availability of borrow materials required
- Geographic distribution of sites
- Environmental considerations
- Supply needs along route
- Potential to expand and supply project needs

Prior to opening a borrow pit, the sites will be surveyed and investigated to ensure the expected quantity and quality of material is available. Borrow pits will be developed, operated and decommissioned in full compliance with all regulatory requirements.



LEGEND

- 2009 Route
- - Other Alignments Considered
- - Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- - Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes
- 1000m Setback
- Borrow Sources
- Borrow Sources - (further investigation and potential use in construction)

NOTES

Base data source: NTS 1:250,000
Borrow Sources: Inuvialuit Land Administration

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Potential Borrow Sources Requiring Further Investigation For Potential Use

PROJECTION UTM Zone 8		DATUM NAD83		 
Scale: 1:400,000 				
FILE NO. V23201098_PDR-Map020-Dev-GranInvest.mxd				
PROJECT NO. V23201098	DWN KWM	CHK RM	REV 4	
OFFICE EBA-VANC	DATE January 19, 2010			 

Figure 5.8-2

Figure 5.8-2

ISSUED FOR USE

5.8.6 Pit Development Plans

Pit Development Plans will conform to the applicable regulatory guidelines. Plan content will include documentation of site conditions (including estimated resource quantity, quality and ice content), source and temporary access road design, a description of the development approach, a map, mitigation measures to address potential environmental concerns, and operational and reclamation plans.

Proposed borrow sources will typically be developed during the fall and winter months when the ground is frozen. Winter pit development will employ drilling and blasting, if required. The decision to use these methods will depend on the quality and moisture content of the granular material in the source and the quantity of material needed from the source. Drilling patterns and powder factors will be adjusted as required to optimize the size of blasted material being produced.

Borrow pits will be closed as soon as they are no longer required and reclaimed in a progressive manner as soon as possible. Areas required for the maintenance of the Highway during operation will remain open while in use, and will be reclaimed after they are no longer required.. The disturbed areas will be contoured, at closure. Borrow pits will be designed to prevent entrapment of wildlife at closure. These details will be identified in the specific Pit Development Plans.

5.8.7 Winter Access Roads

Temporary winter access roads will be constructed to access borrow sources since most of the earth moving construction activities will take place during the winter months when the frozen ground is more accessible. Winter access roads are constructed according to methods developed over the years designed to provide a solid, effective road access while at the same time minimizing environmental disturbance to the ground surface. First the access route is dragged with a long ground pressure rubber tracked machine such as a snow cat. After dragging, an initial flood of the surface with water is undertaken using a low pressure rubber tired vehicle such as a Delta 3 with a mounted water tank. After the surface is made passable, water trucks are used to flood the access. Snow is moved into holes and depressions as required with either a loader or with small dump trucks. The snow and water is mixed together. Several layers of the snow/water mixture are applied to the surface. The surface is continually dragged with either a loader or low ground pressure tracked machine. Through the application of successive layers of snow and ice the winter road is constructed. The final product is basically an ice road of sufficient thickness, built over land to prevent damage to the underlying tundra.

5.9 CONSTRUCTION

5.9.1 Winter Approach to Construction

A fundamental tenet of the construction methodology is to utilize winter construction techniques rather than more typical summer construction as used in southern Canada.

Advantages of Winter Construction

- Winter construction allows the use of temporary ice/winter access to borrow sources, without the need to construct costly all-weather access roads.
- Winter construction allows the placement of construction material directly onto frozen ground. This approach enables the establishment of a frozen core for the Highway and helps protect sensitive and ice-rich terrain.
- Winter construction minimizes potential effects on vegetation and soils adjacent to the actual roadway that might occur if working under snow-free or wet conditions.
- Winter construction promotes initial Highway stability through the placement of frozen borrow material directly onto frozen ground (with geotextile separation layer). In the first construction year, it is anticipated that the majority of construction settlements will occur in the top layers of the emplaced borrow material as it thaws, dries and consolidates. The lower layers are not expected to thaw much if at all in the first years, leading to greater Highway stability than has been the case with the placement of warm fill on thawed ground in summer construction in this area. This will reduce maintenance problems in the future.

Disadvantages of Winter Construction

- Work is difficult, with temperatures of -35°C or colder common at the beginning of construction in late December and early January. This is challenging for both personnel and equipment.
- At the start of construction in February, there is little daylight, as we are just past the 24 hrs of darkness period in late December.
- Excavating frozen material may require the use of drill and blast methods to be able to source the required volumes of material for construction from existing largely frozen borrow sources.
- Excavating and placing frozen material directly on the existing surface makes it more difficult to achieve desired compaction of the embankment layers.
- There is a shorter construction season from approximately late December to the beginning of May.

5.9.2 Construction Overview

The Tuktoyaktuk to Source 177 Access Road, currently under construction, presents a model for how the remainder of the Highway is anticipated to be constructed.

The Tuktoyaktuk to Source 177 Access Road construction schedule proceeded as follows:

- Early February: Mobilization of pioneer crew and initial winter access road construction to Source 177.
- Mid February: Mobilization to Source 177 of surveyors and drillers. If blasting is required, initial blast layout will be staked and drilling will commence.
- Surveyors then stake the initial several kilometres of the Highway and a temporary winter access road is constructed paralleling the permanent alignment.
- Late February: Construction of the Highway begins. Geotextile is placed from toe to toe of embankment and material is directly dumped and spread on the geotextile. An initial lift of approximately 300 mm to 400 mm is placed, followed by smaller lifts, with the embankment being left some 150 to 200 mm higher than design to accommodate settlements.
- Construction proceeds, with surveyors responsible for providing 'ground-truth' original ground surveys back to the design team to allow adjusting of the design to match the actual ground elevations rather than the design remote sensing information.

This is an approach that would be considered reasonable to consider for the construction of the Inuvik to Tuktoyaktuk Highway. The Highway is expected to take two to three years to complete. Further discussion of the segmenting and construction approach is presented in the following sections.

5.9.3 Construction Activities

The aggregate will be placed by end-dumping directly on the existing ground surface without disturbance to the vegetative ground cover.

Construction activities will be limited, to the extent possible, within the planned footprint of the Highway, with the exception of the temporary winter road that parallels the alignment, and temporary winter roads providing access to borrow sources. Prior to the commencement of construction, the route will be surveyed and staked, and temporary winter roads will be constructed to identified borrow sources (Photo 5.9-1). Initially snow cats and small dozers will be used to clear snow from the staked footprint (Photos 5.9-1 and 5.9-2). Dozers used for snow clearing will be equipped with mushroom pads to ensure that the vegetative layer on the right-of-way is not disturbed. After the route is staked, the snow is cleared, and adequate material is stockpiled at the borrow source, the construction activities will commence.

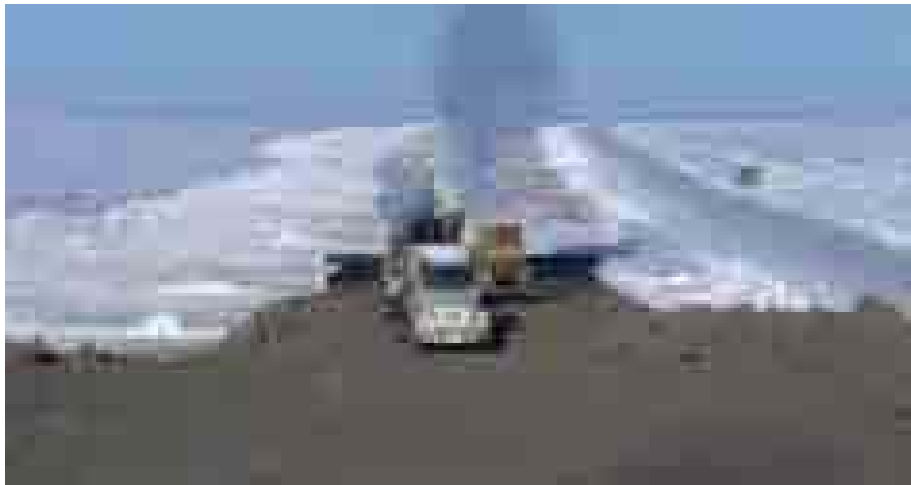


Photo 5.9-1
Example of winter road access constructed parallel to highway alignment
Tuktoyaktuk to Source 177 Access Road, 2009)

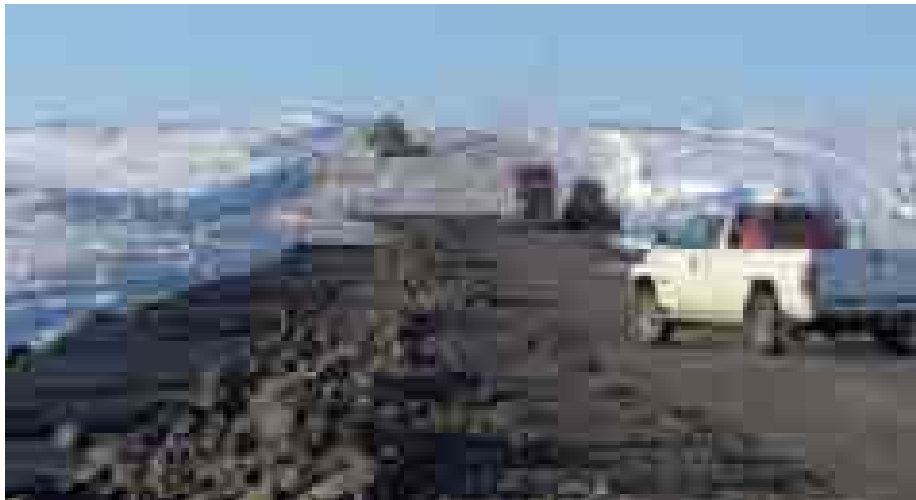


Photo 5.9-2
Winter construction approach, note grader in the distance clearing
snow from embankment footprint. (Tuktoyaktuk to Source 177 Access Road, 2009)

Geotextile will be placed between the existing ground and the embankment (fill) material (Photo 5.9-3). This is a common design technique in permafrost regions to provide additional stability over perennially frozen ground. Workers will spread out rolls of non-woven geotextile onto the cleared Highway footprint ahead of the placement of embankment materials.



Photo 5.9-3
Example of geotextile placement and end dumping method of construction.
(Tuktoyaktuk to Source 177 Access Road, 2009)

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 is placed, followed by smaller lifts, with the embankment being left some 150 to 200 mm higher than design to accommodate settlements.

Culvert and bridge installation will proceed along with construction of the embankment. As the bridge structures will be prefabricated single span bridges on binwall abutments, it is anticipated that access to bridge sites in advance of the embankment construction will not be necessary. Design, ordering and fabrication of bridges will need to be undertaken months in advance of the scheduled installation, to ensure that shipping schedules are achieved, and structures and binwall materials arrive on site in time for installation. Access to opposite sides of stream crossing will be required for ground preparation on binwall assembly prior to the installation of the bridge structure.

This will be accommodated with an ice crossing component of the temporary winter road near the bridge site. Prefabricated bridges structures can be shipped to the individual bridge sites by truck along the constructed embankment or temporary winter road. Bridges will be installed with typical construction equipment that is in general use for the Highway construction. Specialized equipment is not required.

Highway construction and installation of drainage structures will be carried out each year in a similar manner. Final compaction, adjustment of grade due to settlements and placement of surfacing gravel will be undertaken in the year following construction of the embankment.

5.9.4 Production Rate, Construction Staging and Overall Schedule

The proposed construction timing and staging is based on the premise that construction will proceed from both the north (Source 177) and south (Inuvik). Embankment construction will include installation of culverts and bridges. The high level milestones by month and year are:

March/April 2010: Survey control will be extended each way along the route to be able to complete a proper survey to enable detailed design to progress. This would be done using GPS and control points every 5 to 10 km to be within good working range of the base station. After control is established, a survey of the recommended centreline will proceed, as will further geotechnical investigation, and baseline data collection necessary to support detailed design. Detailed design will commence in the spring of 2010, as will design of bridge structures and culvert installations, in preparation for commencement of construction.

August 2010: Position equipment at Source 177 when permitting is in place and continue development of this active borrow source for initial construction requirements.

November/December 2010: Construct winter access and haul roads to borrow sources at both north and south ends of the highway construction. Commence with development of borrow sources and stockpiling of material.

January to April 2011: Construct Highway, moving both northward from Inuvik area and southward from Source 177. Equipment at borrow sources will include drilling/sampling equipment for further geotechnical investigation, drilling/blasting/ excavating equipment for working frozen material, loaders, dozers, water trucks and 15 to 24 person camps. It is anticipated that there will be three to four borrow sources under development and being worked in any given construction period. There are likely to be four construction equipments spreads working in any given construction period, two from the north and two from the south, each with sufficient equipment and personnel to haul and place material at a rate of over 400,000 m³ per season.

June to September 2011: Construction from January to April will ensure that segments of the Highway are connected to either other segments of Highway or the existing all weather access road. This will provide opportunity for grading and compaction of the embankment that was constructed in the earlier winter construction season in the summer months of the same year without the concern of equipment travelling over unfrozen ground.

November 2011 to April 2012: Construction will continue through this fall and winter season in the same manner described above. Additional work will include placing the surfacing gravel on the embankment that was constructed, graded and compacted in the previous year.

June to September 2012: Grading and compaction of embankment constructed in the previous winter.

Fall 2012 and Early Winter 2013: Placement of remaining surfacing gravel on embankment and upgrade of Tuktoyaktuk to Source 177 Access Road.

5.9.5 Anticipated Equipment and Personnel

The equipment proposed for construction of the Highway will be similar to that used on the current Tuktoyaktuk to Source 177 Access Road construction. There will likely be four (4) equipment spreads or operations. Each spread is expected to consist of the following equipment:

- (2) D8T or D9N bulldozers with rippers
- (2) D6R and/ or D6N bulldozers (drop D7G and D6D bulldozers)
- (2) BR-180 or BR-400 snowcats
- (2) EX-300 excavators
- (2) 966 or 950 loaders
- (8) to (12) tractor trucks with end-dump trailers
- (2) 140 or 14 graders
- (2) vibratory self-propelled packers
- (4) water trucks with 3000 g tanks
- (2) Delta 3 all-terrain vehicles with water tanks
- (4) light stands
- (2) to (4) 13,000 litre double walled fuel sloops
- (10) to (14) dump trucks (either tandem trucks or articulated dump trucks)
- (4) to (8) crew cab trucks
- (1) to (2) service trucks
- (1) crew bus
- (2) to (4) snowmobiles

As stated in the equipment estimate, the Highway will be constructed using four (4) spreads, two working at the Tuktoyaktuk end and the other working at the Inuvik end. Table 5.9-1 identifies the personnel estimate per spread. A wide variety of positions will be available, including supervisors, environmental monitors, scouts, clerks, engineers, and a variety of other positions.

TABLE 5.9-1: ESTIMATED PERSONNEL REQUIREMENT PER SPREAD

Activity	Personnel
I. Winter Road Construction	30 to 35
II. Winter Gravel Haul	55 to 65
III. Summer Grade and Compact	10 to 15
IV. Fall/Early Winter Pit Development and Material Production	15 to 20

5.9.6 Winter Access/ Haul Roads

5.9.6.1 Construction

Winter access/haul roads will need to be constructed to access borrow sources since it is expected/planned that most of the earth moving construction activities will take place during the winter months when the frozen ground is more accessible.

5.9.6.2 Water Usage

The overall daily water usage for winter road construction is expected to range from at least 500 m³/day to more than 1,000 m³/day. During the long term operational phase of the Highway, the average daily water usage during the summer is anticipated to be in a similar range. Procedures and mitigative measures for water usage and water extraction are described in later sections of this document.

6.0 PROJECT TIMETABLE

The proposed Project review and approvals schedule and generalized construction schedule for the Highway is provided in Table 6-1.

TABLE 6-1: PROPOSED SCHEDULE OF ACTIVITIES	
Activities	Approximate Dates
Environmental Screening	
Submit Project Description Report for Screening	February 2010
EISC Screening Review Process	March 2010 to April 2010
Partners Presentation to EISC	April 2010
EISC Screening Decision	April 2010
Permits, Licences and Other Approvals	April 2010 to August 2010
Field Investigations and Highway Design	
Undertake engineering and environmental field investigations. Complete detailed design for 50% of alignment	Spring to Fall 2010
Undertake remaining field investigations and detailed design.	Spring to Fall 2011
Highway construction	Spring 2010 to Winter 2013
Construction	
Pre-positioning of equipment at Source 177 Potentially commence construction at Inuvik end	August 2010
Strip and develop initial borrow source(s)	October 2010
Continue work at borrow sources, construct winter access and haul roads	November-December 2010

TABLE 6-1: PROPOSED SCHEDULE OF ACTIVITIES

Activities	Approximate Dates
Transport, spread borrow material, construct road and install bridges and culverts	January-April 2011
Compact and grade Year 1 embankment	June-September 2011
Repeat cycle of construction similar to Year 1	Fall 2011-April 2012
Compact and grade embankment; substantial completion of Highway	June-September 2012
Placement of remaining surfacing material on embankment and upgrade of Tuktoyaktuk to Source 177 Access Road.	Fall 2012- Early Winter 2013

7.0 TRADITIONAL AND OTHER LAND USES

The Tuktoyaktuk Peninsula, the Mackenzie Delta, and the Husky Lakes area have been occupied for several thousand years by the Inuvialuit, with recent in-migration by westerners. There are several areas with traditional land use significance, and areas that are specially managed. Due to the rich natural resources in the area, industrial, transportation, and recreational land uses are prevalent and/or proposed for the future. Amongst the natural resources are wildlife, waterfowl, fish, and berries that continue to be harvested by the Inuvialuit.

Information regarding traditional and other land uses in the area of interest along the proposed alignment of the Inuvik to Tuktoyaktuk Highway has been drawn from a number of sources. In October 2009 and January 2010, consultations and discussions were held with elders, hunters and trappers, and community residents for this project, as described in Section 8.0. In addition, information gathered during the consultation process for the Tuktoyaktuk to Source 177 Access Road Project Description Screening Report (Kiggiak-EBA 2008) was reviewed and incorporated. Further traditional knowledge information was collected from the Proposed Inuvik to Tuktoyaktuk Road Environmental/ Socioeconomic Baseline Report (Rescan 1999). Other key sources of information include the Tuktoyaktuk Community Conservation Plan (TCCP) (Community of Tuktoyaktuk et al. 2000) and the Inuvik Inuvialuit Community Conservation Plan (IICCP) (Community of Inuvik et al. 2000).

7.1 TUKTOYAKTUK PENINSULA

Tuktoyaktuk is located on a peninsula extending into Kugmallit Bay, just east of the Mackenzie River Delta, on the arctic coast. The name in Inuvialuktun means “resembling a caribou”. It was formerly called Port Brabant, and the present name is commonly abbreviated to “Tuk”. Tuktoyaktuk is located 122 km (76 mi.) by air or 177 km (110 mi.) by river north of Inuvik. In 1934, the Hudson’s Bay Company chose this site as an alternative to Herschel Island and as the most suitable harbour in the region for shipping freight down

the Mackenzie River for distribution along the arctic coast (Community of Tuktoyaktuk et al. 2000).

For thousands of years, the Inuvialuit have inhabited the coastline from the United States (Alaska)-Canada border to Cape Bathurst. The primary land use patterns of the Inuvialuit in the Tuktoyaktuk region have centered on the Tuktoyaktuk-Kitigaaryuit area. Prior to 1890, the Inuvialuit had minimal contact with westerners and a traditional harvesting lifestyle was led by all Inuvialuit with very little disturbance. This changed with the arrival of the whaling ships at Herschel Island in 1890.

The influence of the westerners and the spread of various diseases dramatically affected the local population and disrupted previous traditional subsistence patterns. The large settlement at Kitigaaryuit was abandoned just after the turn of the century. The previous local groupings of Inuvialuit became blurred as intermingling of the local Inuvialuit population occurred with whalers and Alaskan Inupiat who had come into the region with the whalers. With the collapse of the whaling economy around 1910, the region suffered a major economic downturn. Many of the westerners who travelled north with the whaling ships remained in the region establishing trading and fur posts.

In the 1920s, high fur prices and an increase in schooner ownership facilitated the expansion of trapping areas. During the 1950s, the decline of fur prices and the beginning of DEW-Line construction at Tuktoyaktuk caused a shift in land use from the surrounding areas into the community. This resulted in a temporary contraction of the areas used for hunting and trapping. However, with the introduction of the snowmobile, the Inuvialuit have re-expanded into these areas (Community of Tuktoyaktuk et al. 2000).

During the 1970s and 1980s, oil exploration created major changes in the region. The continued decline in the fur market and the availability of employment with industry shifted large numbers of people into a wage based economy. The decline of the oil and gas industry in the late 1980s created a high level of unemployment. Guided sports hunting in the winter and other forms of tourism during the summer have provided employment for a few people. The future potential for tourism in the region remains strong due to the location of Tuktoyaktuk on the Beaufort Sea coast of the Arctic Ocean and its proximity to Inuvik and access to the South (Community of Tuktoyaktuk et al. 2000).

The majority (75%) of households continue to supplement their wage earnings by deriving a portion of their food from hunting and fishing. Wage employment generally limits the time available to travel to weekends and holidays. This increases the residents' dependence on hunting/fishing areas that are located close to the community, within 100 km (62 miles) (Community of Tuktoyaktuk et al. 2000).

A profile of Tuktoyaktuk's population, demographics and community services is provided in Section 9.8.1.

7.2 INUVIK

Inuvik is located on the East Channel of the Mackenzie River Delta. It lies within the northernmost reaches of the tree-line and is located 97 km (60 mi.) south of the Beaufort Sea. The name “Inuvik” means “living place”.

The Inuvik town site was first surveyed in 1955 and a permanent settlement was established in 1958 when the federal government moved its regional offices from Aklavik to the present site of Inuvik, due to yearly flooding and erosion. It was originally intended that all government services and employees, as well as the local population would be relocated from Aklavik to the new Town of Inuvik. However, many of the Aboriginal residents decided to remain in Aklavik and the settlement continues to exist today. The Mackenzie Hotel, Recreation Hall, Polaris Theatre, RCMP Building and numerous “512s” were some of the first buildings to be built in Inuvik, but many of the residents remained living in tents by the river until public housing was completed (Community of Inuvik et al 2000).

Most of the Inuvialuit that moved to Inuvik were from the Mackenzie Delta Region, but had family ties with other settlements around the Western Arctic and even Alaska. John Keevik was the last elected Inuvialuit Chief for the Mackenzie Delta in approximately 1953, before any land claims or politics had arisen (Community of Inuvik et al 2000).

The Armed Forces moved to the community after it was established and left in 1986, when satellites replaced their function (Community of Inuvik et al 2000). During the 1960s, people remember turning on their radios for the first time to listen to Wally Firth and Nellie Cournoyea for messages and announcements (Community of Inuvik et al 2000).

During the 1970s and 1980s, Inuvik flourished with oil and gas exploration. The oil patch industry left Inuvik temporarily; however, there is a renewed interest in natural gas development in the region (Community of Inuvik et al 2000) and continues to be the main headquarters for the oil and gas industry operating in the Beaufort Sea/Mackenzie Delta (Town of Inuvik 2009).

Inuvik is the government centre, and transportation and recreation hub for the Canadian Western Arctic. The airport, government services, recreational programs and hospitality industry attract residents from neighbouring communities and those traveling to and from other communities. A profile of Inuvik’s population, demographics and community services is provided in Section 9.8.2.

The Inuvialuit traditionally hunted and fished in the region where Inuvik is now situated. Historically, trapping muskrat, fox and other furbearers created employment and prosperity in the area. This culturally supported opportunity has been significantly reduced over time as a result of declining fur prices. Although many Inuvialuit do not trap as regularly or as extensively as in past times, they still trap occasionally on weekends and during springtime for muskrats in the Delta. Subsistence harvesting of animals and plants remains of vital importance to the Inuvialuit community (Community of Inuvik et al 2000).

7.3 HERITAGE RESOURCES

Heritage resources are non-renewable and finite. They are important sources of historical knowledge and cultural identity. They are considered of value to local communities, scientists and the Governments of the Northwest Territories and Canada. Consequently, they are protected by legislation. It is illegal to disturb an archaeological site, burial or artifact, and no land use activity is permitted within 30m of a known or suspected heritage site.

The following summary is based on research of available archaeological documentary data as well as the preliminary field reconnaissance of the proposed Highway alignment conducted in September, 2009. Sources that were consulted include: archaeological site inventory records held by the Northwest Territories government, early fur trader/explorer accounts, ethnographic/anthropological studies, and reports on past archaeological studies. The methods employed to assess archaeological potential along the proposed alignments is detailed in Section 7.3.3. Traditional knowledge studies and pertinent palaeogeological and paleoenvironmental information were incorporated to form a detailed knowledge base in order to assess the potential for heritage resources.

7.3.1 Human History Summary

7.3.1.1 Prehistory

Unlike many other coastal areas of the Arctic, the low lying nature of the terrain in the Mackenzie Delta region has resulted in land subsidence and coastal erosion that is thought to have obliterated many of the earliest archaeological sites. Northwest Microblade tradition (as old as 6,000 years) has been recognized by the presence of distinctive burins, blades and microblades at sites in the Mackenzie valley, eastern Mackenzie Delta and as far north as Cape Bathurst (Morrison 1987). This is said to represent seasonal northward movement of interior people over the arctic coastal plain to hunt caribou and muskox (Le Blanc 1994). This group predates and possibly overlaps Paleoeskimo sites, represented by Pre-Dorset or Arctic Small Tool tradition (ASTt). The ASTt began an extremely rapid expansion from western Alaska eastward across the Canadian Arctic about 4,500 years ago. The Paleoeskimo period is sparsely represented in the Mackenzie region, probably mainly due to severe coastal erosion. The sites that are known suggest a regionally distinct variant with western influences (Betts 2008). An early regional variant of the Arctic Small Tool tradition called the Inuvik Phase, dating to 4,300 to 3,400 years ago, has been suggested (Pilon 1994a) for the southeastern portion of the Mackenzie region. ASTt is characterized by microblades and burins with specific characteristics and small, very finely worked bifaces.

Dorset culture expanded across the High and Eastern Arctic from Foxe Basin about 3,000 years ago. Dorset sites have not been identified in the Mackenzie region. It is speculated that due to the warm climate of this period, southern aboriginal groups expanded north to near the arctic coast, particularly in the forested Delta area, and prevented Dorset people from exploiting the mainland (McGhee 1978).

Approximately 1,000 years ago, another series of rapid eastward migrations from northwestern Alaska began. This was Thule, a culture focused on whaling. Work in Alaska resulted in the definition of a regionally distinct Western Thule culture characterized by multiple room houses built of wood, curvilinear stamped pottery, Thule Type 2 harpoons, and arrowheads with knobbed tangs (Betts 2008). Most researchers now recognize an early and a late Thule period (Betts 2008). The term Neoeskimo (also known as Siglit) is typically applied to cultural remains in the Western Arctic dating between 1,500 and 150 years ago. It includes western Thule, the earliest group, and Mackenzie Inuit, thought to have derived from Thule. Mackenzie Inuit, dated to between 600 and 150 years ago, are associated with the appearance of large whaling villages on the East channel of the Mackenzie River and along the coast east and west of the mouth of the river. Their lifestyles are detailed below. Current Inuvialuit residents of the Mackenzie Delta are considered to have descended from remnants of the Mackenzie Inuit following their decimation by disease and Alaskan Inupiat who migrated to the Delta in early historic times (Betts 2008).

7.3.1.2 Historic Period

Alexander Mackenzie in 1789 travelled up the Mackenzie River's East Channel on his return journey from the mouth of the river but had no contact with aboriginal people. A number of subsequent explorers recorded ethnographic details of their encounters with Mackenzie Inuit and later Delta residents:

- 1826 - John Richardson, part of John Franklin's second polar expedition, explored and mapped the East Channel of the Mackenzie River and the arctic coastline to the east (Franklin 1828).
- late 1860s - missionary Emile Petitot (1887) worked in the Mackenzie region.
- 1906-1912 - the Stefansson-Anderson Arctic Expedition travelled from Alaska to Coronation Gulf; the expedition wintered in the Delta the first year (Stefansson 1919).
- 1913-1918 - the Canadian Arctic expedition was led by V. Stefansson, accompanied by ethnographer Diamond Jenness (1991).
- 1924 - the western team of the Fifth Thule expedition was led by Dr. Knut Rasmussen who made notes and ethnological collections from western Inuit groups (Mathiassen 1930; Rasmussen 1942).

Direct trading for European goods began in earnest in 1889 when whalers came into the Mackenzie Delta-Beaufort sea area (Bockstoce 1986). They frequently traded with the Inuit from their ships, and later established a post on Herschel Island. Whaling in the Beaufort Sea ceased in 1907, but various independent trading posts continued. In 1912, the Hudson Bay Company opened a trading post at Kittigazuit, a former focal point for Mackenzie Inuit. This post operated until 1934 when the Hudson's Bay Company moved to Tuktoyaktuk (Usher 1971). Several independent traders continued operations at Kittigazuit until 1940.

7.3.1.3 Inuvialuit Ethnography

Prior to the 1890s, the Mackenzie Inuit were perhaps the most numerous Inuit in Canada. They were culturally most closely related to the Inupiat of Alaska (Morrison and Arnold 1994). Their range extended east and west along the coast from the Delta and south to the head of the Delta and some distance south of Husky (also called Eskimo) Lakes (Stefansson 1919). The rich resource base of the Mackenzie region, anchored by beluga whale, caribou, muskox and fish, permitted the Mackenzie Inuit to develop a semi-sedentary lifestyle.

Historically, the Mackenzie Inuit were reportedly clustered into at least five more or less distinct territorial groups. Each group was centred on a resource focal point that provided sufficient resources for the establishment of a seasonally permanent village. There may have been two or three additional subgroups that had disappeared prior to the arrival of European and Canadian explorers; one of those was Imaryungmiut (“Eskimo Lake people”) who inhabited the Husky Lakes area and focused on caribou hunting and fishing (Betts 2008). After that group’s disappearance, this territory was exploited by the Kitigaaryungmiut who seasonally utilized the entire area from the lower Tuktoyaktuk Peninsula to the southern Husky Lakes and were probably among the Mackenzie Inuit who annually went as far south along the Mackenzie drainage system as Arctic Red River to trade with the Dene. Trade with Alaskan Inuit was conducted at Barter Island. The Kitigaaryungmiut main winter village, Kittigazuit, located at the mouth of the East Channel served as a summer beluga whale hunting station and winter gathering locale from which sealing and fishing was carried out. They were also reported to make occasional boat trips some 200 miles further up the Mackenzie River to obtain slate from a quarry near the Ramparts (McGhee 1974).

The following subsistence cycle summary is based mainly on Stefansson (1919). During dark winter months, people were relatively sedentary in the larger coastal villages, subsisting on dried or frozen whale, fish and caribou meat and conducting shorter hunting and trapping trips. In June, people dispersed in small family groups inland to hunt and fish at the larger lakes. From late July through August, moderate sized groups of people gathered at whaling camps. These gatherings were usually at the winter villages, but whale hunting also occurred in the Husky Lakes. Stefansson (1919) identified a winter and summer camp location at the southern narrows of Husky Lakes (not identified archaeologically to date). Focus was on caribou hunting in September and October when the animals were well fed and the hides were in prime condition. Cooperative hunting activities commonly included whaling, weir fishing, caribou drives and floe-edge sealing.

Food was generally stored in permafrost pits although raised platforms were also recorded. Fish was eaten raw or frozen, or dried and sometimes partly smoked. Meat was usually stored directly in the pits although some may have been dried. Fats and oils of sea mammals accompanied most meals and sometimes food was preserved in oil. According to Stefansson’s informants, the Mackenzie Inuit ate much less raw food than their Alaskan neighbors (Stefansson 1919). Various berries were used, as well as edible roots of young willow and knotweed.

The vast quantities of driftwood available in the Mackenzie Delta meant that, contrary to most of the arctic, people living in the Delta region used wood for construction as well as fuel. The commonly used winter house was a semi-subterranean structure built of wood, often with whalebone, and covered with sod; multiple chambers were connected to a large central area. Such a structure would have been shared by two or more families. Snowhouses were used only when travelling and generally were built for one nuclear family. Skin covered tents were used on summer hunting trips. Winter travel was by dog team and sled. Water travel in summer was by larger whale skin covered boats called umiaks, and the smaller kayaks were used for sea mammal hunts.

Tools comprised more wood components than elsewhere in the Arctic. Most implements were composed of combinations of wood, bone, antler and stone. Harpoon shafts and fish hooks were made of bone. Wooden bows and arrows were used. Projectile points, endblades and knives were made of chipped or polished chert or slate. Labrets, beads and various ornaments were made of polished steatite, antler or ivory. Cooking pots of steatite were traded from the east (Smith 1984).

Burial usually involved placing the body, wrapped in skins, on a low hill and covering it with driftwood. Personal possessions were placed in, near or on top of the grave.

7.3.2 Previous Archaeological Studies

A considerable amount of archaeological research has been conducted in certain areas of the Mackenzie Delta-Tuktoyaktuk Peninsula region. Many of the early explorers commented on seeing old camps or graves as they travelled through the region (i.e., Franklin and Richardson; Franklin 1828). The first excavations were conducted as part of ethnoarchaeological research during two arctic expeditions: in 1911 by Stefansson and in 1914 by Jenness.

Beginning in the 1950s, several archaeological research projects were aimed at elucidating the early culture history of the Mackenzie region, for example, MacNeish in 1954 and McGhee in 1974. These studies comprised both surveys and excavations conducted at sites on the Mackenzie River and adjacent coastlines. They studied the prehistoric cultural relationships between the Mackenzie Delta and Alaska. Robert McGhee spent several years excavating at Kittigazuit and a nearby smaller site, and developed a preliminary cultural synthesis for the Mackenzie Inuit (McGhee 1974).

Most archaeological investigations since the 1980s related to Mackenzie oil and gas projects (Cinq-Mars and Pilon 1991; Pilon 1994b; Hanna 2002; Clarke et al. 2004). These studies again included both surveys and excavations and provided a substantial body of data relating to the early human history of the Mackenzie region. Two research projects of specific interest to this study are an archaeological survey and testing of several sites in the interior Tuktoyaktuk Peninsula (Swayze 1994), and survey and excavations conducted on limited portions of the Husky Lakes (Morrison and Swayze 1991; Morrison and Arnold 1994). In 2001, the Mackenzie Delta Heritage Resource Survey conducted revisits of 117

previously recorded site locations and found 70 more sites (Hanna 2002). In 2003, archaeological work associated with the Mackenzie Gas Project revisited/recorded 12 sites in the Inuvialuit portion of their study (Clarke et al. 2004). In 2009, an archaeological impact assessment was completed of a portion of the northern 19 km of road alignment for which construction had already been initiated; no sites were recorded (IMG-Golder 2009a).

Previous studies focused on specific areas, largely the coastal region, the Mackenzie Delta and River, and portions of the Husky Lakes. The latter includes essentially the entire present project footprint, excluding the northern 19 km. However, substantial portions of the region remain unexamined. In particular, the region south of the Husky Lakes and east of the Mackenzie River has not been subjected to any previous archaeological investigation.

7.3.2.1 Recorded Heritage Resources

Given the limited areas previously subjected to archaeological surveys, the site inventory is quite significant, both in terms of numbers of sites and site remains. 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, there are 103 previously recorded sites (Figure 7.3-1). 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. Excavated sites have revealed cultural deposits often to 30cm below surface and some remains are as deep as 60 cm. Dates from a number of sites confirmed the time periods represented range from Northwest Microblade tradition over 5000 years old and 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, four of which are within prospective gravel sources; one additional site is within a possible borrow source further from the route (Table 7.3-1; Figure 7.3-1). These sites 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.

Artifacts that have been found at some of these sites include harpoon parts, projectile points of flaked stone, fish hooks, net sinkers, and pottery. The Cache site, on a large, unnamed lake along the western upland route alternative, contains remains of several different occupation periods, from Paleoeskimo to Inuvialuit; remains include wood house remains, hearth, a range of artifacts and numerous animals remains, predominantly fish, waterfowl and caribou. One of the sites on Big Lake also revealed prehistoric pottery. These are the types of site features and artifacts that can be expected to be present within the Project Study Area.

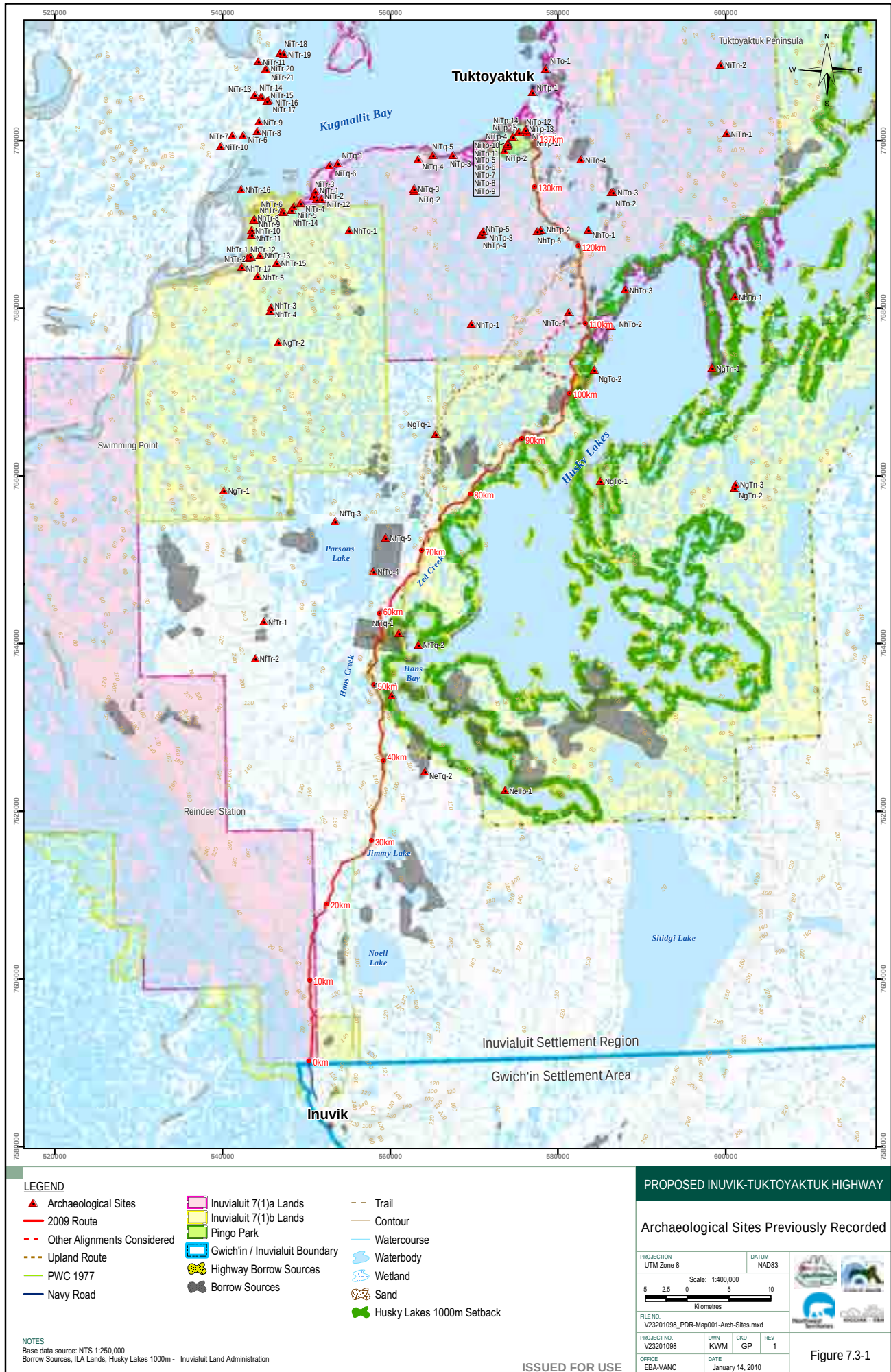


TABLE 7.3-1: ARCHAEOLOGICAL SITES NEAR PROJECT COMPONENTS

Site	Location	Distance to Highway	Type	Features
NeTq-1	Husky Lakes	1.4km+b	tool making	scatter (lithic)
NeTq-2	S. Husky Lakes	borrow	trail	trail
NfTq-1	Husky Lakes	800m+b	campsite	bone scatter; tent ring (fire cracked rock)
NfTq-4	Parsons Lake	3.3km+b	camp	scatter (lithic); sub. house
NfTq-5	large unnamed lake	2.5km+b	tool making	lithic scatter
NgTo-2	Husky Lakes	2 km	isolated find	lithic flake
NgTq-1	large unnamed lake	150m	tool making, campsite	scatter (fire cracked rock), scatter (lithic)
NhTo-1	Sukunnuk Narrows	1.8km	campsite	bone scatter
NhTo-2	Husky Lakes	2.4km	campsite	scatter (bone)
NhTo-4	west of Husky Lakes	1.8km	tool making	scatter (lithic)
NhTp-1	large unnamed lake	4.8km	campsite	cache pits, house, midden, lithic remains, pottery
NhTp-2	Big Lake	1.5km	campsite	midden, bones, pottery
NhTp-6	Big Lake	4.5km	isolated find	harpoon frag/wood debris

Note: +b = in proposed borrow source

7.3.3 Archaeological Overview Assessment

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. The route was depicted on topographic maps at a scale of 1:25,000. The borrow sources were also overflown, but the boundaries were roughly approximated using topographic maps. Data gathered during the overview assessment were used to identify specific portions of project components that will require ground reconnaissance surveys during the next phase of study.

The best potential terrain types include level and dry banks, terraces or benches along major streams or lakes. Areas with good potential include well defined, elevated landforms adjacent to larger water bodies. Low lying expanses of tussock tundra or wet muskeg have limited potential for archaeological resources.

7.3.3.1 Findings

No previously recorded archaeological sites occur within the primary proposed Highway alignment, assuming a typical right-of-way width. The sections of the Highway route that are close to Husky Lakes and cross elevated, dry terrain (Photo 7.3-1) are judged to have

good archaeological potential. Elevated terrain features such as moraines, knolls, pingos, esker remnants, and ridges (Photo 7.3-2) all have good potential. Major creek crossings are suggestive of good archaeological potential. These sections of the Highway route were roughly outlined on preliminary topographic maps (Figure 7.3-2 and 7.3-3). It is estimated that about one quarter of the route will require ground reconnaissance.



Photo 7.3-1:
Terraces and benches along Husky Lakes suggestive of good archaeological potential

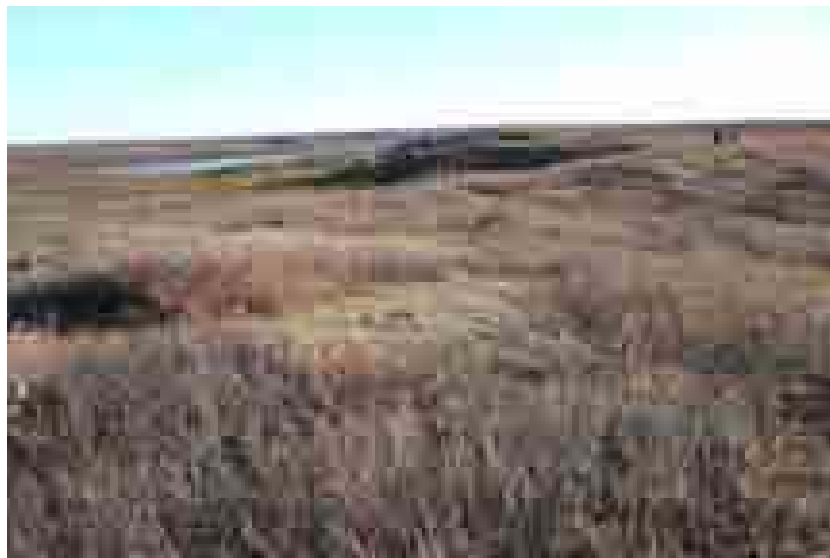
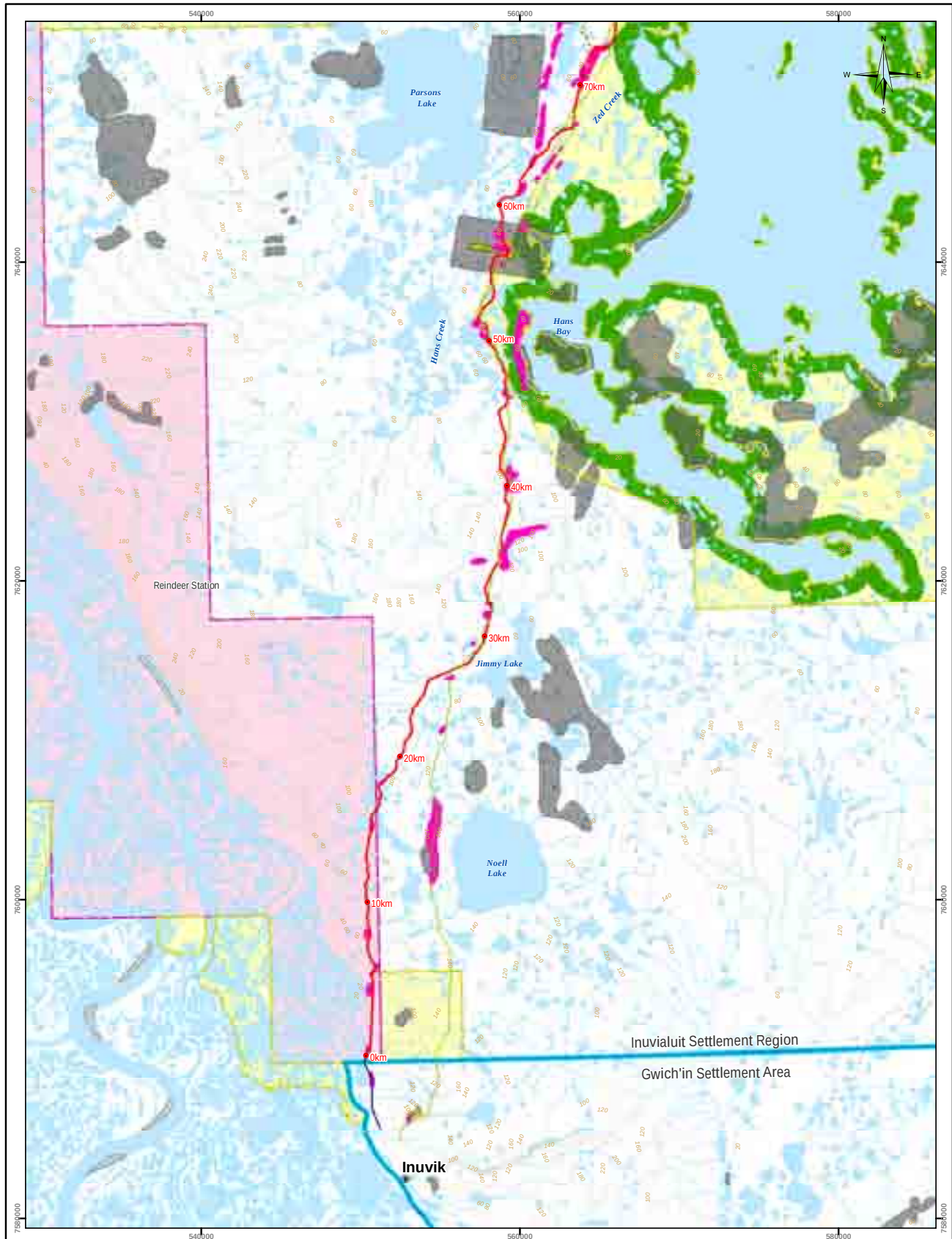


Photo 7.3-2:
Checking surface exposures on a good potential ridge to be used as a borrow source



LEGEND

- 2009 Route
- - Other Alignments Considered
- - Upland Route
- - PWC 1977
- - Navy Road

- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Pingo Park
- Gwich'in / Inuvialuit Boundary
- Highway Borrow Sources
- Borrow Sources

- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

- Archaeological Potential Area

NOTES

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

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Archaeological Potential Areas (Map 1 of 2 - Southern Portion)

PROJECTION
UTM Zone 8

DATUM
NAD83

Scale: 1:225,000
10 5 0 1 2 3 4 5 6 7
Kilometres

FILE NO.
V23201098_PDR-Map002-Arch-Areas1.mxd

PROJECT NO.
V23201098

DWN
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OFFICE
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DATE
January 14, 2010

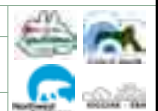
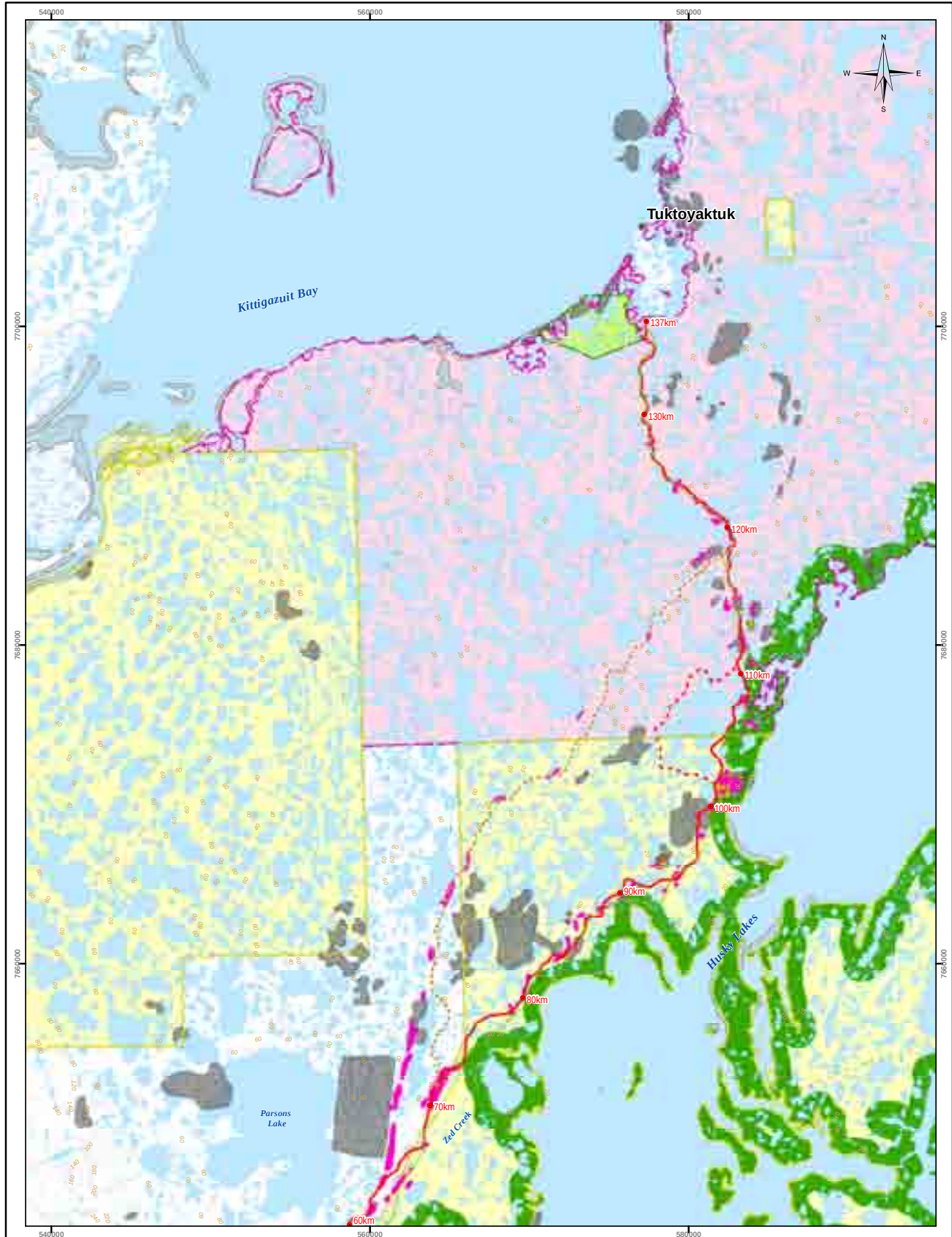


Figure 7.3-2

ISSUED FOR USE



LEGEND

- 2009 Route
- - - Other Alignments Considered
- - - Upland Route
- PWC 1977
- Navy Road

- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Pingo Park
- Gwich'in / Inuvialuit Boundary
- Borrow Gravel Sources
- Borrow Sources

- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

- Archaeological Potential Area

NOTES

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

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Archaeological Potential Areas (Map 2 of 2 - Northern Portion)

PROJECTION
UTM Zone 8

DATUM
NAD83

Scale: 1:225,000

10 5 0 1 2 3 4 5 6 7
Kilometres

FILE NO.
V23201098_PDR-Map003-Arch-Areas2.mxd

PROJECT NO.
V23201098

DWN
KWM

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REV
1

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DATE
January 14, 2010

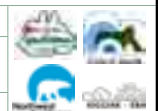


Figure 7.3-3

ISSUED FOR USE

Borrow sources were not assessed south of Hans Creek in September 2009 as they had not yet been identified at that time, as well as the time limitations during the September 2009 field investigation. One site is located within or immediately adjacent to Borrow Area 19, and several more may fall within borrow sources that were not assessed. All of the proposed borrow sources that were examined are situated on elevated terrain features that include sections suggestive of good archaeological potential; therefore, ground reconnaissance will be necessary in most of the sources.

Areas with the best potential terrain types include level and dry banks, terraces or benches along major streams or lakes, particularly along Husky Lakes, in close proximity to the Mackenzie drainage system, Zed Creek and Hans Creek; however, any well defined, elevated landforms adjacent to larger water bodies have good potential. Low lying expanses of tussock tundra or wet muskeg have limited potential for archaeological resources. A few such areas should be sampled during ground reconnaissance to ensure that all types of terrain are considered.

7.3.3.2 Heritage Expectations

The background research and visual assessment conducted of the areas in close proximity to the proposed Highway route and borrow sources provides the basis for some preliminary statements on expected heritage resources.

7.3.3.3 Heritage Site Locations

Heritage sites on the Tuktoyaktuk Peninsula and in the Husky Lakes area have most often been recorded on outlet creeks at larger lakes and along the Husky Lakes shoreline. It must be emphasized that this distribution is likely at least partly due to the fact that the research strategies of past studies focused on examination of these high potential locations. Since those are high potential locations, sites can be expected on elevated ridges, hills and terraces adjacent to larger lakes and streams. Besides Husky Lakes, of particularly good potential would be Parsons Lake, the lake known locally as Big Lake, Hans and Zed creeks, and elevated terrain close to channels of the Mackenzie drainage. Old sites have been found on pingos in northern Alaska (Lobdell 1986); therefore, such features are also considered to have archaeological potential.

7.3.3.4 Heritage Site Types

Based on ethnographic research and known heritage sites, the types of heritage sites to be expected could include various types of structural remains, stone tools and flakes, a variety of bone and wood artifacts, and bone concentrations. Mounds could be semi-subterranean houses or middens, that is, refuse accumulations. Piles of driftwood could represent graves or house remains. Pits could have been used as caches for food or belongings. Rock piles could represent caches or cairns marking a particular location or feature. The typically dense vegetation cover and the subtle nature of the some types of remains will necessitate

particularly intensive investigation strategies, involving closely spaced pedestrian transects to ensure thorough ground inspection as well as subsurface testing.

7.3.4 Heritage Resources Conclusions

1. The combination of background documentary data and overview terrain assessment has resulted in the identification of specific areas with sufficient potential for archaeological resources that ground reconnaissance is recommended.
2. To adequately complete intensive archaeological inventory survey, the Highway route must be finalized within a 100m wide corridor and boundaries of all associated components such as borrow sources, work staging areas, construction camps must be identified prior to field work.
3. Due to dense ground cover typical over most of the project footprint and the buried nature of archaeological resources in this area, intensive systematic subsurface testing will be required in most areas judged to be suggestive of good archaeological potential.
4. Mitigation measures will be designed as appropriate for each individual site. These may include avoidance (the preferred mitigation), temporary site protection, or systematic data recovery. It is expected that most archaeological sites found will be small and could be readily avoided with a minor project realignment or footprint adjustment. GNWT Department of Transportation and the Hamlet of Tuktoyaktuk, along with the selected contractor, will make every effort to avoid and protect recorded and unrecorded archaeological and heritage resources during the conduct of this project. In the unlikely event that project relocation is not feasible and a site will be impacted, recommended site mitigation will likely comprise detailed mapping, recording and excavation of a sufficient number of units to ensure a representative sample of the site contents is obtained. This ensures that knowledge of that site is available for future generations.

7.4 TRADITIONAL LAND USE AREAS

Information from the Tuktoyaktuk Community Conservation Plan (TCCP)(Community of Tuktoyaktuk et al. 2000) and the Inuvik Inuvialuit Community Conservation Plan (ICCP) (Community of Inuvik et al. 2000) are summarized in the following sections. Representatives from each community organization, including the Tuktoyaktuk Hunters and Trappers Committee (HTC), Inuvik HTC, Tuktoyaktuk and Inuvik Community Corporations, Elders, and other community representatives coordinated development of the original TCCP and IICCP in 1993. In 2000, updated editions were prepared by the Tuktoyaktuk HTC, Inuvik Inuvialuit HTC, the newly established Community Conservation Plan Working Group, the Wildlife Management Advisory Council (NWT), and staff from the Joint Secretariat.

There are several areas in the vicinity of the proposed 2009 Route that are used for traditional purposes between Inuvik and Tuktoyaktuk.

Gungi – Gungi, also spelled gunny, roughly translated means “bottom of the bay.” During the consultations held in the community of Tuktoyaktuk on November 21, 2008 for the proposed access road to Source 177 (Kiggiak-EBA 2008), many residents indicated that the area to the south of Tuktoyaktuk, including the Gungi area at the south end of Tuktoyaktuk Harbour and further south towards Big Lake, is used regularly during the summer months for picnicking and berry picking. The residents indicated that the road would allow them to carry on these activities more easily in the future.

Husky Lakes Area – is considered by the residents of Tuktoyaktuk and Inuvik to be very important for year-round hunting, trapping, fishing, and recreation and for seasonal berry picking. The lakes provide spawning habitat for herring and lake trout. The Tuktoyaktuk Community Conservation Plan (TCCP) (Community of Tuktoyaktuk et al 2000) reported that fish harvesting has been typically concentrated in the upper parts of Husky Lakes around Saunatuk, Zieman Cabin and Stanley Cabin. Community of Tuktoyaktuk et al (2000) also suggests that harvesting use has been more limited to the west of Husky Lakes (including the vicinity of the Inuvik to Tuktoyaktuk Highway alignment). Information for the harvest locations of key species is found in Section 7.8.

Fishing Areas – Big Lake, Ilkaasuat (or “fishing area”) was identified as a popular fishing area for lake trout and pike. Residents stated that the road would allow easier access to this fishing area (Kiggiak-EBA 2008; Rescan 1999). In 1999, residents from Tuktoyaktuk suggested that people do not fish along the proposed route, but they do fish further to the east, so the road would not affect their fishing areas. Inuvik residents identified Husky Lakes as important fishing areas, and were concerned that traffic and industrial activity associated with the road may negatively affect the lakes. They suggested that the road be moved further from the lakes. Fish lakes include Jimmy Lake, Noell Lake, and Parsons Lake. Further information about the fish harvesting area located near the proposed Highway is found in Section 7.8.

Hunting and Trapping Areas – Tuktoyaktuk residents stated that there is little hunting from Inuvik to Husky Lakes, but that hunting usually occurs around Parsons Lake. It was further stated that the road would be good for hunters and trappers. Inuvik residents identified that there were traplines along the proposed 1999 route, and that signage was necessary if/when the road crossed a trapline (Rescan 1999). Harvest locations and information are described further in Section 7.8.

Caribou Feeding Areas – According to the Tuktoyaktuk elders Traditional Knowledge interviews conducted in 1999, the main feeding area for caribou is along the shore of Husky Lakes. It was further mentioned that the caribou migrate along the shore of the lake, and not on higher ground (where the proposed road is) as there is not much food available at the higher elevation. Several elders stated that the proposed 1999 alignment would not affect caribou (Rescan 1999). More information about caribou related to harvesting is found in Section 7.8.

Creek Crossings – According to the Tuktoyaktuk and Inuvik HTC's, the proposed road crosses several creeks where fishing has taken place. These include Jimmy Creek, Trail Creek, Hans Creek and Zed Creek. Further information regarding creeks along the proposed Highway alignment is available in Section 9.7.

Culturally Significant Sites – According to Tuktoyaktuk residents, and supported by historical and archaeological records, the area around Husky Lakes was subject to intermittent, violent conflict between Dene and Inuvialuit individuals and groups. Saunatuk, although well removed from the proposed alignment of the Inuvik to Tuktoyaktuk Highway, is a particularly important and culturally significant site. It is located on a long sandspit that separates the second Husky Lake from the third Husky Lake. Archaeological work conducted at the site validates the traditional stories of violent conflict between the Dene and the Inuvialuit. More information about the heritage resources in the area is available in Section 7.3.

7.5 SPECIAL MANAGEMENT AREAS

According to the Tuktoyaktuk and Inuvik Inuvialuit Community Conservation Plans, the proposed Highway alignment passes through several special management areas. In general, the Highway is located in the areas with Management Categories “B” and “C” (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

Management Category “B” means that the “lands and waters where there are cultural or renewable resources of some significance and sensitivity but where terms and conditions associated with permits and leases shall assure the conservation of these resources” (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

Management Category “C” means that the “lands and waters where cultural or renewable resources are of particular significance and sensitivity during specific times of the year. These lands and waters shall be managed so as to eliminate, to the greatest extent possible, potential damage and disruption” (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

The special management areas that the proposed Highway is located in, or in the vicinity of, are described below, and are shown on Figure 7.5-1. Information regarding these areas is drawn from the Tuktoyaktuk Community Conservation Plan (Community of Tuktoyaktuk et al. 2000) and the Inuvik Inuvialuit Community Conservation Plan (Community of Inuvik et al. 2000).

Grizzly Bear Denning Areas - 322C

Grizzly bears make their dens over an expansive area between October and May each year. The proposed Highway is located within this area.

Bluenose-West Caribou Herd Winter Range - 701B

This area provides important winter habitat for the Bluenose-West caribou herd, which are valued for year-round subsistence harvest. The proposed Highway is located within the Bluenose-West caribou's winter range.

Caribou Hills - 702B

The Caribou Hills management area is an area in the Middle Mackenzie Delta, with a unique transition zone between alluvial taiga and low tundra habitats. It has a unique successional plant life and is an important subsistence berry picking and harvesting area.

Fish Lakes and Rivers - 704C

The northern portion of the proposed Highway is located within Fish Lakes and Rivers management area. This area includes the rivers and lakes along the shoreline west of Tuktoyaktuk, inland to their headwaters, and includes Parsons and Yaya Lakes. These lakes and rivers are used by the residents of Tuktoyaktuk and Inuvik for subsistence harvesting.

Husky Lakes - 705D

The Husky Lakes management area is adjacent to a portion of the proposed route of the Inuvik to Tuktoyaktuk Highway. In accordance with anticipated revisions to the Husky Lakes Criteria which are in the process of being updated by the EIRB and specific directions received from the ILA, the alignment of the proposed Highway has been re-routed as necessary to maintain a minimum setback of at least 1 km from the boundary of the Husky Lakes Special Management Area with one encroachment.

The EIRB (2009) has prepared a draft guidance document for proposed developments in the Husky Lakes Area entitled "Criteria for Establishing Environmental Standards and Criteria for Evaluating a Developer's Standard of Performance in the Husky Lakes Area (Area Number 2, Annex D, Inuvialuit Final Agreement)". This document is a draft update from the previously adopted in 2002.

This Project Description Report outlines the methods that will be employed to conform to EIRB's criteria for establishing environmental standards. EIRB's draft criteria are:

Traditional and Beneficiary Usage

Developments shall not produce air conditions, vibrations, noise levels, or any other disturbance that interfere with beneficiaries' use of the HLA.

Development Footprint

Developments shall be carried out so that the area occupied by the project site is no larger than necessary. Ideally, after final remediation, there will remain no evidence of environment disturbance in and about the development site.

Land-Use Conflicts

Developments shall avoid conflicts with community and beneficiary use of the land. Traditional land use activities will have priority over development activities.

Archaeological and Heritage Resources

Developers must take all reasonable steps to identify, locate and protect known and unknown heritage resources in the Husky Lakes Area.

Flora

Developments will be carried out in such a manner that plants are preserved and undisturbed to the greatest extent possible. Reasonable efforts must be taken to identify and protect areas of rare, at risk, and traditional use plants in the Husky Lakes Area

Water Quality

Developments in the Husky Lakes Area must not result in any adverse impact to the ambient hydrological regime—taking into consideration seasonal variations.

Air Quality

Air emissions resulting from a development in the Husky Lakes Area must meet the most current Canadian and Northwest Territories air quality standards.

Soils

Developments must proceed in such a manner that the native soils and any imported project materials (e.g. aggregate, rock, crushed stone) are used in the most appropriate manner to minimize soil degradation and not significantly affect other lands, water bodies, or marine areas. Every effort shall be made to preserve native soils.

Sediments

Developments must not disturb benthic soils and organic/inorganic materials in any manner that would adversely impact the water quality and/or quantity of that water body or feeding/receiving waters beyond seasonal variations.

Kugmallit Bay - 714C

The area managed under category 'C' consists of the eastern portion of Kugmallit Bay. Whales concentrate in these shallow, warm, brackish and highly turbid waters to calve, rear calves, moult and/or socialize. The area is an important past and present beluga whale subsistence harvesting area from June 15 to August 15.



LEGEND

- 2009 Route
- Other Alignments
- Considered
- Upland Route
- Navy Road

NOTES

Base data source: National Atlas
Management Areas - Joint Secretariat Maps

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Special Management Areas

PROJECT NO. V23201098	DWN KMW	CHD TS	REV 2
OFFICE EBA-VANC	DATE January 19, 2010		

Figure 7.5-1

Pingo Canadian Landmark - 728D

The area around Tuktoyaktuk has the greatest concentration of rare geological landforms consisting of ice-cored hills called pingos. In particular, the Ibyuk Pingo is 50m (164 ft) tall, and is approximately 1,000 years old. This area is protected under the *National Parks Act* and *Western Arctic (Inuvialuit) Claims Settlement Agreement*.

Wildlife, Waterfowl and Fish Harvest Areas

Specific areas related to wildlife, waterfowl and fish harvesting are identified in the Natural Resources Harvesting section of the Project Description Report (Sections 7.8.1 to 7.8.3).

7.6 PAST AND EXISTING LAND USES

The land between Inuvik and Tuktoyaktuk is currently used for a variety of purposes, which are described in this section. Figure 7.6-1 identifies the location of existing land uses.

7.6.1 Ikhil Gas Development and Pipeline Project

The Ikhil Gas Development and Pipeline Project consists of two producing gas wells, associated feeder lines, a small gas processing plant and a 50 km (30 miles) long, 168.3 mm (6 inch) diameter buried gas pipeline. The gas production site is located approximately 50 km north of Inuvik in the Caribou Hills, and extends south from there to a pressure regulation and metering facility near the Northwest Territories Power Corporation power plant in Inuvik. The project was developed during the period 1997 to 1999 and is expected to be in service for the foreseeable future.

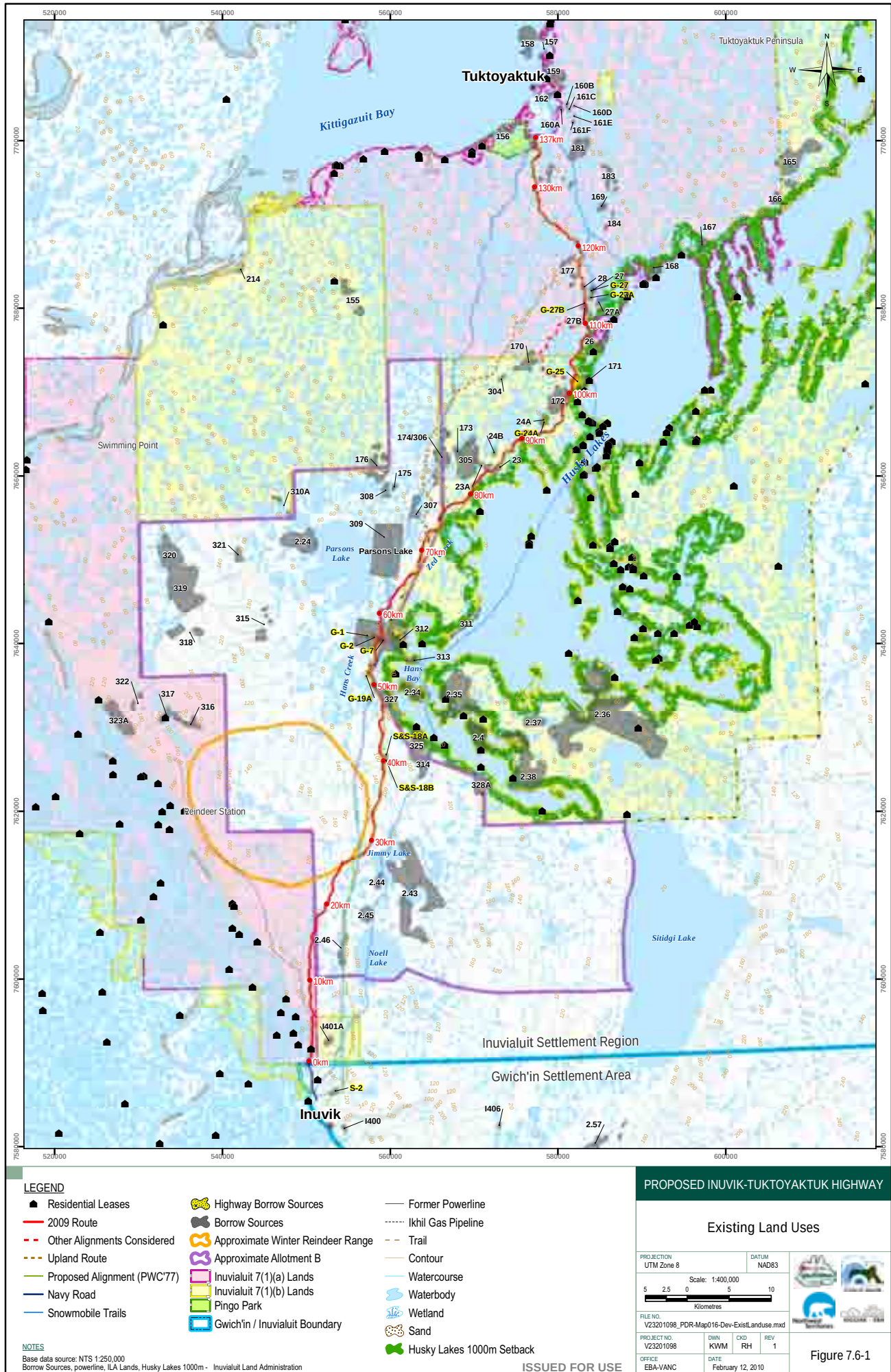
The buried gas pipeline approaches the proposed Inuvik to Tuktoyaktuk Highway alignment at KM 5 and then runs parallel to the proposed Highway alignment heading south towards the end of Navy Road in Inuvik.

7.6.2 Tuktoyaktuk to Source 177 Access Road

The Tuktoyaktuk to Source 177 Access Road is a 19 km long road that is currently under construction. The proposed road alignment follows the same general route as originally selected for the northernmost 19 km of the proposed all-weather Highway between Inuvik and Tuktoyaktuk. The alignment is located entirely on Inuvialuit Private Lands.

7.6.3 Winter Access Trails

Since the introduction of snow machines, winter access trails have been developed each winter as needed, to allow residents of Tuktoyaktuk and Inuvik to pursue their traditional recreational, hunting, trapping and other activities on the Tuktoyaktuk Peninsula and in the Mackenzie Delta, including the general area of the proposed Inuvik to Tuktoyaktuk Highway. Several series of routes that becomes established every winter are the traditional routes from Tuktoyaktuk and Inuvik to the Husky Lakes area (Figure 7.6-1).



The consultations sessions held in October 2009 confirmed that many families have and continue to use the traditional winter routes to the Husky Lakes. The consultations also identified a second, more overland route, which generally followed the alignment of the former Northern Canada Power Commission (NCPC) power line right-of-way (ROW) that extended from Inuvik to Tuktoyaktuk (Figure 7.6-1).

7.6.4 Husky Lakes Area

The Husky Lakes area is considered by the residents of Tuktoyaktuk and Inuvik to be very important for year-round hunting, trapping, fishing, and recreation and for seasonal berry picking. The lakes provide spawning habitat for herring and lake trout. The TCCP (Community of Tuktoyaktuk et al. 2000) reported that fish harvesting has been typically concentrated in the upper parts of Husky Lakes around Saunatuk, Zieman Cabin and Stanley Cabin. Community of Tuktoyaktuk et al. (2000) also suggests that harvesting use has been more limited to the west of Husky Lakes (including the vicinity of the Inuvik to Tuktoyaktuk Highway alignment).

According to ILA records, there are currently 118 registered leases located throughout the Husky Lakes area with the heaviest concentrations of cabins present in the narrows northwest of Five Hundred Lakes and to a lesser extent around Whale Point and Portage Point at the southern limit of Husky Lakes (Figure 7.6-1).

The Husky Lakes Integrated Management Planning Study completed in 2001 suggested that the area was already under pressure and that the local people were concerned about the deterioration of the “specialness” of Husky Lakes due to increased garbage and crowding of Husky Lakes related to the increasing number of cabins and residential leases (Hoyt 2001). At that time there was already a concern that land use activities may affect the traditional ways of life. As reported in Hoyt (2001), the region was considered to be vital to the community as a place where families could spend time together and pass on the skills and culture of the Inuvialuit.

7.6.5 Former Northern Canada Power Commission (NCPC) Power Line

In 1972, a 144 km wood pole power (transmission) line (69 kV) was constructed by the NCPC from Inuvik to Tuktoyaktuk, the only line of its type in the world north of the Arctic Circle (NTPC 2009). The route of this former power line is illustrated in Figure 7.6-1.

Due to high maintenance costs, this line was abandoned and salvaged in the late 1980s. The former power line ROW was used as a winter trail between Tuktoyaktuk and Inuvik and also served to help harvesters on the land to determine their location (G. Colton, NTPC Pers. Com. 2009). Today little physical evidence remains of the former NCPC power line.

7.6.6 Seismic Lines

Since the 1960s the most extensive non-traditional land use that has occurred in the Mackenzie Delta, including the area in the vicinity of the proposed Inuvik to Tuktoyaktuk Highway, has been seismic exploration. As an example, in the 41,105 ha Parsons Lake Study Area defined for the Mackenzie Gas Project, approximately 1.5% of that Study Area had been subjected to seismic lines and associated activities (IOL et al. 2004). Although from the air the vegetation along the seismic lines sometimes appears to have a different colour, on the ground, little physical evidence remains of these historic seismic programs.

7.6.7 Oil and Gas Well Sites

A number of exploratory oil and gas wells were completed by Imperial Oil near the proposed Highway right-of-way near Tuktoyaktuk on the Tuktoyaktuk Peninsula. For example, 13 wells were drilled in the mid-1980s during Imperial Oil's Tuktoyaktuk Tertiary program. In addition, Gulf drilled a number of exploratory and development wells in the Parsons Lake area in the early 1970s.

7.7 PROPOSED FUTURE LAND USES

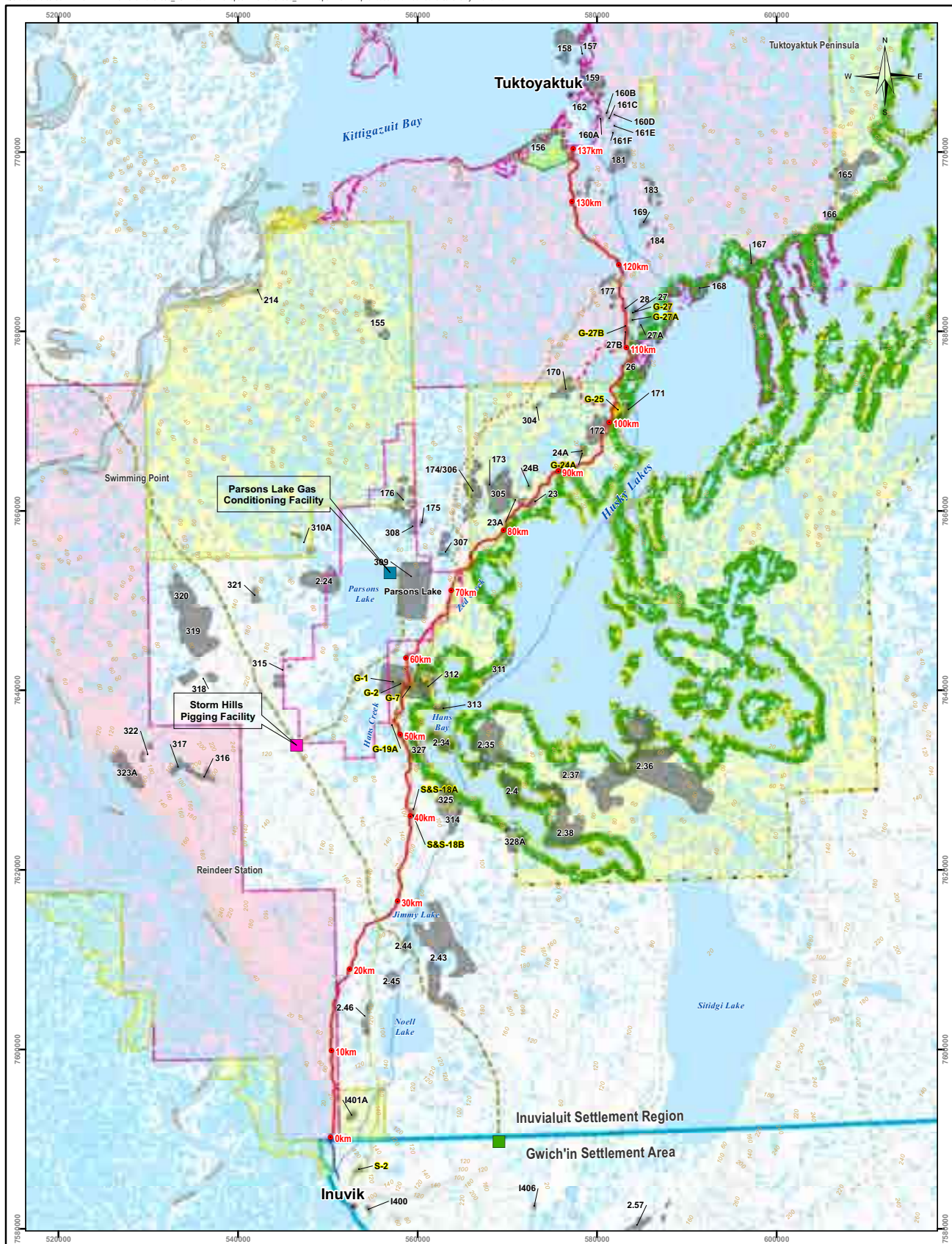
Figure 7.7-1 identifies the locations of known proposed future projects that may be developed in the region.

7.7.1 Mackenzie Gas Project

Developing a natural gas pipeline from the Mackenzie Delta through the Northwest Territories to southern markets has been contemplated for many years. Various pipeline projects have been proposed during the last 30 years that consider economics, regulatory requirements, socio-economic and environmental conditions, and engineering and geotechnical issues in the decision-making process (IOL et al. 2004).

The proponents of the proposed Mackenzie Gas Project include Imperial Oil Resources Ventures Limited Partnership (IOL), ConocoPhillips Canada (North) Limited (ConocoPhillips), ExxonMobil Canada Properties (ExxonMobil), Shell Canada Limited (Shell) and Mackenzie Valley Aboriginal Pipeline Limited (MVAPL) partnership.

The purpose of the proposed project is to develop three onshore natural gas fields (anchor gas fields) in the Mackenzie Delta and to transport natural gas and natural gas liquids (NGLs) by pipeline to market (Figure 7.7-1).



LEGEND

- Facility Site
- Gas Conditioning Facility
- Piggling Facility Site
- Route of Gathering Pipelines
- Significant Discovery Licence Area

- 2009 Route
- Other Alignments Considered
- Upland Route
- Proposed Alignment (PWC/77)
- Navy Road
- Snowmobile Trails

- HighwayBorrow Sources
- Borrow Sources
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Pingo Park
- Gwich'in / Inuvialuit Boundary
- Husky Lakes 1000m Setback

- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand

NOTES

Base data source: NTS 1:250,000
Borrow Sources, powerline, ILA Lands, - Inuvialuit Land Administration
Mackenzie Gas Project 2004

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Proposed Future Land Uses

PROJECTION UTM Zone 8		DATUM NAD83		
Scale: 1:400,000 				
Kilometres				
FILE NO. V23201098_PDR-Map017-CE-PropLanduse.mxd				
PROJECT NO. V23201098	DWN KWM	CHK RH	REV 0	
OFFICE EBA-VANC	DATE January 25, 2010			



Figure 7.7-1

ISSUED FOR USE

7.7.2 Parsons Lake Gas Field Associated Infrastructure and Gathering Pipeline

The Parsons Lake gas field, currently operated by ConocoPhillips, is located about 55 km southwest of Tuktoyaktuk and 70 km north of Inuvik (Figure 7.7-1). The main production facilities at the Parsons Lake field will be located on two main gravel pads, the most northerly and larger of the two near the northeast shore of Parsons Lake. The north pad, which will accommodate the gas conditioning facility, camp, fuel storage, and other associated infrastructure, is proposed to be built first. The connection to the Mackenzie Gas gathering system will also be located at the north pad. The second, smaller well pad will be constructed about five or six years later and will be located about 14 km from the north pad at a location south of Parsons Lake. An elevated two-phase flow line will transport natural gas from the south pad to the north pad's gas conditioning facility (ConocoPhillips 2004).

The Parsons Lake gathering pipeline (Parsons Lake lateral) will originate from the gas conditioning facility located on the north pad and will head south around Parsons Lake. From there, the buried lateral will continue southwest between West Hans Lake and East Hans Lake to the Storm Hills Junction (Figure 7.7-1).

7.7.3 Tuktoyaktuk Harbour Project

The harbour at Tuktoyaktuk is the only existing natural and active port along the Canadian Beaufort Sea coastline. Historically it has served as the primary base for offshore oil and gas exploration in the 1970s and 1980s when the oil and gas exploration companies were active in the area. With the recent renewed interest in Beaufort Sea exploration and the possible development of the Mackenzie Gas Project, Tuktoyaktuk harbour may again play an important role as an offshore logistics and service centre for the oil and gas industry.

The Tuktoyaktuk Harbour, however, can only be used by vessels with a draft of 13 feet (4 m), or less. Therefore the larger drillships, ice breakers and supply boats cannot presently enter the harbour. With the projected thinning of the polar ice caps, the expected increase in global marine traffic through the north and the anticipated intensification of Beaufort oil and gas exploration and possible development, there will be an important requirement to provide a suitable harbour for deeper draft vessels. Both Government and industry have expressed an interest in developing the Tuktoyaktuk Harbour to support deeper draft vessels and proposals for such potential development may be forthcoming.

The potential option to bring modules for the Parsons Lake gas field through the Beaufort Sea to Tuktoyaktuk is currently under study by ConocoPhillips. To date no formal proposal for the development of Tuktoyaktuk harbour has been put forward.

7.8 NATURAL RESOURCES HARVESTING

The traditional culture of the Inuvialuit is unique due to the adaptations to every day challenges posed by the harsh northern environment in which they have evolved (IOL et al. 2004). Traditionally the people have lived off the land and relied on a variety of wildlife and plant species for sustenance. The ability to survive in such an environment has shaped

Inuvialuit behaviour and activities, creating a focus on harvesting game, fish and fowl for food because the supply of available plant foods was too limited and seasonal to sustain life (IOL et al. 2004). Despite the continued importance of harvesting to the Inuvialuit culture, these activities have diminished in recent years (IOL et al. 2004; NWT Bureau of Statistics 2008a and 2008b).

Traditional activities which, above all others, sustain the full expression of the Inuvialuit values and identity include hunting, fishing and trapping (IOL et al. 2004). The Inuvialuit use local resources to provide traditional foods and their hunting, fishing and trapping activities convey a tradition-based and fundamental relationship between the Inuvialuit and their environment. Species that the Inuvialuit have traditionally relied upon for sustenance includes beluga whale, seal, caribou, fur-bearing animals, fish and birds. The most important food sources to the Inuvialuit are caribou and whale (IOL et al. 2004).

The data presented in the following section is primarily derived from the Inuvialuit Harvest Study 1988-1997 (Joint Secretariat 2003). This study has not been updated since it was originally published.

Harvest data between 1988 and 1997 presented in this section have been reported separately for Inuvik and Tuktoyaktuk.

7.8.1 Wildlife

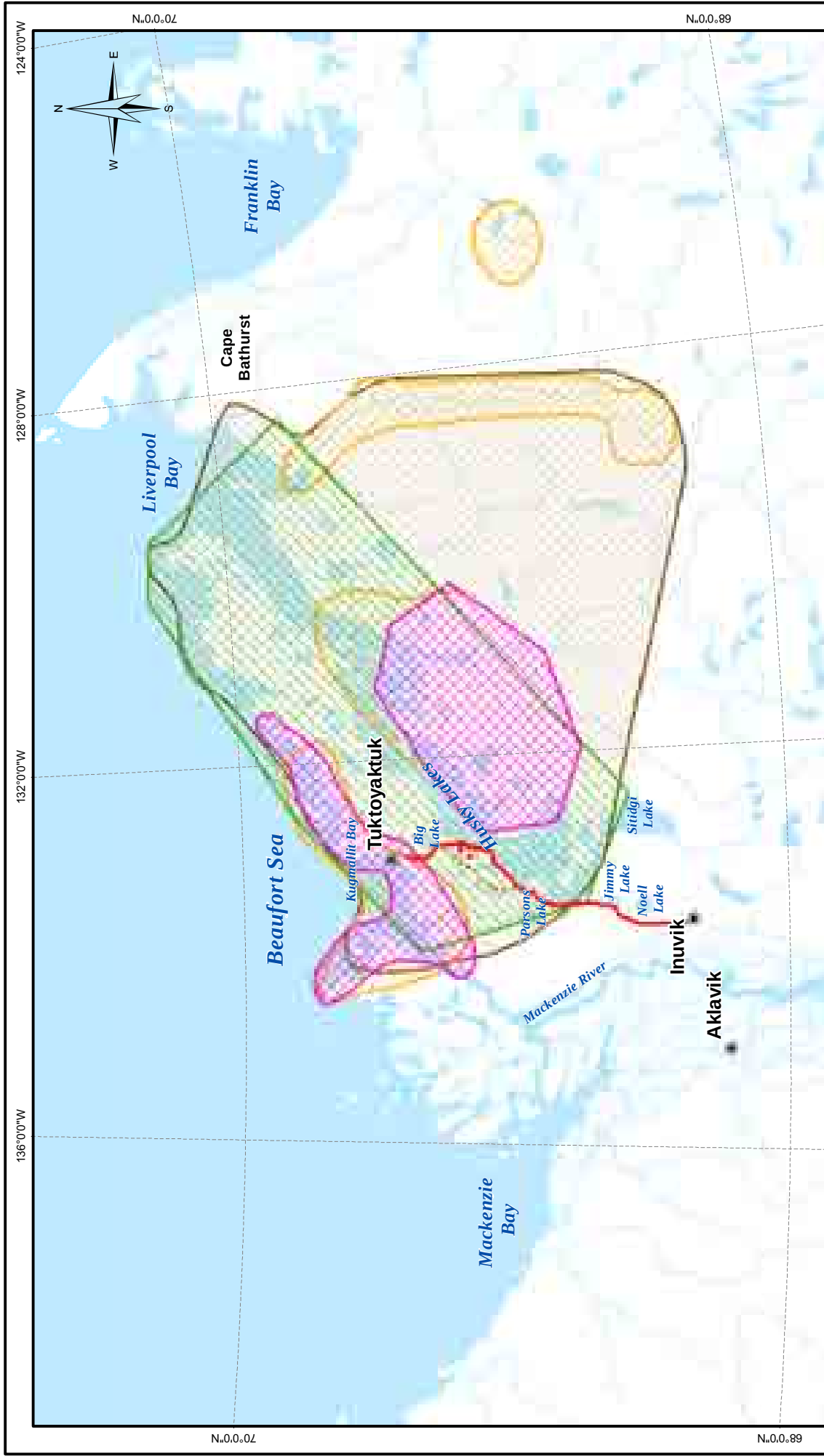
7.8.1.1 Caribou

Inuvialuit communities rely on the Cape Bathurst and Bluenose-West herds of barren-ground caribou which occupy the northern portion of the Northwest Territories and western Nunavut (Community of Inuvik et al. 2000 and Community of Tuktoyaktuk et al. 2000). For the period July 1, 2008 to June 30, 2009, Area I/BC/07 (which includes the area of the proposed Highway) was closed to all hunters for barren-ground caribou hunting. Hunting for barren-ground caribou is still permitted to occur between June 16 and March 31 in Area I/BC/08 located to the north and west of Tuktoyaktuk on the Tuktoyaktuk Peninsula. This area is closed from April 1 to June 15 of each year to allow the Cape Bathurst caribou herd to migrate back to their calving grounds along the coast.

Figure 7.8-1 depicts the seasonal caribou harvesting areas. In particular, the area near Caribou Hills provides important wintering habitat (IOL et al. 2004).

Inuvik

In the Inuvik area between 1988 and 1997 the Inuvialuit annual caribou harvest fell from 1,589 to 275 caribou per year (Figure 7.8-2). The sharpest decline followed the 1988 hunting season of 1,589 caribou to 635 the following year. Since 1989, caribou harvesting has continued to decline to 275 in 1997.



LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road

NOTES

Base data source: National Atlas
Caribou Harvest Areas - Joint Secretariat Maps

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Caribou Harvesting Areas
Spring, Summer, Fall, Winter

PROJECT NO.
V23201098

OFFICE
EBA-VANC

DWN
KMW

DATE
January 2010

CHD
TS

REV
0

Scale: 1:2,250,000

10 5 0 10 20 30 40 50 60 70

Kilometres

PROJECTION
Canadian Lambert Cont. Conic

DATUM
NAD83

FILE NO.
V23201098_PDR-Map008-Trad-CaribouHarv.mxd

Figure 7.8-1

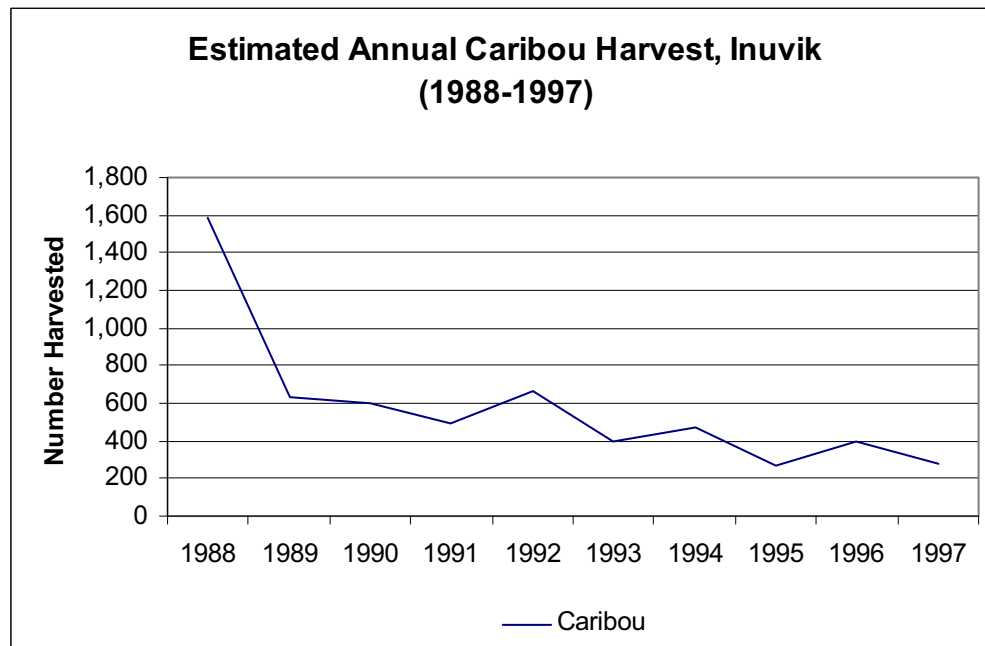


Figure 7.8-2
Estimated Annual Caribou Harvest, Inuvik (1988-1997)

More recent barren-ground caribou harvest estimates for the ISR were not available. However, the GNWT Department of Environment and Natural Resources has conducted NWT Resident Hunter Harvest Surveys from 1984 to 2006 in the Inuvik region for Woodland Caribou. Survey data indicate approximately 68 caribou were harvested between 1997 and 2006, ranging from approximately two in 2002 to approximately 13 in 2005 (GNWT ENR 2006c).

Tuktoyaktuk

Between 1988 and 1997, the annual caribou harvest near Tuktoyaktuk fluctuated from a high of 1,398 caribou in 1992 to a low of 586 caribou in 1989 (Figure 7.8-3; Community of Tuktoyaktuk et al. 2000). The sharpest decline followed the 1988 hunting season of 1,589 caribou to 635 the following year. With the exception of the 1991 and 1992 harvest years, annual caribou harvests have remained below 1,000 caribou per year in the Tuktoyaktuk region.

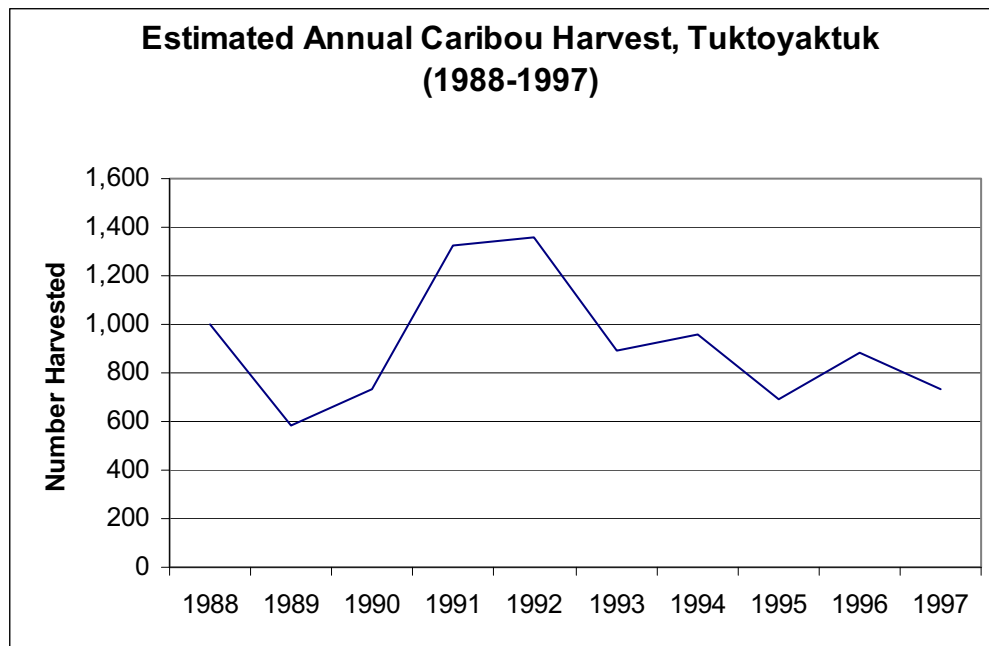


Figure 7.8-3
Estimated Annual Caribou Harvest, Tuktoyaktuk (1988-1997)

Residents of Tuktoyaktuk have expressed concern that hunting pressure on caribou and other wildlife may increase as a direct consequence of building the Highway. To protect wildlife, organizations such as the HTC's, Wildlife Management Advisory Council (WMAC) and GNWT Department of Environment and Natural Resources will need to work together and develop guidelines and conditions for use of the Highway. The success of this approach would require a high level of voluntary compliance from the users of the proposed Highway. Consequently, this process would require a public education program to be undertaken, including the use of signage along the highway alignment highlighting hunting and other restrictions, to discourage excessive hunting along the corridor.

7.8.1.2 Big-Game

Other big-game annually harvested include moose, and to a lesser extent grizzly bear and black bear. Moose are an important alternate food source when caribou are not available, and are also used for clothing and tools (Community of Inuvik et al. 2000). Figure 7.8-4 depicts the spring time moose harvesting areas.

The Inuvialuit have exclusive harvesting rights to grizzly bear within the Inuvialuit Settlement Region. In 1987 the Tuktoyaktuk HTC expressed concern about over-harvesting of grizzly bears (Community of Tuktoyaktuk et al. 2000). The organization suggested that a quota be established, and the process of implementation began (IRDC n.d.). Grizzly bears have traditionally been used only as a furbearer and are typically hunted between April 1 to June 15 and August 15 to September 30 each year (Community of Tuktoyaktuk et al. 2000).



LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road

NOTES

Base data source: National Atlas
Moose Harvest Areas - Joint Secretariat Maps

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

PROJECTION Canadian Lambert Conf. Conic	DATUM NAD83
FILE NO. V23201098_PDR-Map011-Trad-MooseHarv.mxd	

PROJECT NO. V23201098	DWN KMMW	CHD TS	REV 0
OFFICE EBA-VANC	DATE January 14, 2010		

**Moose Harvesting Areas
Spring**

Figure 7.8-4

Inuvik

Moose hunting typically occurs between February 1 to March 31 and August 1-31 each year in the Inuvik Planning Area (Community of Inuvik et al. 2000). As indicated in Figure 7.8-5, between 1988 and 1997 the Inuvialuit annual moose harvest near Inuvik declined from 41 in 1988 to 8 in 1997. The sharpest decline followed the 1988 hunting season of 41 moose to 18 moose the following year. Between 1989 and 1997 moose harvest near Inuvik fluctuated from 8 to 15 moose. According to a recent NWT Resident Hunter Harvest Survey conducted in the Inuvik region (GNWT ENR 2006c), 317 moose were harvested between 1997 and 2006, ranging from 10 in 2001 to 40 in both 1997 and 2006.

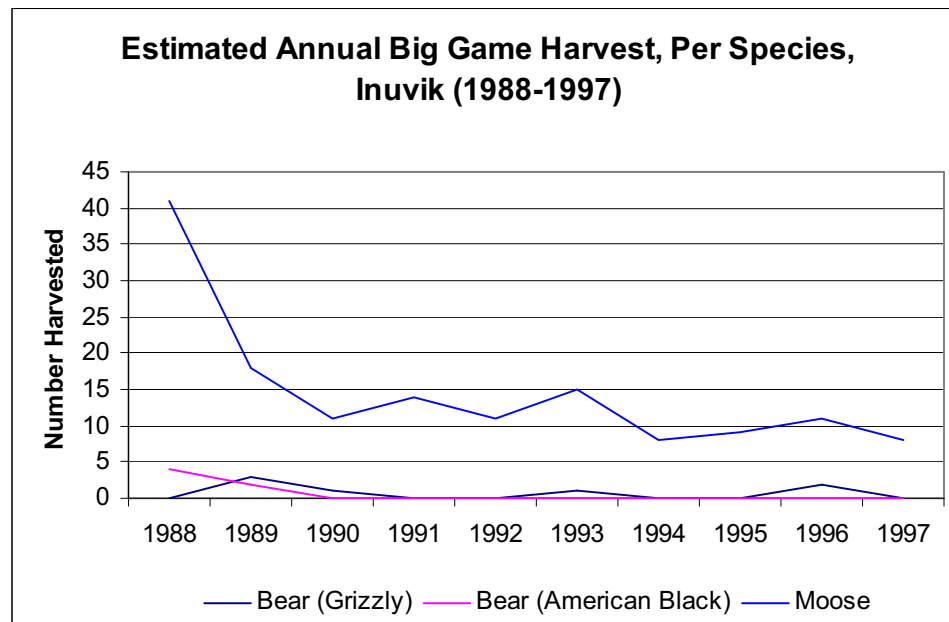


Figure 7.8-5
Estimated Annual Big-game Harvest, Per Species, Inuvik (1988-1997)

As indicated in Figure 7.8-5, the Inuvialuit harvested seven grizzly bears in the Inuvik area between 1988 and 1997 with the highest number (four) harvested in 1989. No grizzly bears were harvested in the Inuvik area during 1988, 1991, 1992, 1994, 1995, or 1997. More recent data indicate that between July 2003 and June 2008, 129 grizzly bears were harvested (GNWT 2008). Despite the increase from the earlier data, the harvest between 2003 and 2008 was less than the sustainable harvest level (GNWT 2008).

Near Inuvik, it is estimated that less than five black bears were harvested during 1988 and 1989 (Figure 7.8-5).

Tuktoyaktuk

The annual harvest of big-game in the Tuktoyaktuk area has shown fluctuation over time for grizzly bear, moose and muskox (Figure 7.8-6). All species have been harvested at rates of six or fewer individuals per year with the exception of the moose harvest in 1993 when 10 moose were harvested.

Muskoxen are typically harvested between April 1 to May 31 within the Tuktoyaktuk Planning Area (Community of Tuktoyaktuk et al. 2000).

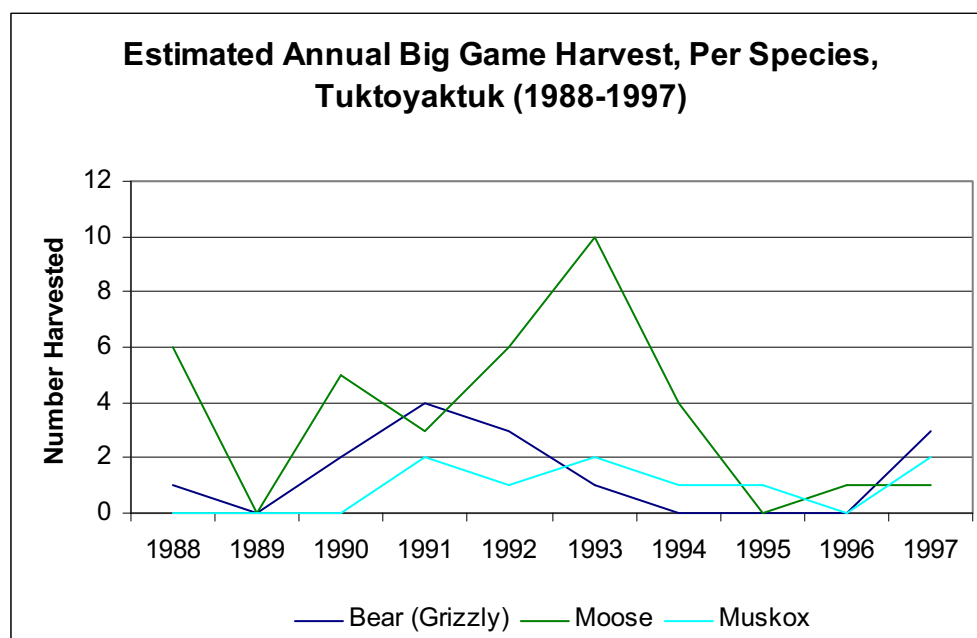


Figure 7.8-6
Estimated Annual Big-game Harvest, Per Species, Tuktoyaktuk (1988-1997)

More recent big-game harvest estimates for the ISR region were not available.

7.8.1.3 Furbearers and Small Mammals

Active trapping by the Inuvialuit near Inuvik has also been in decline. Fur-bearing species harvested include fox, American mink, hare, wolf (also classified as big-game), marten, wolverine and muskrat. These species are highly valued fur-bearing species, while the hare are also considered an important food source (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

Inuvik

In the Inuvik area, fur bearers are typically harvested between January 1 to May 15 and November 1 to December 31 of each year (Community of Inuvik et al. 2000). Muskrat are specifically harvested March 5 to June 15 each year (Community of Inuvik et al. 2000).

As shown in Figures 7.8-7 and 7.8-8, harvest rates have decreased between 1988 and 1997. An exception is the hare harvest in 1990, which increased sharply in 1990. Wolf and wolverine had the fewest individuals harvested each year (Joint Secretariat 2003). Figure 7.8-9 depicts the winter harvesting areas for wolverine.

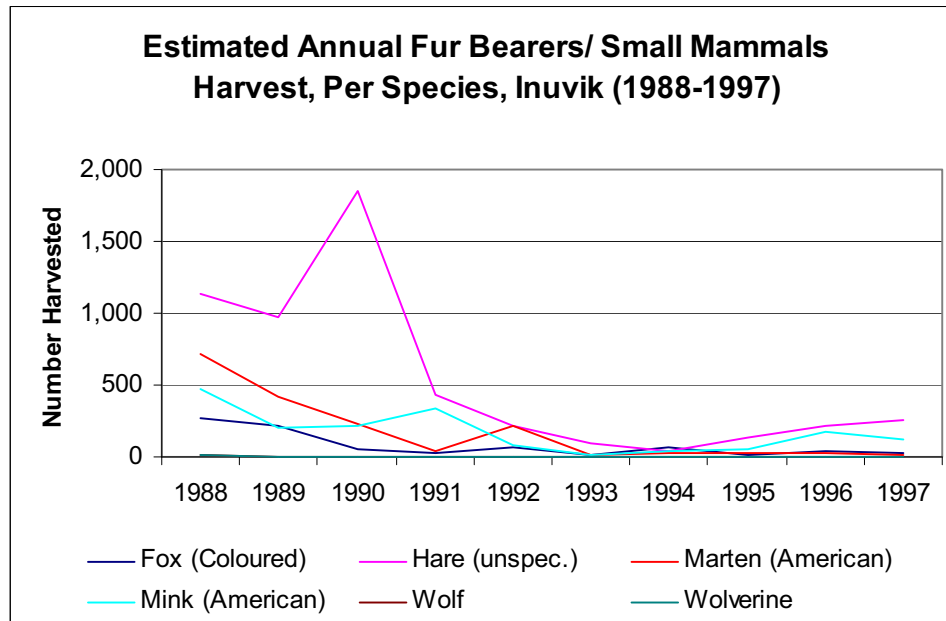


Figure 7.8-7
Estimated Annual Fur Bearers / Small Mammals Harvest, Per Species, Inuvik (1988-1997)

Muskrat harvesting has also declined between 1988 and 1997 with the sharpest decline from 38,136 individuals in 1988 to 6,305 in 1989. Between 1989 and 1997 the muskrat harvest fluctuated from 698 to 6,314.

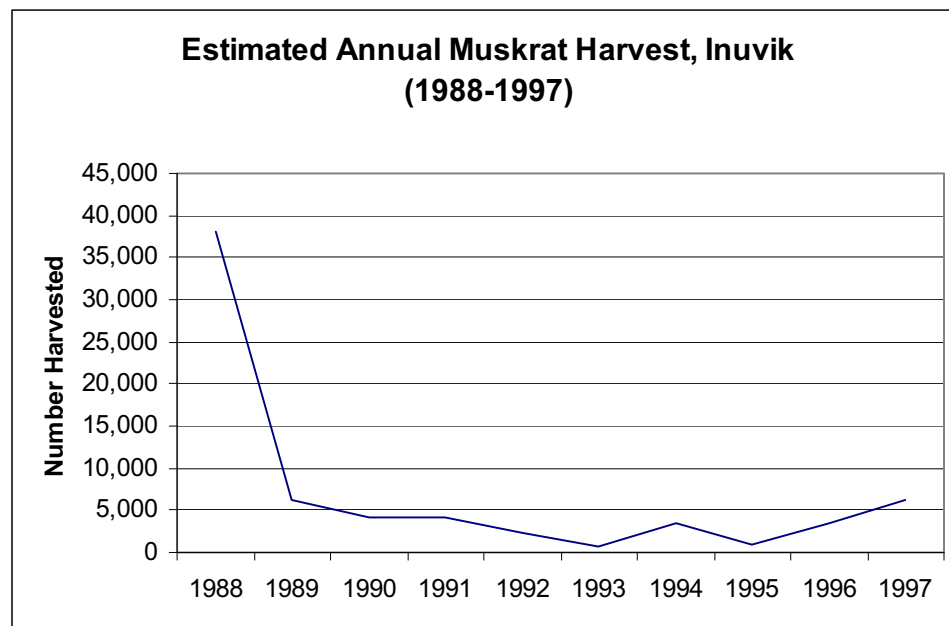
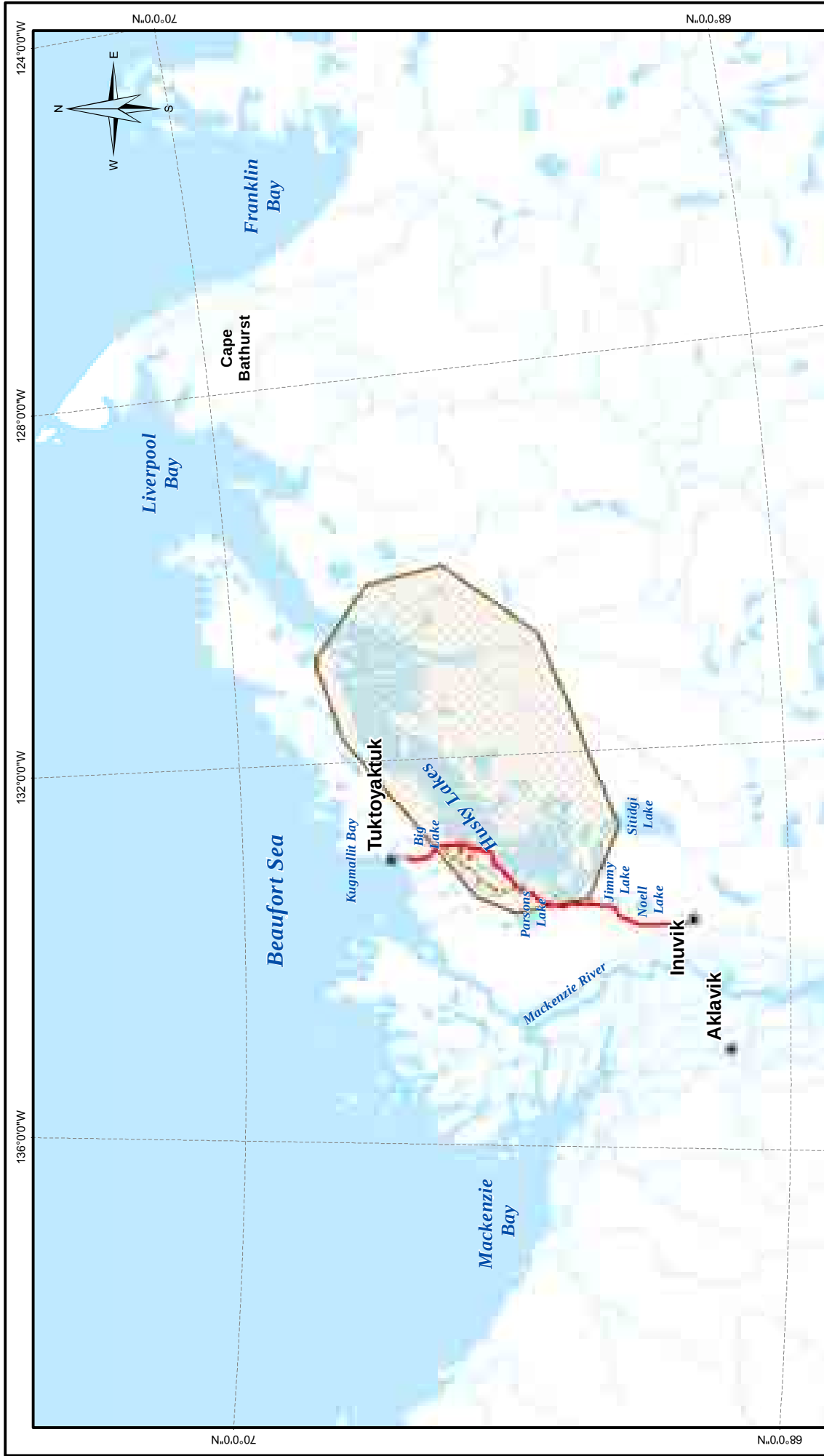


Figure 7.8-8
Estimated Annual Muskrat Harvest, Inuvik (1988-1997)



LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road

NOTES

Base data source: National Atlas
Wolverine Harvest Areas - Joint Secretariat Maps

314C - Winter Wolverine Harvesting Area

Watercourse

Waterbody

Scale: 1:2,250,000

10 5 0 10 20 30 40 50 60 70

Kilometres

PROJECTION: Canadian Lambert Conf. Conic

DATUM: NAD83

FILE NO.: V23201098_PDR-Map012-Trad-WolverineHarv.mxd

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Wolverine Harvesting Areas

Winter

PROJECT NO.	DWN	CHD	REV
V23201098	KMW	TS	0
OFFICE	DATE		
EBA-VANC	January 14, 2010		

ISSUED FOR USE

Figure 7.8-9

Tuktoyaktuk

Active trapping by the Inuvialuit near Tuktoyaktuk has fluctuated over the period from 1988 to 1997 (Figure 7.8-10). Fur-bearing species harvested include fox, American mink, hare, wolf, marten, wolverine and muskrat. These species are highly valued, fur-bearing species, while the hare is also considered an important food source (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000). In the Tuktoyaktuk Planning Area fur bearers are typically harvested between January 1 to April 15 and November 1 to December 15 of each year (Community of Tuktoyaktuk et al. 2000). Muskrat are specifically harvested between March 5 to May 31 each year (Community of Tuktoyaktuk et al. 2000).

As indicated in Figure 7.8-10, mink and hare harvest rates have decreased between 1988 and 1997. Other species have generally fluctuated over this time period (Figures 7.8-10 and 7.8-11 (Joint Secretariat 2003).

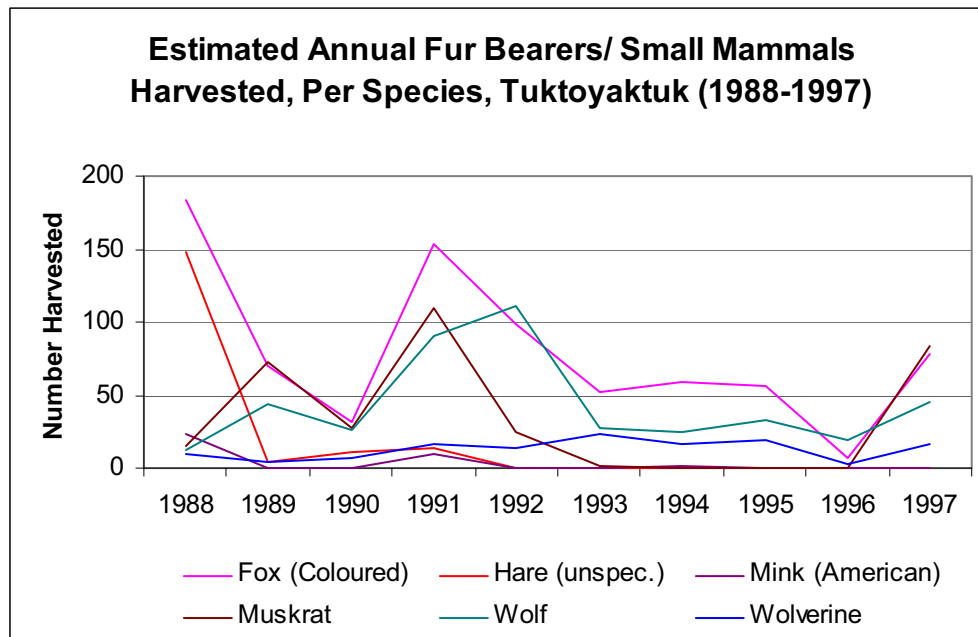


Figure 7.8-10
Estimated Annual Fur Bearers/ Small Mammals Harvest, Per Species, Tuktoyaktuk (1988-1997)

The number of Arctic fox and marten harvested near Tuktoyaktuk reduced substantially between 1988 and 1990 and then rose steadily again until 1996.

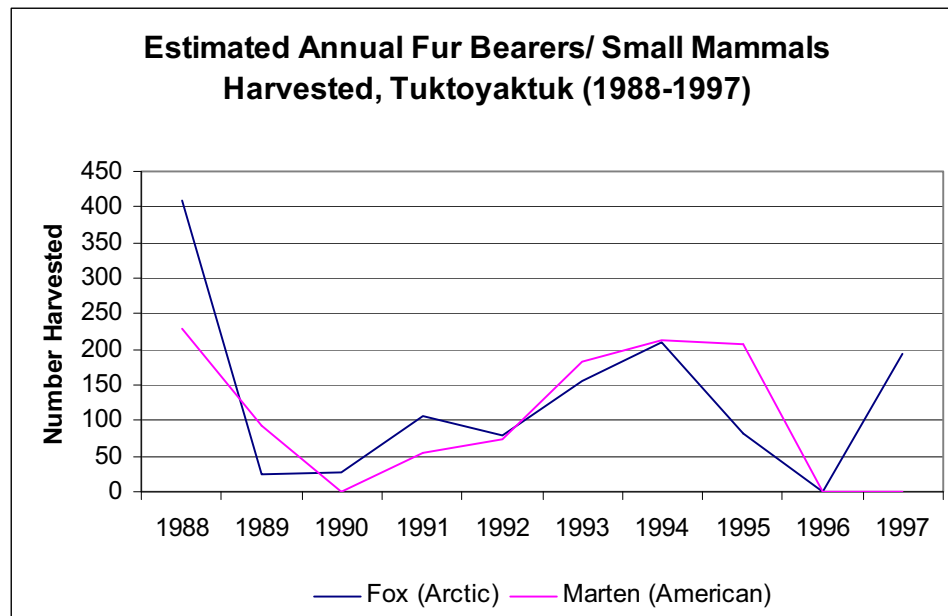


Figure 7.8-11

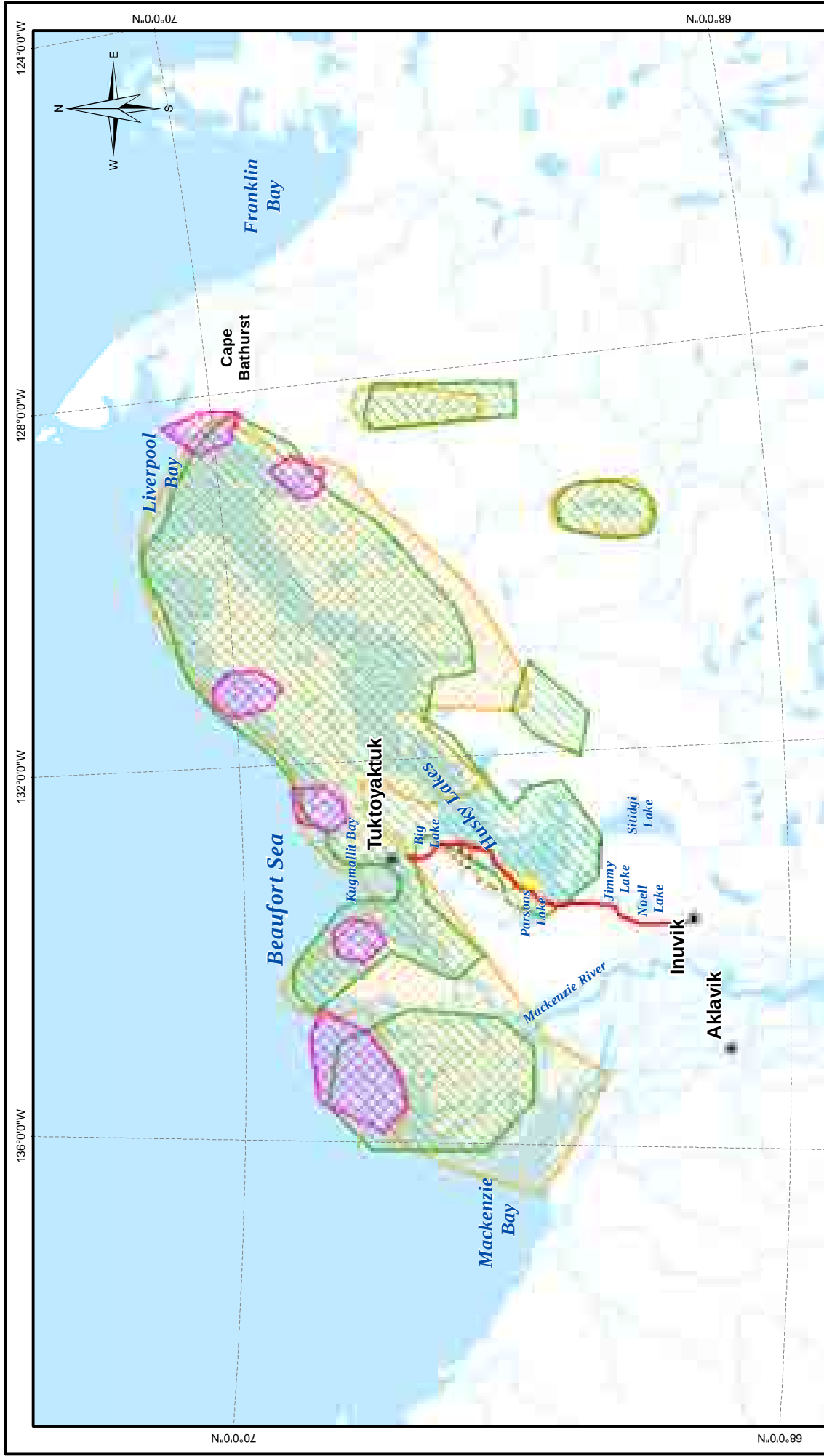
Estimated Annual Fur Bearers / Small Mammals Harvest, Per Species, Tuktoyaktuk (1988-1997)

7.8.2 Waterfowl

Waterfowl are an important food source for the Inuvialuit during the spring and fall and down is traditionally used in pillows and blankets (Community of Inuvik et al. 2000). Figure 7.8-12 depicts the spring, summer and fall goose harvesting areas.

Inuvik

As shown in Figure 7.8-13, the annual harvest rate of the greater white-fronted goose, snow goose and mallard near Inuvik have fluctuated considerably between 1988 and 1997 (Joint Secretariat 2003). Overall, harvest levels declined between 1988 and 1995 but increased again in 1996 and 1997.



LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road

Base data source: National Atlas
Goose Harvest Areas - Joint Secretariat Maps
Area of Geese Congregation - Community Consultation, Oct. 2009

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Scale: 1:2,250,000
Kilometres
10 5 0 10 20 30 40 50 60 70

PROJECTION: Canadian Lambert Conf. Conic
DATUM: NAD83
FILE NO.: V23201098_PDR-Map010-Trad-GooseHarv.mxd

PROJECT NO.: V23201098
OFFICE: EBA-VANC

PROJECT NO.: V23201098
DATE: January 14, 2010

REV: 0

Goose Harvesting Areas
Spring, Summer, Fall

Figure 7.8-12

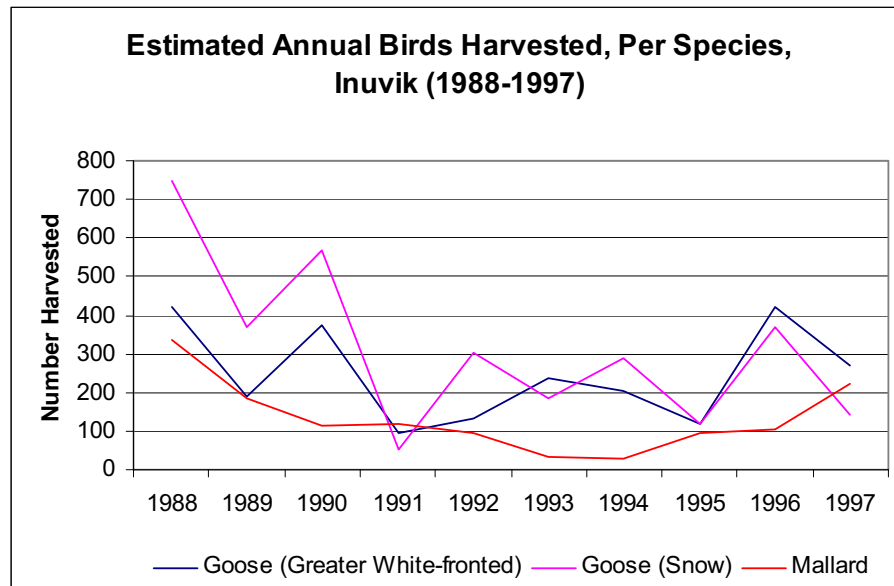


Figure 7.8-13
Estimated Annual Bird Harvest, Per Species, Inuvik (1988-1997)

Tuktoyaktuk

Birds are harvested in the Tuktoyaktuk Planning Area from May 1 to June 30 and August 1 to September 30 each year (Community of Tuktoyaktuk et al. 2000). As shown in Figure 7.8-14, the annual harvest rate of the greater white-fronted goose, snow goose and ptarmigan near Tuktoyaktuk have fluctuated considerably between 1988 and 1997 (Joint Secretariat, 2003).

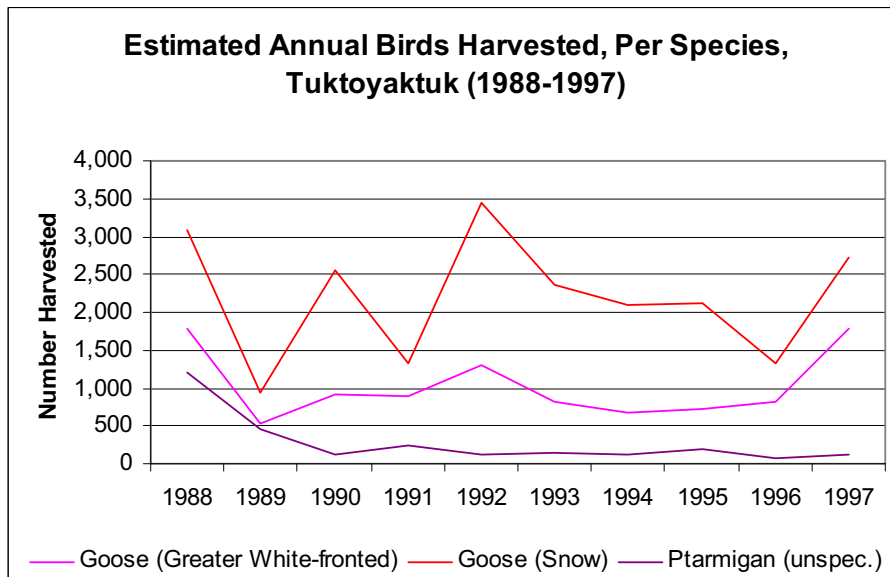


Figure 7.8-14
Estimated Annual Bird Harvest, Per Species, Tuktoyaktuk (1988-1997)

As shown in Figure 7.8-15, the annual harvest rates of eider and mallard ducks near Tuktoyaktuk have fluctuated considerably year to year between 1988 and 1997 (Joint Secretariat 2003). According to the available records, no mallards were harvested near Tuktoyaktuk between 1993 and 1997.

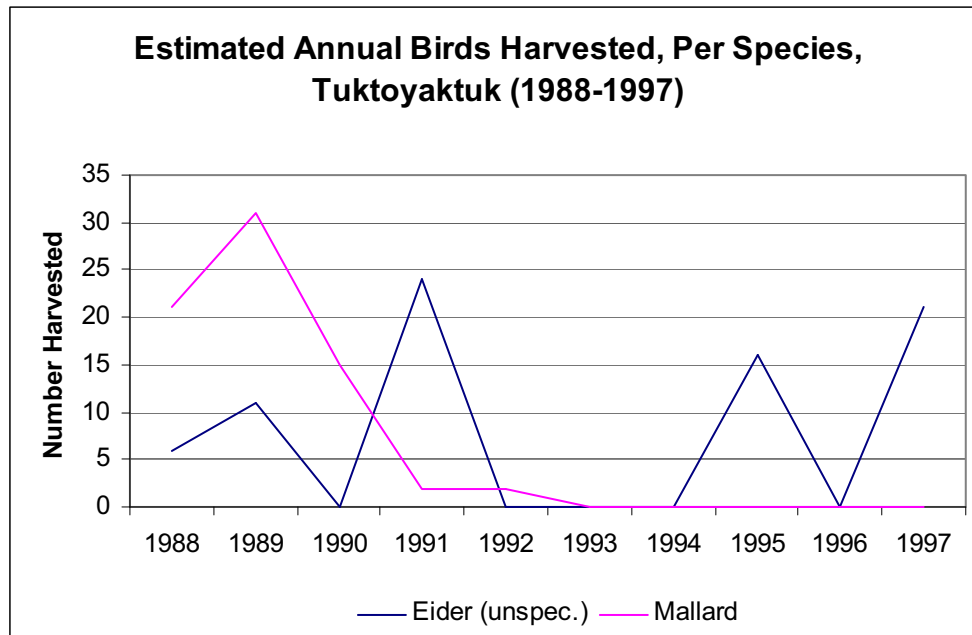


Figure 7.8-15
Estimated Annual Bird Harvest, Tuktoyaktuk (1988-1997)

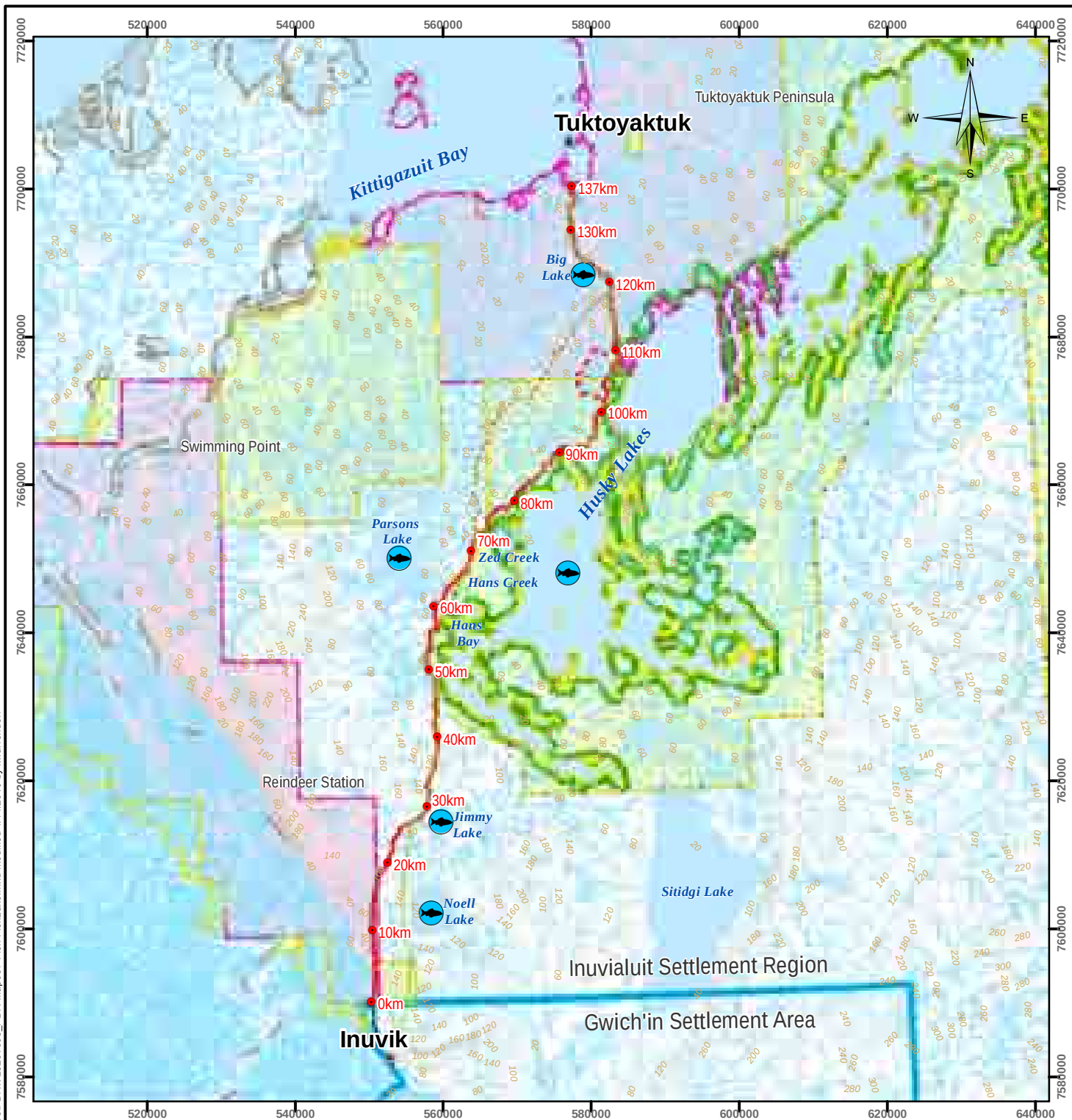
7.8.3 Fish

Fish are an important food source for the Inuvialuit. The main fish bearing lakes along the proposed Highway alignment are depicted in Figure 7.8-16 while fish harvesting areas are depicted in Figure 7.8-17. Fish bearing lakes were identified by Rescan (1999) and IOL et al. (2004), while the fish harvesting areas are identified in the Tuktoyaktuk Community Conservation Plan (Community of Tuktoyaktuk et al. 2000).

Inuvik

Fish species harvested near Inuvik between 1988 and 1997 included Arctic grayling, inconnu, northern pike, lake trout, burbot, lake whitefish and broad whitefish. In general, the harvest of all fish species near Inuvik declined over the reported timeframe. As shown in Figures 7.8-18 and 7.8-19, the greatest reductions in harvest occurred in broad whitefish, from 21,557 in 1988 to 1,149 in 1997; lake whitefish, from 19,094 in 1988 to 261 in 1997; and burbot, from 8,772 in 1988 to 216 in 1997. The 1990 harvest year saw a considerable increase in the harvest of broad whitefish, burbot, and inconnu from the previous year (1989) before further declines were recorded from 1991 onwards.

Q:\Vancouver\GIS\ENVIRONMENTAL\23201\098_PDR-Map007-Fish-FishLake.mxd modified 1/14/2010 by kwarrendorf



LEGEND

- Fish Bearing / Ilkaasuut
- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Husky Lakes 1000m Setback
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand

NOTES

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

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

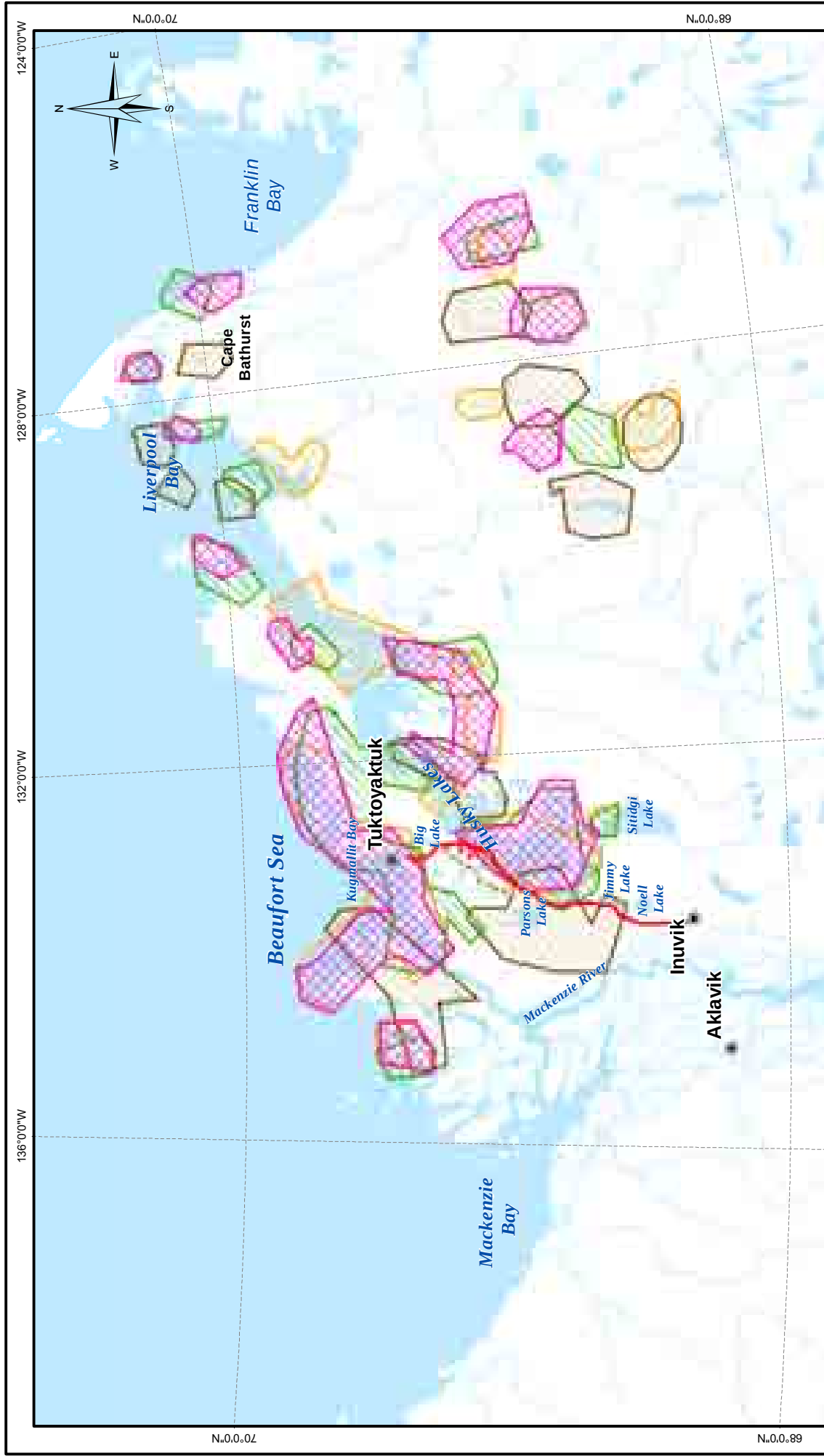
Fish Bearing Lakes Along the Proposed Alignment

PROJECTION UTM Zone 8		DATUM NAD83	
Scale: 1:750,000			
			
Kilometres			
FILE NO. V23201098_PDR-Map007-Fish-FishLake.mxd			
PROJECT NO. V23201098	DWN KWM	CKD TS	REV 0
OFFICE EBA-VANC	DATE January 14, 2010		



Figure 7.8-16

ISSUED FOR USE



Scale: 1:2,250,000

10 5 0 10 20 30 40 50 60 70

Kilometres

PROJECTION
Canadian Lambert Conf. Conic

DATUM
NAD83

FILE NO.
V23201098_PDR-Map009-Trad-FishHarv.mxd

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road

NOTES

Base data source: National Atlas
Fishing Harvest Areas - Joint Secretariat Maps

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Fish Harvesting Areas
Spring, Summer, Fall, Winter

PROJECT NO. V23201098	DWN KMW	CHD TS	REV 0
OFFICE EBA-VANC	DATE January 14, 2010		

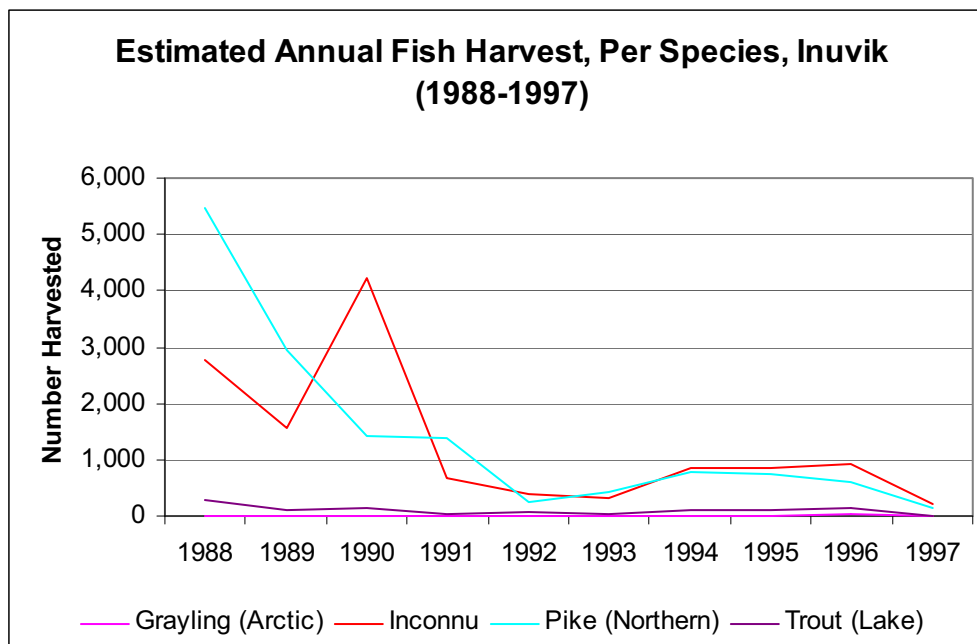


Figure 7.8-18
Estimated Annual Fish Harvest, Per Species, Inuvik (1988-1997)

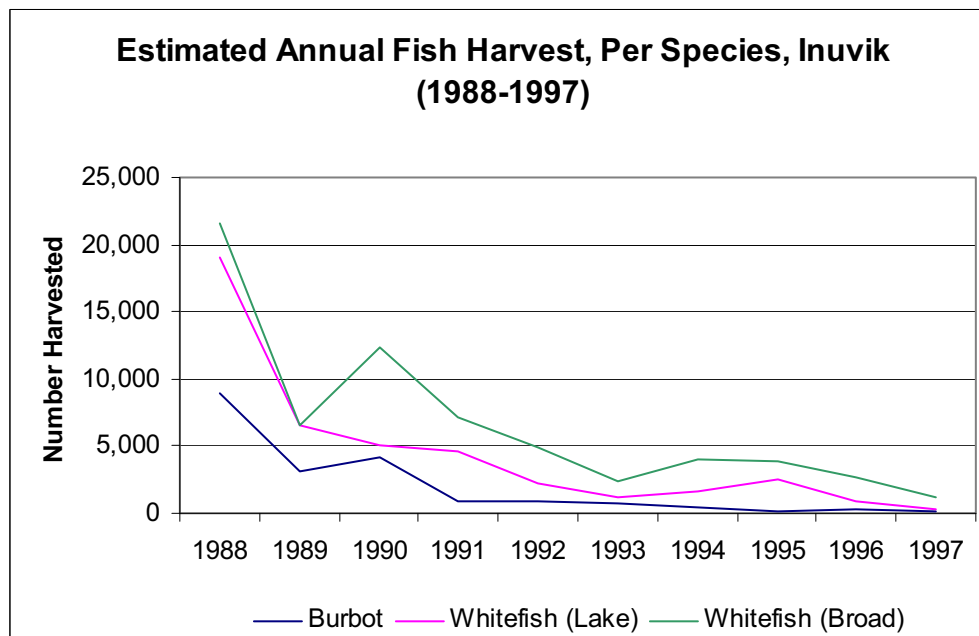


Figure 7.8-19
Estimated Annual Fish Harvest, Per Species, Inuvik (1988-1997)

Tuktoyaktuk

Fish species harvested near Tuktoyaktuk between 1988 and 1997 included inconnu, northern pike, lake trout, burbot, lake whitefish, broad whitefish and cisco. In general, the harvest of cisco near Tuktoyaktuk declined significantly over the reported timeframe. As shown in Figures 7.8-20 and 7.8-21, all other species showed minor fluctuations in the number harvested. Between 1989 and 1990, there was a considerable increase in the harvest of unspecified whitefish from 1988. Inconnu harvesting increased sharply in 1991, and declined again in 1992.

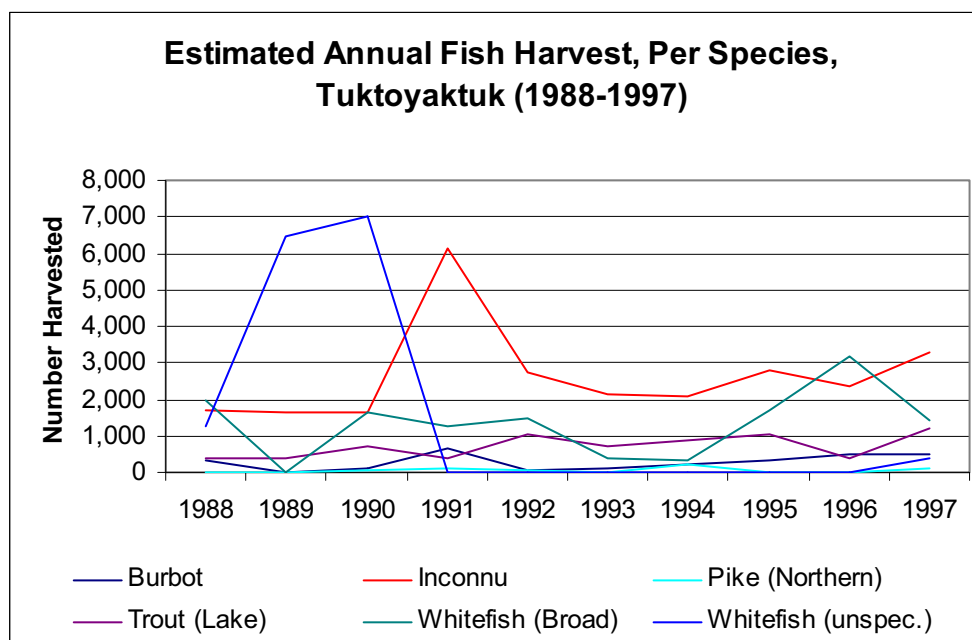


Figure 7.8-20
Estimated Annual Fish Harvest, Per Species, Tuktoyaktuk (1988-1997)

7.8.4 Berries

Berry (asiat) picking is an important summer activity (IOL et al. 2004; Kiggiak-EBA 2008). Key berry species include blueberry (*Vaccinium uliginosum* ssp. *alpinum* and ssp. *Microphyllum*), or asivit, and salmonberry or cloudberry (*Rubus chamaemorus*), or aqpiq. During the October 2009 consultation sessions held for the proposed Inuvik to Tuktoyaktuk Highway, a number of participants at Inuvik and Tuktoyaktuk identified berry picking as an important summer family activity. The participants also indicated that the future highway will help families to access new berry picking areas along the highway that they cannot get to at this time. Furthermore, several of the Tuktoyaktuk participants in the October 2009 consultation sessions also indicated that during the summer of 2009, a number of families drove down the completed portion of the Tuktoyaktuk to Source 177 Access Road to pick berries along the new road.

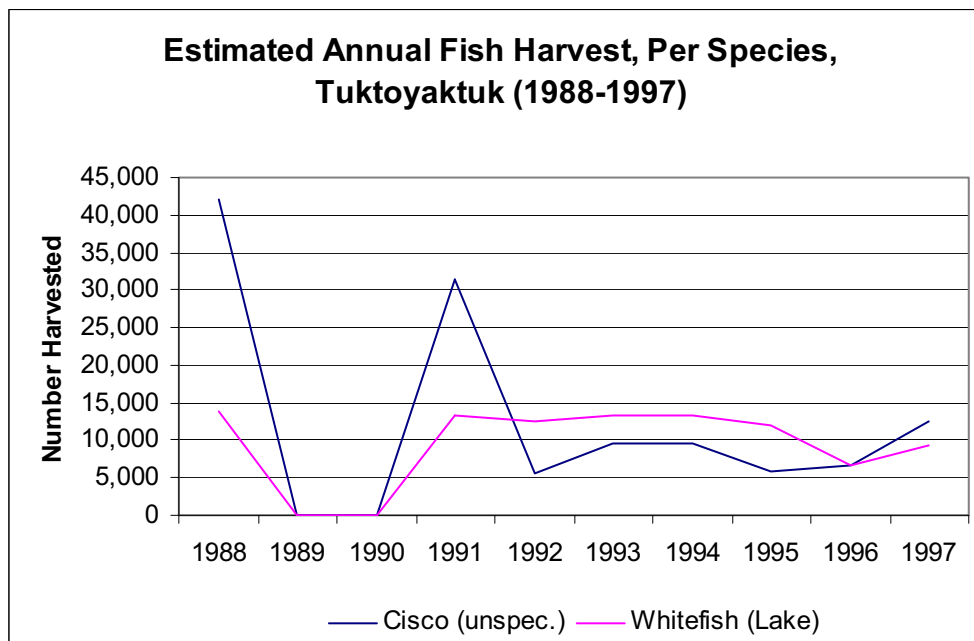


Figure 7.8-21
Estimated Annual Fish Harvest, Per Species, Tuktoyaktuk (1988-1997)

8.0 COMMUNITY 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 October consultations provided insights that the Project Team incorporated into project planning and the development of the Project Description Report. 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 A.

8.1 OCTOBER 2009 CONSULTATIONS

Planning and scheduling for the October 26-30, 2009 consultations began in September 2009. Organizations were contacted to establish availability and to open communication about any questions or comments on the prospect of the Highway. Once meeting dates were set, organizations were provided with confirmation of the meeting place, date, and time, and were also sent a Backgrounder (see Appendix A) that provided a preliminary overview of the proposed Project.

The community meetings in Inuvik and Tuktoyaktuk were publicized using notices on bulletin boards and television advertising in each community. 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 project Partnership, 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 8-1
Tuktoyaktuk Community Meeting, October 27, 2009



Photo 8-2
Tuktoyaktuk Community Meeting, October 27, 2009



Photo 8-3
Inuvik Community Meeting, October 28, 2009



Photo 8-4
Tuktoyaktuk Community Meeting, October 27, 2009



Photo 8-5
Inuvik Community Meeting, October 28, 2009



Photo 8-6
Project Team meeting with ILA in Tuktoyaktuk, October 27, 2009

In the summary provided in Appendix A, 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 proponent,
- 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 Granular 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 Steering Committee and the Partners' about the acceptability of various alignment options. The prospect of development near the Husky Lakes was 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 Highway 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;
- further investigation into the volumes, cost, and construction considerations for the Upland Route alternative to enable reasonable comparison to the 2009 Route. This effort took place in November and December 2009 to support the January 2010 consultations;
- elaboration in the Project Description Report regarding the history of Inuvik to Tuktoyaktuk highway proposals and studies;
- providing October 2009 consultation notes to the communities of Inuvik and Tuktoyaktuk prior to the January 2010 meetings;
- 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
- ongoing discussion with Inuvialuit and Federal regulatory agencies to establish the regulatory path for the project review.

8.2 JANUARY 2010 CONSULTATIONS

On December 18, 2009, community organizations were emailed advance notification that dates would soon be announced in Inuvik and Tuktoyaktuk for meetings during the week of January 11-15, 2010. On January 5, 2010, the community meetings were announced as concurrent evening sessions 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 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 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, a Steering Committee member, 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 for permafrost

protection, 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 Project's regulatory timeline raised a number of questions during the January 13, 2010 regulatory meeting. For example, the Project Team was asked if the timeline considered the potential involvement of the Environmental Impact Screening Committee, the Environmental Impact Review Board, and screening under the Canadian Environmental Assessment Act (CEAA). As well, the Project Team was reminded that the review could take longer if a trigger for a 'comprehensive study' (a more rigorous federal assessment than a screening) under CEAA was invoked. The Project Team was advised that the federal CEAA process would start concurrently with the EISC screening, but there will be a point where the CEAA process must wait for input from the Inuvialuit process. In any event, the federal agencies must receive the Project Description in order to determine what their trigger is and how federal coordination, scoping, and staging would be done.

The Project Steering Committee 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 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. Candidate land tenure arrangements were suggested, along with identification of possible precedents. 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 the clear consensus arising from both meetings was that the participants were generally supportive of the 2009 Route (Photo 8-7). Discussion points from the January meetings are presented in Appendix A. The outcomes of the meetings are summarized below.



Photo 8-7
Tuktoyaktuk Community Meeting, January 14, 2010

The Tuktoyaktuk community meeting began with elder Persis Gruben speaking directly to the community members to express her views on the Project. She expressed her support for the Project and the preferred 2009 Route. She highlighted a number of reasons including increased safety, cheaper costs for Tuktoyaktuk residents, increased opportunities for the youth, and being able to travel year-round.

Tuktoyaktuk residents expressed general satisfaction that the Project Team had employed all reasonable mitigation measures to address the concerns of the community members. Residents of Tuktoyaktuk and Inuvik were generally pleased with the Project'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 project.

Inuvik residents generally indicated great interest in seeing the Highway project move forward. Those who attended the meeting raised no objections to the proposed 2009 Route. However, it must be noted that a few of the community members continued to favour the Upland Route. Participants stated a preference for the Upland route spoke from two perspectives. One perspective was that the Upland route would be several kilometres farther from Husky Lakes than the 2009 Route and with that separation, it might have less of an effect on Husky Lakes. The other perspective preferred the 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 2009 Route were discussed and were generally accepted as a clear rationale for presenting the 2009 Route for funding and regulatory screening. Without opposition or major concerns about the 2009 Route, the discussion 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.

8.3 CONSULTATIONS OUTCOME

Inuvik and Tuktoyaktuk residents identified a long-held community sentiment that a year-round connection between Inuvik and Tuktoyaktuk will 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 results of the consultation meetings (see summary in Appendix A) and subsequent discussions have been integrated into the Partners' decision-making process and the overall project design. The desire and interests brought forward by the communities, and additional information that they provided, has been integrated into the project plan and the preparation of the Project Description Report.

9.0 ENVIRONMENTAL OVERVIEW

The following sections provide a brief description of the biophysical conditions and resources existing in the Inuvik to Tuktoyaktuk Peninsula area. This background information is subsequently considered in Section 10.0 of this Project Description Report to identify potential environmental effects and proposed mitigation measures to avoid or minimize negative effects.

9.1 CLIMATE

Climate data from two meteorological stations operated by Environment Canada, Tuktoyaktuk-A and Inuvik-A are used for the discussion of climate for the Inuvik/Tuktoyaktuk area. Inuvik climate normals between 1971-2000 and 1976-2005 are summarized in Tables 9.1-1 and 9.1-2, respectively. Tuktoyaktuk climate normals between 1971-2000 and 1978 – 2007 are summarized in Tables 9.1-3 and 9.1-4, respectively.

9.1.1 Air Temperature

For both locations the climate is characterized by long, cold winters followed by short summers.

The Inuvik climate normals for the periods of (1971-2000), and (1975-2006), are summarized in Tables 9.1-1 and 9.1-2, respectively. July is the warmest month with a daily average of 14.1°C. The lowest average daily winter temperatures occur in February and the two sets of climate normals indicate that these temperatures have increased over time from -26.9°C (1971-2000) to -26.0°C (1976-2005). The average annual temperature has also increased from -8.8°C (1971-2000) to -8.3°C (1978-2007).

The Tuktoyaktuk A climate normals for the periods of (1971-2000), and (1978-2007) are summarized in Tables 9.1-3 and 9.1-4, respectively. July is again the warmest month with a daily average of 11.0°C. This is 2.1°C cooler than equivalent Inuvik temperatures. The lowest average daily winter temperatures based on the (1971-2000) climate normals occur in January. These temperatures have increased over time from -27.0°C (1971-2000) to -26.4°C (1978-2007). The average annual temperature has also increased from -10.6°C (1971-2000) to -10.1°C (1978-2007).

In general the temperature data indicate that the Tuktoyaktuk climate is 2°C cooler than Inuvik.

Several studies have documented a slight warming of air temperatures in the Mackenzie River Delta. It is anticipated that the Canadian Arctic will continue to experience greater warming and generally higher precipitation, according to the General Circulation Model. Any changes in mean annual temperature would most certainly affect the distribution of permafrost and thermokarst processes (Lawford and Cohen, 1989). Environment Canada (1997a, 1997b) agrees with these observations.

In northern regions, warming is expected to be greatest on land, during winter. Winter precipitation and soil moisture are expected to increase over much of the North. Over the past 100 years, the average temperature of the Mackenzie Basin has risen by about 2.5°C, with the greatest warming occurring in winter and spring (Environment Canada 1997a; 1997b; IOL et al. 2004).

9.1.2 Precipitation

Rainfall generally occurs throughout June through September; while snowfall generally occurs from September through May (Tables 9.1-1 through 9.1-4).

The mean annual total precipitation measured at Tuktoyaktuk has decreased from 167.9 mm (1971-2000) to 165.6 mm (1978-2007). The proportion of rainfall to precipitation has increased from 44.8% (1971-2000) to 46.4% (1978-2007). There has been an increase in the mean annual total snowfall recorded from 95.2 cm (1971-2000) to 104.1 cm (1978-2007). This indicates that slightly greater winter precipitation (snowfall) is occurring over time.

The mean annual total precipitation measured at Inuvik has decreased from 248.4 mm (1971-2000) to 237.9 mm (1976-2005). The proportion of rainfall to precipitation has increased from 47.0% (1971-2000) to 48.0% (1976-2005). There has been a decrease in the mean annual total snowfall recorded from 169.9 cm (1971-2000) to 158.2 cm (1976-2005). This indicates that slightly less winter precipitation (snowfall) is occurring over time.

On an average annual basis Inuvik receives 67% more precipitation than Tuktoyaktuk.

9.1.3 Wind Speed and Direction

The mean annual maximum hourly wind speed at Inuvik between 1971 and 2000 was 54 km/hr, with winds generally from the east. The period with the lowest maximum hourly wind speeds (46 km/hr) occur during April through July. During this period the winds shift direction from east to northeast. The period with the highest maximum hourly wind speed occurs from December to March, (>60 km/hr) typically blowing from the east.

The mean annual maximum hourly wind speed at Tuktoyaktuk between 1971 and 2000 was 72 km/hr, with winds generally from the west. The period with the lowest maximum hourly wind speeds (61 km/hr) occur during March through June where the winds shift direction from west to northeast. The period with the highest maximum hourly wind speeds (85 km/hr) occurs from December to February, typically from the west.

Tuktoyaktuk is located close to the Beaufort Sea and its topography and vegetation leave it less sheltered and more susceptible to greater wind speeds than other communities further inland, such as Inuvik. This is reflected in the average annual winds of 72 km/hr for Tuktoyaktuk compared to Inuvik where the average is 54 km/hr.

TABLE 9.1-1: CLIMATE DATA, INUVIK A STATION, NWT (1971-2000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature:													
Daily Average (°C)	-27.6	-26.9	-23.2	-12.8	0.2	11.3	14.2	11.0	3.7	-8.2	-21.0	-25.7	-8.8
Standard Deviation	4.8	4.7	3.7	4.0	3.0	1.6	1.8	2.0	2.2	2.7	4.8	3.4	1.9
Daily Maximum (°C)	-23.2	-22.0	-17.5	-7.1	5.0	17.3	19.8	16.1	7.8	-4.8	-16.8	-21.3	-3.9
Daily Minimum (°C)	-31.9	-31.7	-28.8	-18.4	-4.7	5.3	8.5	5.9	-0.4	-11.6	-25.1	-30.1	-13.6
Extreme Maximum (°C)	5.4	5.2	6.1	13.8	25.0	32.8	32.8	32.5	26.2	15.0	10.6	5.0	
Extreme Minimum (°C)	-54.4	-49.4	-47.6	-46.1	-26.6	-5.1	-2.2	-5.9	-20.1	-32.9	-42.8	-47.2	
Precipitation:													
Rainfall (mm)	0.1	0.0	0.0	0.0	6.1	20.2	32.9	37.5	18.7	1.3	0.0	0.0	117.0
Snowfall (cm)	17.4	15.0	14.6	13.5	13.1	1.9	0.3	2.4	10.7	34.9	23.7	20.4	167.9
Precipitation (mm)	13.8	11.6	11.0	10.5	17.0	22.1	33.2	39.9	28.0	28.0	17.8	15.7	248.4
Average Snow Depth (cm)	46	54	57	54	20	0	0	0	0	11	29	39	
Median Snow Depth (cm)	47	54	57	55	19	0	0	0	0	10	29	39	
Snow Depth at Month-end (cm)	51	56	59	41	1	0	0	0	2	23	34	42	51
Extreme Daily Rainfall (mm)	1.8	0.2	0.8	.04	19.3	19.1	41.0	33.0	22.9	13.2	0.8	0.4	
Extreme Daily Snowfall (cm)	11.4	13.7	13.0	17.8	24.9	10.2	4.8	22.6	12.2	44.2	22.0	18.6	
Extreme Daily Precipitation (mm)	10.4	13.7	10.8	17.8	24.2	19.3	41.0	42.9	30.7	29.2	16.9	15.8	
Extreme Snow Depth (cm)	89	97	96	99	87	8	3	5	16	81	79	81	
Wind:													
Maximum Hourly Speed (km/hr)	65	56	61	46	47	46	46	56	50	56	56	64	54
Direction of Maximum Hourly Speed	E	E	E	E	NE	NE	NE	E	E	E	E	E	E

Source: Environment Canada 2009. INUVIK A Station; Location: 68°18' N, 133°28.8' W; Elevation: 68.3 m. Climate Station ID: 2202570

TABLE 9.1-2: CLIMATE DATA, INUVIK A STATION, NWT (1976-2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature:													
Daily Average (°C)	-26.7	-26.0	-22.8	-12.0	0.2	11.4	14.0	11.0	3.9	-7.6	-20.4	-24.9	-8.3
Standard Deviation													
Daily Maximum (°C)	-22.5	-21.3	-17.2	-6.5	5.0	17.5	19.5	16.1	7.9	-4.3	-16.4	-20.7	-3.6
Daily Minimum (°C)	-30.8	-30.6	-28.3	-17.6	-4.6	5.3	8.5	5.9	-0.1	-10.9	-24.4	-29.1	-13.1
Extreme Maximum (°C)	5.4	5.2	4.7	13.8	25.0	32.8	32.8	32.5	26.2	20.9	6.9	4.3	
Extreme Minimum (°C)	-50.0	-49.1	-47.6	-40.0	-26.6	-5.1	-1.0	-5.9	-20.1	-32.9	-42.6	-47.2	
Precipitation:													
Rainfall (mm)	0.1	0.0	0.0	0.5	6.6	19.0	31.5	35.9	19.7	0.8	0.0	0.0	114.2
Snowfall (cm)	15.4	15.1	14.4	12.2	14.1	1.9	0.2	2.5	11.5	30.2	21.9	18.9	158.2
Precipitation (mm)	13.6	12.1	11.5	9.9	17.0	20.6	32.0	38.5	28.5	23.8	16.5	14.1	237.9
Average Snow Depth (cm)													
Median Snow Depth (cm)													
Snow Depth at Month-end (cm)	50	55	58	37	0	0	0	0	2	20	32	40	
Extreme Daily Rainfall (mm)													
Extreme Daily Snowfall (cm)													
Extreme Daily Precipitation (mm)													
Extreme Snow Depth (cm)													

Source: Environment Canada, 2009. INUVIK A Station; Location: 68°18' N, 133°28.8' W; Elevation: 68.3 m. Climate Station ID : 2202570

TABLE 9.1-3: CLIMATE DATA, TUKTOYAKTUK A STATION, NWT (1971-2000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature:													
Daily Average (°C)	-27.0	-26.6	-25.7	-16.8	-4.8	6.0	11.0	8.9	2.8	-8.1	-21.0	-25.4	-10.6
Standard Deviation	4.5	4.6	3.5	3.0	2.6	1.6	2	1.9	1.9	2.9	4.0	3.1	
Daily Maximum (°C)	-23.4	-22.6	-21.8	-12.2	-1.1	10.5	15.2	12.3	5.3	-5.6	-17.5	-21.8	-6.9
Daily Minimum (°C)	-30.8	-30.8	-29.7	-21.2	-8.4	1.5	6.8	5.5	0.3	-10.9	-24.5	-29.1	-14.3
Extreme Maximum (°C)	0.6	0.7	-0.5	4.8	20.9	28.2	29.4	27.6	20.4	11.7	2.2	0.8	
Extreme Minimum (°C)	-48.9	-46.6	-45.5	-42.8	-28.9	-8.9	-1.7	-2.5	-12.8	-28.5	-40.1	-46.7	
Precipitation:													
Rainfall (mm)	0.2	0.0	0.0	0.0	1.3	8.1	21.4	27.2	15.6	1.2	0.1	0.3	75.2
Snowfall (cm)	10.1	10.6	6.3	8.9	5.6	1.6	0.1	1.9	8.9	19.2	12.3	9.8	95.2
Precipitation (mm)	9.8	10.2	6.2	8.6	6.8	9.7	21.5	29.1	24.2	19.9	12.2	9.6	167.8
Average Snow Depth (cm)			35	35	21	1	0	0	1	7		18	
Median Snow Depth (cm)			35	35	23	0	0	0	0	6		19	
Snow Depth at Month-end (cm)	30	35	37	32	9	0	0	0	2	11	21	21	
Extreme Daily Rainfall (mm)	2.5	0.4	0.0	0.4	4.0	11.5	19.6	14.7	24.2	8	1	4.8	
Extreme Daily Snowfall (cm)	8.8	9.8	6.5	7.1	9.6	7.6	1	7.4	12.8	9.1	15	9.4	
Extreme Daily Precipitation (mm)	7.1	9.8	6.5	7.1	10.8	11.5	19.6	14.7	24.2	9.1	15	9.4	
Extreme Snow Depth (cm)	61	62	72	72	61	45	0	0	21	26	34	49	
Wind:													
Maximum Hourly Speed (km/hr)	78	89	63	60	67	56	74	74	77	69	74	87	72
Direction of Maximum Hourly Speed	W	W	W	NE	NE	NE	W	SW	NW	W	NW	NW	W

Source: Environment Canada, 2009. TUKTOYAKTUK A Station; Location: 69°25.8' N, 133°1.8' W; Elevation: 4.6 m. Climate Station ID : 2203912

TABLE 9.1-4: CLIMATE DATA, TUKTOYAKTUK A STATION, NWT (1978-2007)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature:													
Daily Average (°C)	-26.4	-26.8	-25.4	-16.0	-4.7	6.2	11.0	8.9	3.2	-7.3	-20.0	-24.1	-10.1
Standard Deviation													
Daily Maximum (°C)	-22.8	-22.7	-21.3	-11.8	-1.2	10.8	15.0	12.3	5.7	-4.7	-16.5	-20.3	-6.5
Daily Minimum (°C)	-30.1	-30.9	-29.3	-20.4	-8.2	1.6	6.9	5.5	0.7	-9.8	-23.3	-27.8	-13.8
Extreme Maximum (°C)	0.0	0.7	-0.5	4.8	20.9	28.2	29.3	27.6	20.9	17.4	0.5	0.8	
Extreme Minimum (°C)	-46.0	-46.6	-45.5	-39.0	-28.9	-8.9	-1.5	-2.5	-11.2	-28.5	-40.1	-42.9	
Precipitation:													
Rainfall (mm)	0.0	0.0	0.0	0.0	1.6	9.6	22.8	25.8	15.2	1.5	0.0	0.2	76.8
Snowfall (cm)	12.6	9.7	9.3	9.8	6.3	1.3	0.1	1.4	8.9	20.2	13.0	11.6	104.1
Precipitation (mm)	10.0	8.6	7.7	8.8	7.1	10.9	22.8	27.2	23.1	19.1	10.9	9.4	165.6
Average Snow Depth (cm)													
Median Snow Depth (cm)													
Snow Depth at Month-end (cm)	29	32	36	31	6	0	0	0	2	11	18	23	29
Extreme Daily Rainfall (mm)													
Extreme Daily Snowfall (cm)													
Extreme Daily Precipitation (mm)													
Extreme Snow Depth (cm)													

Source: Environment Canada, 2009. TUKTOYAKTUK A Station; Location: 69°25.8' N, 133°1.8' W; Elevation: 4.6 m. Climate Station ID : 2203912

9.1.4 Air Quality

Available air quality information for the proposed Inuvik – Tuktoyaktuk Highway corridor has been drawn primarily from the baseline air quality monitoring conducted at Parsons Lake and Inuvik during the period 2001 to 2003 for the proposed Mackenzie Gas Project (IOL et al. 2004). Table 9.1-5 summarizes background concentrations of the key indicator compounds for the Parsons Lake field area, the Storm Hills pigging facility and the Inuvik Area Facility, all of which would be located in the general vicinity of the proposed Inuvik – Tuktoyaktuk Highway corridor.

As noted, background levels of combustion products, e.g., SO₂, NO₃, CO and PM_{2.5} were all low. Detectable levels of ozone (O₃) were recorded, but this was to be expected as ozone levels in northern Canada are naturally high (IOL et al. 2004).

Background levels of VOCs were also recorded but again this was to be expected as organic compounds are released naturally by vegetation and decaying plant material. Background PAI (Potential Acid Input), attributed to the long range transport of acid-forming compounds emitted by large industrial facilities elsewhere in the northern hemisphere, has and will continue to be deposited by precipitation in the region (IOL et al. 2004).

Using the available baseline air quality information, estimated Mackenzie Gas Project emissions (IOL et al. 2004), and the results of modelling, it was predicted that potential air quality effects of the Mackenzie Gas Project, based on the key indicator compounds were generally of a low magnitude, localized in extent and well below existing Northwest Territories air quality standards.

TABLE 9.1-5: BASELINE AIR CONDITIONS FOR PARSONS LAKE AND THE GATHERING PIPELINES AND ASSOCIATED FACILITIES

Parameter	Parsons Lake	Storm Hills Pigging Facility	Inuvik Area Facility
Sulphur dioxide (SO ₂) ¹ (ug/m ³)	0.5	0.5	0.5
Nitrogen dioxide (NO ₂) ¹ (ug/m ³)	0.8	0.8	0.8
Carbon monoxide (CO) ² (ug/m ³)	0.0	0.0	0.0
Fine particulate matter (PM _{2.5}) ² (ug/m ³)	0.0	0.0	0.0
Benzene ³ (ug/m ³)	2.6	2.6	2.6
Total BTEX ^{3,4} (ug/m ³)	3.7	3.7	3.7
Potential acid input ⁵ (keq/ha/a)	0.03	0.03	0.03
Sulphate deposition ⁵ (kg/ha/a)	0.96	0.96	0.96
Nitrate deposition ⁵ (kg/ha/a)	0.62	0.62	0.62
Ozone (O ₃) ^{1,6} (ug/m ³)	46.5	46.5	46.5

NOTES:

- 1 Results based on passive monitoring from Inuvik
- 2 Results assumed to be zero
- 3 Results based on SUMMA canister data from Parsons Lake

- 4 Total BTEX was calculated as the sum of the benzene, toluene, ethylbenzene and xylene concentrations and converted to $\mu\text{g}/\text{m}^3$ assuming the molecular weight of benzene
- 5 Results based on wet deposition monitoring data for Snare Rapids, Northwest Territories
- 6 Background ozone concentrations were not selected as a key indicator, but are important in determining the quantity of NO_x emissions converted to NO_2 in the atmosphere

9.1.5 Climate Change

9.1.5.1 Background

Information collected over many years at northern climate stations, suggests that the climate in the Mackenzie Delta and the Mackenzie Valley region has been changing. Communities and other stakeholders are concerned about the potential effects of climate change on the northern environment and the economy.

Natural variability, expressed as averages over the last 30 years, shows variations in average annual temperatures of 3°C to 6°C . Depending on the climate model scenario used, these exceed by two to three times the average annual temperature increases obtained from the model. Nonetheless, based on observed trends and on future modeled predictions, there is a consistent and gradual warming trend. Generally model results indicate a warming trend in air temperature of up to 2.5°C and an increase in precipitation of up to 11.8% in the 30 years between 2010 and 2039 (IOL et al. 2004).

9.1.5.2 Inuvialuit Settlement Region

Table 9.1-6 summarizes the current climatic conditions as well as past and future climate trends in the Inuvialuit Settlement Region. Expected future temperature changes will be comparable to the changes that have occurred over the last 30 years. For example, the future change in average temperature is between $+1.3^\circ\text{C}$ and $+2.5^\circ\text{C}$. These values are similar to the $+1.5^\circ\text{C}$ increase observed between 1971 and 2000. The current average annual temperature is -10.3°C and the annual average winter temperature is -26.5°C (IOL et al. 2004).

TABLE 9.1-6: CLIMATE CONDITIONS AND CHANGE IN THE INUVIALUIT SETTLEMENT REGION

Parameter	Current ¹ Conditions	Trend (1971 to 2000)	Forecast Trend ² (2010 to 2039)		
			Low	Medium	High
Average annual temperature ($^\circ\text{C}$)	-10.3	+1.5	+1.3	+1.6	+2.5
Average winter temperature ³ ($^\circ\text{C}$)	-26.5	+2.1	+1.3	+2.1	+2.2
Total precipitation ^{4,5} (mm)	191.0	+5.2	+2.1%	+7.4%	+11.8%

Notes:

- 1 Current conditions are based on 1996 to 2000 observations. Source: IOL et al. 2004
- 2 Trend estimates ranges from Burn (2003)
- 3 Winter temperatures are based on December, January and February

4 Total precipitation is presented as millimeters of equivalent rainfall.

3 Future trends are presented as percentage change from the 1961 to 1990 climate normals.

Source: IOL et al. 2004

The future trend in total precipitation in this region ranges from 2.1 to 11.8% above the 1961 to 1990 climate normals. Total precipitation in the Inuvialuit Settlement Region has increased by 5.2 mm during the past 30 years. Current annual total precipitation is 191 mm (IOL et al. 2004). Section 10.8 of this Project Description Report discusses the possible effects of climate change on the future integrity of the Highway and current approaches to the mitigation of this concern.

9.2 GEOLOGY

9.2.1 Bedrock Geology

Bedrock in the Mackenzie Delta is sedimentary, comprised of Tertiary shale and sandstone. Preglacial, glacial and postglacial deposits overlie the bedrock. Depth to bedrock in the Delta ranges from about 50 m near Inuvik to greater than 150 m near the seaward limit of the modern delta.

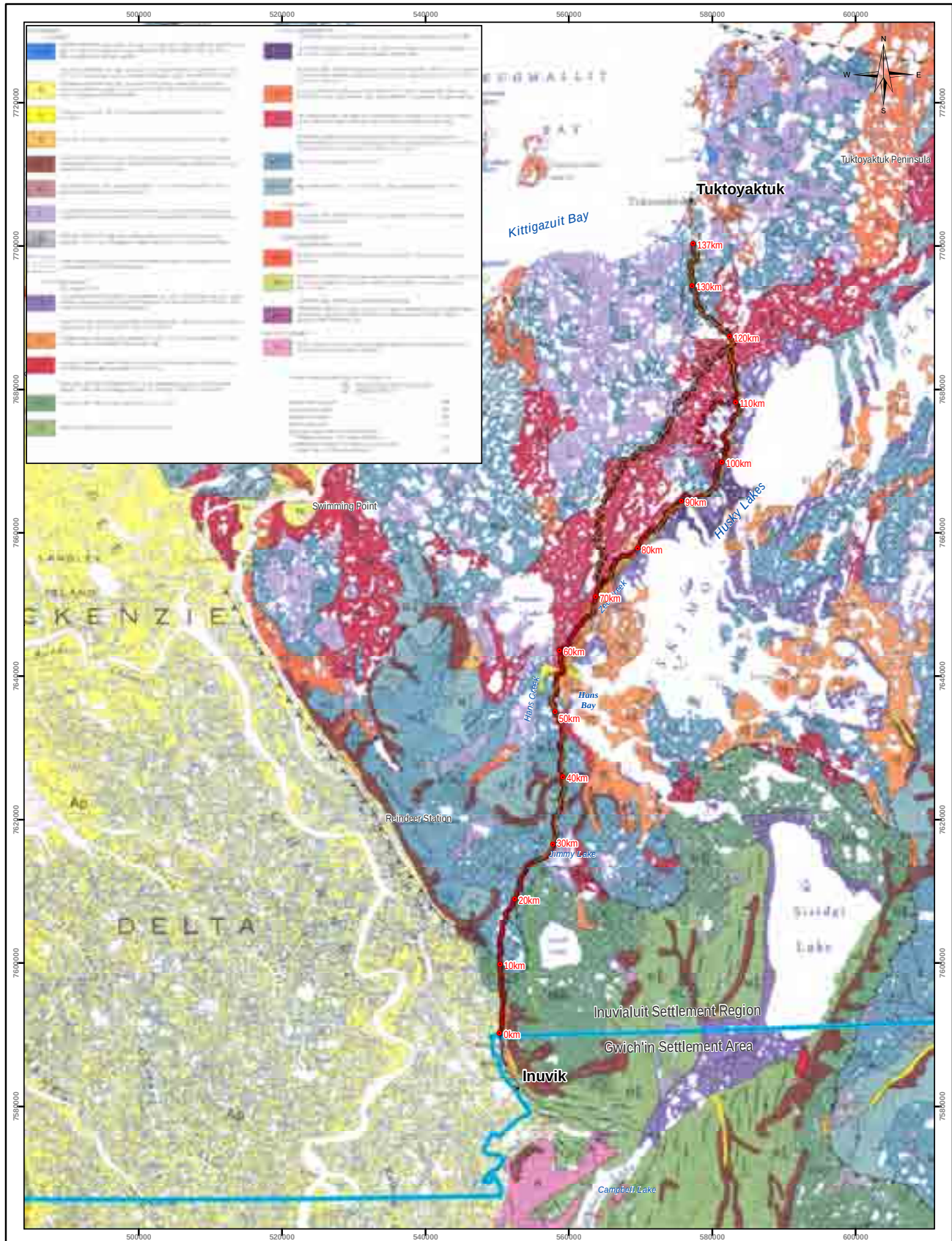
In the northern and eastern parts of the Caribou Hills, north of Inuvik and adjacent to the Parsons Lake area, Tertiary shale lies beneath glacial and post glacial deposits, and occasionally is near surface with rare exposures. The bedrock consists of weathered, poorly indurated shale, sandstone and mudstone. The bedrock in the southern part of the Caribou Hills more commonly consist of Cretaceous shale and regularly outcrops.

The proposed Highway is located within the Cenozoic Sedimentary Rock – Tertiary (IOL et al. 2004). Quaternary glacial deposits overly the Tertiary bedrock, which overlies Cretaceous strata.

9.2.2 Surficial Geology

9.2.2.1 General

Figure 9.2-1, originally generated by Rampton (1987; 1979), illustrates the the surficial geology of the Tuktoyaktuk Peninsula and general project area. 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 alignments enter 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.



LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Gwich'in / Inuvialuit Boundary

NOTES

Base data source:
Natural Resources of Canada - gscmap-a_1647a_e_1987_mn01.jp2, Rampton (1974 and 1987)

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Surficial Geology

PROJECTION UTM Zone 8		DATUM NAD83		  
Scale: 1:500,000 5 2.5 0 5 10 15 				
Kilometres				
FILE NO. V23201098_PDR-Map015-Ter-SurfGeology.mxd				
PROJECT NO. V23201098				
DWN KWM		CKD EG	REV 0	
OFFICE EBA-VANC		DATE January 14, 2010		

Figure 9.2-1

Figure 9.2-1

ISSUED FOR USE

Surface deposits along a more westerly Upland Route from Parsons Lake to Source 177 are primarily hummocky glacial moraine and undulating terrain studded with numerous lakes of the Pleistocene Coastlands region. The terrain is hummocky and irregular due to the ice-contact deposits, glacial depositional features, and thermokarst activity. Depressions are typically post glacial lakes, or infilled with organic-rich bogs and post glacial lacustrine silt and clay sediments. Retrogressive thaw flow slides are not uncommon along the shores and banks of lakes and streams between Parsons Lake and Tuktoyaktuk. Low and high-centre ice-wedge polygons are present in the moraine and lacustrine deposits.

9.2.2.2 Quaternary History

The Quaternary is the present geological time period, often referred to as the glacial age, and the time during which geological processes fashioned the surface of the Earth as it is known today. Quaternary events are largely responsible for the deposition of the surface materials and landforms that influence the design and construction of the Inuvik to Tuktoyaktuk Highway.

The Quaternary Period is subdivided into Pleistocene and Holocene epochs with the Holocene defined as roughly the last 10 thousand years before present. The predominant characteristics of the Quaternary period are marked climatic change, glacial advances and retreats, and the activity of other processes fuelled by climatic oscillations. Climate change is the likely cause of periods of buildup and decay of ice sheets of continental scale, resulted in transgression and regression of oceans, migration and extinction of plants and animals, etc.

9.2.2.3 Terrain

Terrain types common along the proposed route vary from relatively dry upland and hummocky conditions, to wet, ice-rich lacustrine and thick organic conditions. The unfavorable thick organic and ice-rich polygonal terrain was avoided where possible. Routing focused on traversing the most favorable terrain within the study corridor while being conscious of overall length.

As one would suspect, various types of surficial materials occur along the proposed Inuvik to Tuktoyaktuk Highway. The surficial geology along the proposed route/alignment has been generalized into four distinctive landforms (terrain types); morainal, glaciofluvial outwash, lacustrine and alluvial/colluvial deposits. The route corridor contains many seasonal watercourses, wet lowlands, peatlands and lakes, many of which are remnants of glacial outwash channels.

Through the remainder of the Holocene Period, periglacial processes resulted in the mechanical breakdown of materials and contributed to gravity transport of both glacial soils and products of periglacial grinding. Thin alluvial soil deposits formed along watercourses, and pond (lacustrine) deposits have accumulated in shallow depressions. Thicker organic deposits have formed on poorly drained floodplains and low, flat areas.

The following provides a summary of each terrain type based upon field investigations and mapping by Rampton (1987). The generalized terrain types are presented in Table 9.2-1. This classification is based on observations during the field investigation, a review of orthophotographs and LIDAR topographic surveys along the route, and surficial geology mapping by others of the study area. The majority of the route traverses Terrain Types 1 and 2, with Terrain Types 3 and 4 comprising the remainder of the route.

TABLE 9.2-1: TERRAIN TYPES ALONG THE PROPOSED ALIGNMENT

Terrain Type	Terrain Description	Approximate Percent Distribution Along Proposed Alignment
1	Morainal Deposits – deposited directly, or with minor reworking, by glacier ice; generally modified by cryoturbation. (relatively dry, stable, upland tills, overlain by a thin organic cover)	40
2	Glaciofluvial Outwash and Ice-Contact Deposits – deposited at front of, at margin of, within, and under glacier ice. (kame and kettle complexes and thermokarst modified plains, dry to wet, overlain by a thin to moderate organic cover)	35
3	Lacustrine Deposits – deposited in proglacial or glacially dammed basis, during high water phases of Husky Lakes, in thermokarst basins and recent lacustrine deposits. (wet, silt and clay, fine sand and organic sediments, moderate organic cover)	20
4	Alluvial/ Colluvial Deposits – deposited channel, floodplain, deltaic, and debris flow deposits, along ancient channels, present-day streams and steep slopes.	5

Terrain Unit 1

Morainal Deposits also known as “till” consisting of well-compacted to non-compacted material that is non-stratified and contains a heterogeneous, variable mixture of particle sizes, often in a matrix of sand, silt and clay; deposited by direct glacial action. Morainal deposits are generally moderately-well-drained, relatively ice-poor within the active layer, and smooth to rolling topography, with little surface expression of ice-rich permafrost conditions. However, morainal deposits can also include wet till and till with ice-rich permafrost features indicative of more thermally sensitive terrain; these less favorable conditions were avoided where possible.

Terrain Unit 2

Glacial Outwash and Ice-Contact Deposits dominate the middle section of the route. Materials in these depositional environments are usually interbedded mixes of sand and gravel with some silt. They have been transported away from a glacier by a stream of meltwater and deposited as a floodplain along a preexisting valley bottom or broadcast over

a preexisting plain, or have been deposited in ridges, terraces and hummocky terrain along glacial ice contacts. The ground ice contents of these deposits vary greatly and are usually dependent on topographic location. Crests of prominent ridges and hummocks are typically well-drained and ice free to depths of 2 m to 5 m. Below this depth the till is generally icy with ice lenses, and massive ice is common at depth. The deposits are moderately susceptible to thermokarst activity with signs of subsidence and ground ice slumping and gullying. Local drainage patterns tend to be deranged, draining to local ponds. The potential of these deposits as borrow material is limited by ice content. Typically the high crests and hummocks yield useful material.

Ice-contact deposits are often hummocky and irregular, characteristic of the kettle lake and thermokarst terrain. Drainage in most instances is good over the irregular terrain, however imperfect to poorly drained outwash materials are found where groundwater seepage is pronounced. Textures are quite variable and range from silt to subrounded gravels. There is generally a low ice content in the near surface (active layer), but ice content increases with depth and massive ice can be encountered. These deposits represent essentially the only source of useful borrow material on the Pleistocene Plain.

Terrain Unit 3

Lacustrine deposits include wet silt, clay and fine sand, pond/lake bottom sediment deposits that occur in low-lying wet lowland terrain and old lakebeds. They are defined as sediments that have settled from suspension, and occasionally by underwater gravity flows in bodies of standing fresh water. In general, this terrain is poorly drained with standing water, overlain by moderate to thick organic over. Permafrost is present under this terrain unit, except adjacent to large waterbodies.

Lacustrine deposits are generally found in low-lying areas and depressed topography where slopes are nearly flat. Such deposits are present along the entire shoreline of Husky Lakes and in the coastal lowlands of the Pleistocene Plain. Because of the fine textured nature of these sediments, combined with imperfectly to poorly drained conditions, these sediments are ice-rich and highly susceptible to compaction and rutting.

Terrain Unit 4

Post-glacial alluvial and colluvial deposits are materials transported and deposited by streams and gravity. Fluvial deposits are found along many of the watercourses while colluvial materials are indicative of instability on steeper slopes as noted along the Hans River valley where thick sediments have slumped into the valley. Alluvial sediments are commonly moderately to well sorted and display stratification. Colluvial materials are unsorted, derived from surficial deposits that have moved downslope because of gravity-induced movement.

From an engineering perspective, many of the alluvial deposits represent potential aggregate sources, such as those identified along the north terrace of Hans Creek. These sediments are generally well drained, however, where drainage is poor or where groundwater springs are noted, care must be taken not to impact these areas as they will be prone to disturbance.

9.2.3 Permafrost Conditions

The Inuvik to Tuktoyaktuk corridor is located entirely within the zone of continuous permafrost (NRC 2007). Ground temperatures are within the range of minus 2°C to 5°C. Permafrost is defined as any 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 two-year minimum stipulation is meant to exclude from the definition the overlying ground surface layer which freezes every winter and thaws every summer (called the “active layer” or “seasonal frost”). The thickness of the active layer in the Project area is typically between 0.6 m and 0.8 m, but varies from less than 0.5 m to greater than 2.0 m on elevated, organic-free slopes. The underlying permafrost is typically a few hundred metres thick, but depends on various factors including proximity to lakes, slope, aspect, and many other site-specific conditions.

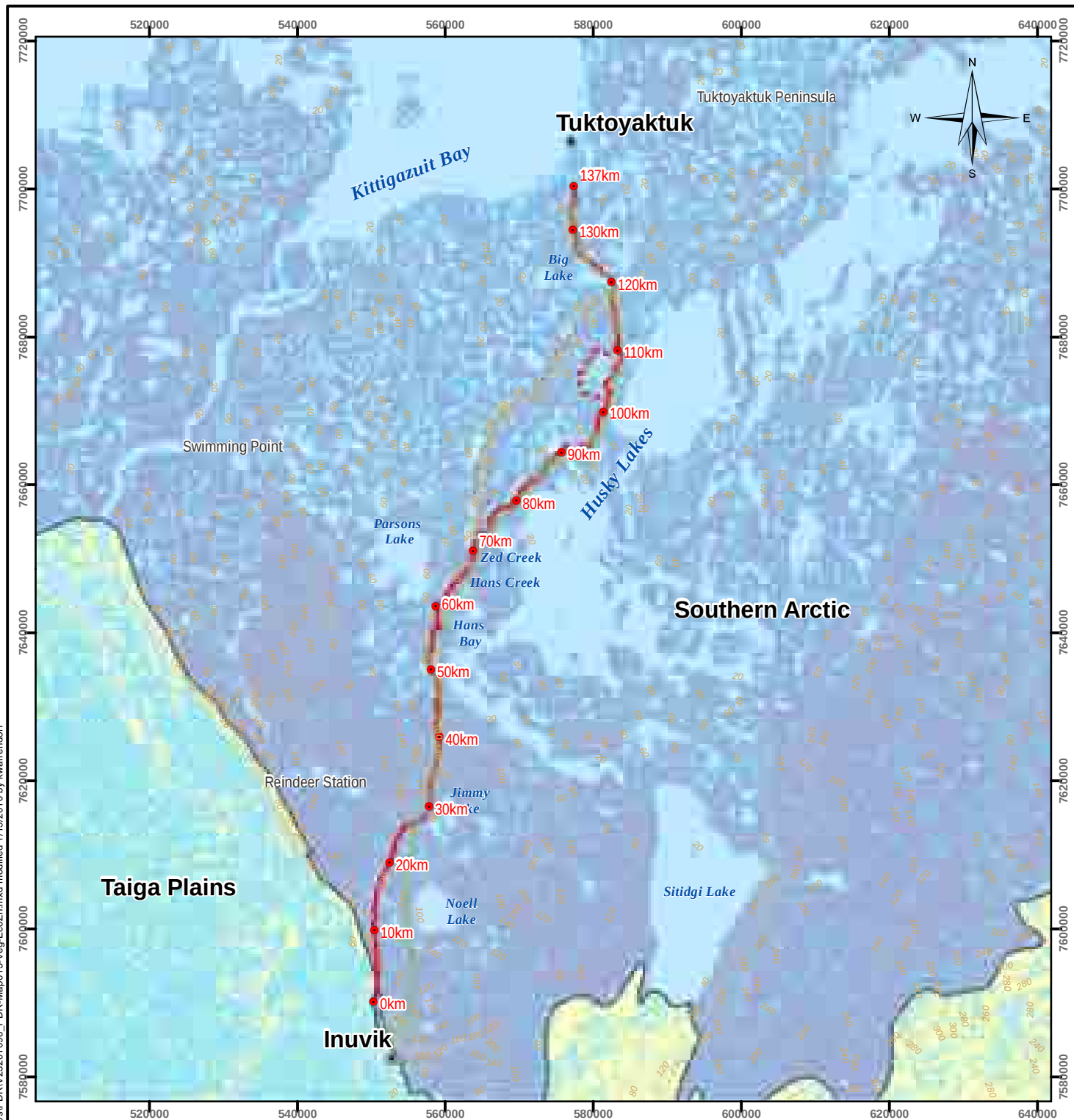
Permafrost is reflected in well developed patterned ground and periglacial processes. The mineral soils in the region generally have high ice content and are sensitive to disturbance. In this periglacial condition there are several forms of frozen ground that can occur. Frozen ground can contain excess 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. The presence of perennially frozen ground limits the percolation of water and promotes the accumulation of organic material. The importance of these ice inclusions is the susceptibility of these materials to melt, the resultant ground disturbance, and the suitability for use as construction material (NRCAN 2007).

9.3 VEGETATION AND SOILS

9.3.1 General

The proposed project is located predominantly within the *Southern Arctic Ecozone*, with a small portion of the highway alignment projecting into the *Taiga Plains Ecozone*, near Inuvik (Figure 9.3-1). An ecozone represents a large generalized unit at the top of the ecological hierarchy as defined by the Canada Committee on Ecological Land Classification, and is characterized by distinctive regional ecological factors, including climate, physiography, vegetation, soils, water, fauna and land use (Ecological Stratification Working Group 1996). The *Southern Arctic Ecozone* extends from the arctic coastline, south close to Inuvik. Inuvik, however, is situated on the edge of the *Taiga Plains Ecozone*. Since Inuvik is at the edge of the *Taiga Plains Ecozone* and the majority of the proposed Highway is within the *Southern Arctic Ecozone*, this ecozone will be described briefly here. The proposed Highway traverses approximately 2.5 km of the *Taiga Plains Ecozone*.

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LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road

- Contour
- Watercourse
- Waterbody
- Wetland

Ecozones

- Southern Arctic
- Taiga Plains

NOTES

Base data source:
NTS 1:250,000
Eco Zones: NWT WWF Data

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Ecozones

PROJECTION
UTM Zone 8

DATUM
NAD83

Scale: 1:750,000



FILE NO.
V23201098_PDR-Map013-Veg-EcoZn.mxd

PROJECT NO.
V23201098

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DATE
January 14, 2010



Figure 9.3-1

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Inuvik and the Mackenzie Delta lie within the *Taiga Plains Ecozone*. This ecozone is dominated by Canada's largest river, the Mackenzie, and its tributaries. It is characterised by an open, generally slow growing, conifer dominated forests of predominantly spruce (Photo 9.3-1). 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 (Photo 9.3-2). The Mackenzie Valley forms one of North America's most travelled migratory corridors for waterfowl (ducks, geese, and swans) breeding along the arctic coast. The Tuktoyaktuk Peninsula lies within the *Southern Arctic Ecozone*. The topography is fairly level, rising from sea level to approximately 100 m in elevation at Granular Source 177. The Mackenzie Gas Project Environmental Impact Statement (IOL et al. 2004) describes this ecozone and corresponding vegetation in detail.



Photo 9.3-1

The northern edge of the Taiga Plains Ecozone is dominated by a slow growing spruce forest



Photo 9.3-2
Mixed wood forests occur on better drained sites such as upland and foothill areas

Numerous lakes, ponds, and streams are common across the Peninsula. Vegetation grows on a veneer of unfrozen organic or granular substrate overlying the permafrost. The dominant vegetation along the proposed Highway alignment is characterized by a continuous cover of shrubby tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, *Dryas* spp., and sedge tussocks (Photo 9.3-3). In wetter areas, sedges, cotton-grasses and sphagnum moss dominate high-centered and low-centered polygons. Drier areas support ericaceous shrubs. Riparian communities include wet sedge communities and taller shrubs (Photo 9.3-4).

9.3.2 Vegetation Communities

The proposed Highway occurs over a variety of terrain and plant community associations (community types) (Figure 9.3-2). The following vegetation communities are described in this section: dwarf shrub heath, upland shrub, cotton-grass tussock, high-centered polygons, low-centered polygons, riparian shrub, riparian sedge – cotton-grass, coastline shrub, coastline sedge – cotton-grass, coastline low-centered polygons, and transition forest.

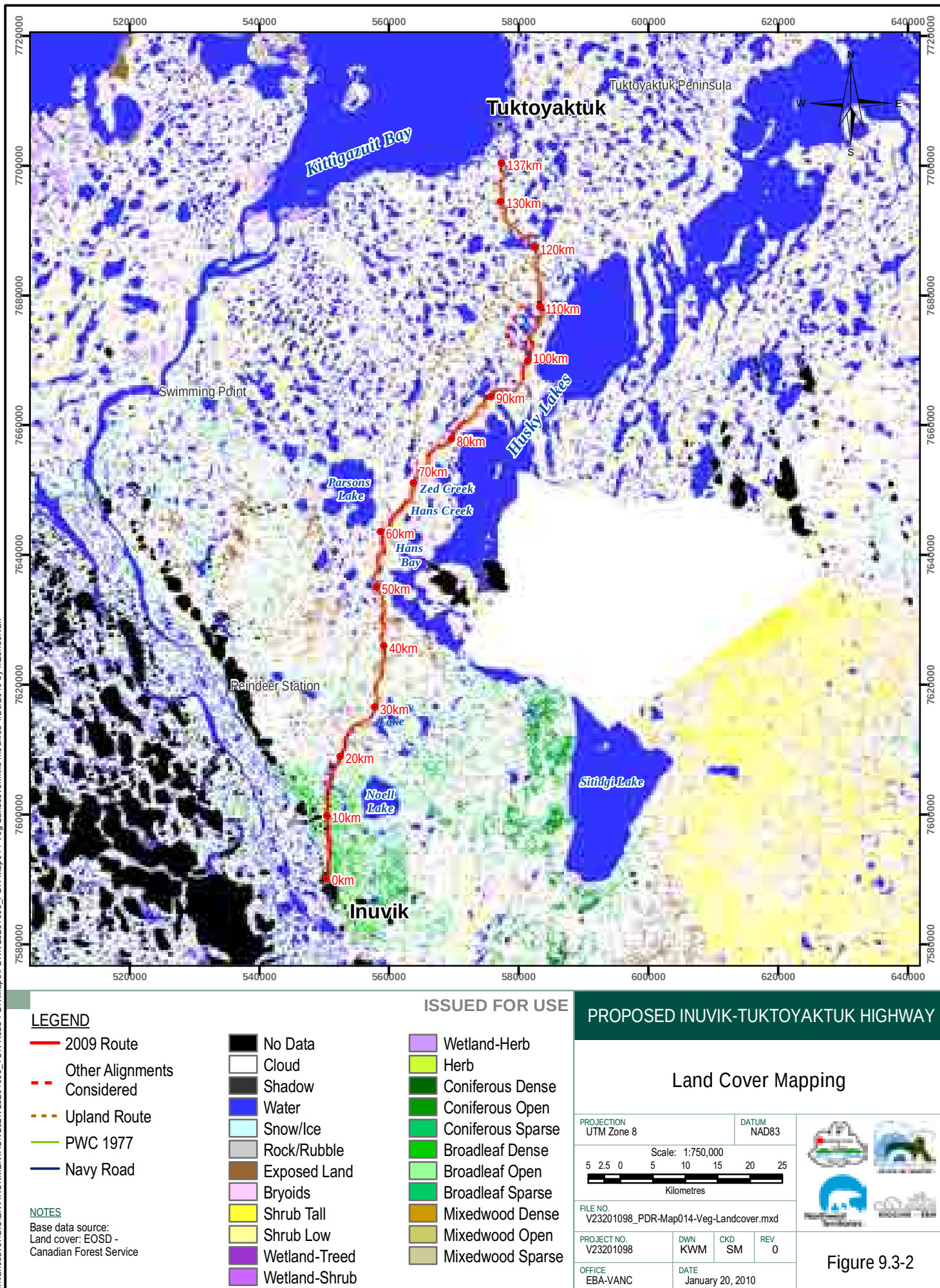


Photo 9.3-3
The dominant vegetation along the proposed road alignment is characterized by shrubby tundra vegetation, consisting of dwarf birch and willow



Photo 9.3-4
Sedge and cotton-grass communities, such as this pond, provide valuable nesting habitat for waterfowl

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9.3.2.1 Dwarf Shrub Heath

Dwarf shrub heath is the most common tundra community type occurring on the Tuktoyaktuk Peninsula (Photo 9.3-5) and has characteristic vegetation consisting of narrow-leaved Labrador tea and alpine bilberry. This community type is widespread throughout flat and rolling terrain, located on a variety of parent materials including glaciofluvial, morainal and colluvial materials. The soils are usually moderately to imperfectly drained, but can be poorly drained in lower landscape positions, as the shallow permafrost table controls drainage. A veneer of peat is often present over mineral deposits, but is usually thinner than 50 cm. Sites with dwarf shrub heath are usually located in crest, upper to mid-slope positions but less commonly in depressions.



Photo 9.3-5

Dwarf shrub heath is a common tundra community type occurring on Tuktoyaktuk Peninsula, and are characterized by narrow-leaved Labrador tea and alpine bilberry

Permafrost features, such as thermokarst subsidence or frost boils, are often present. Topography is undulating with slopes up to 5%. Soils are often Terric Fibric Organic Cryosols and Orthic Eutric or Dystric Turbic Cryosols. The nutrient regime is estimated to be poor and the moisture regime ranges from mesic to hygric. The active layer depth ranges from 18 to 200 cm (IOL et al. 2004).

Dwarf shrubs make up most of the shrub and ground cover layers. Arrow-leaved coltsfoot is an indicator species for this community type. Plant species found within this community type include:

Species	Scientific Name
Arctic Dwarf Birch (Dwarf Birch)	<i>Betula nana</i> (<i>B. glandulosa</i> , <i>Betula</i> × <i>eastwoodiae</i>)
Green Alder	<i>Alnus viridis</i> (incl <i>A. crispa</i>)
Rock Cranberry (Lingonberry)	<i>Vaccinium vitis-idaea</i>
Narrow-leaved Labrador Tea	<i>Ledum palustre</i> ssp <i>decumbens</i> (<i>L. decumbens</i>)
Arctic Sweet Coltsfoot	<i>Petasites frigidus</i> (<i>P. arcticus</i> , <i>hyperboreus</i> , <i>palmatus</i> , <i>sagittatus</i> , and <i>vitifolius</i>)
Cloudberry	<i>Rubus chamaemorus</i>
Black Crowberry	<i>Empetrum nigrum</i>
Red Bearberry	<i>Arctostaphylos rubra</i>
Alpine Bilberry	<i>Vaccinium uliginosum</i>

Source: GNWT ENR 2009a

Of the non-vascular plant species likely to be found in the area, common lichens are reindeer lichens and *Cetraria* spp., and peat moss is the most common bryophyte. *Peltigera* species are often associated with low cover values.

9.3.2.2 Upland Shrub

Slopes on upland areas are frequently vegetated with an upland shrub community type and have characteristic vegetation consisting of willows, *Salix glauca*. This community type typically occurs as lower and/ or taller shrubs forming a scattered to open canopy (Photo 9.3-6). Indicator species of this community type are willow, Arctic sweet coltsfoot, bistort, and lousewort.



Photo 9.3-6

Upland shrub represents another common community type and is dominated by willow, *Salix glauca*

The upland shrub community type occurs on morainal or lacustrine landforms with fine silty clay and loamy texture. Most sites with upland shrub have a hygric to subhydryc moisture regime with moderate to poor drainage and fairly level to gently rolling topography. Soils might be Orthic Eutric Static and Turbic Cryosols. The upland shrub community type also grows on coarse glaciofluvial sediments with coarse loamy sand to sandy loam parent material texture. At these locations, this community type is more common on the mid to lower landscape positions where drainage is restricted by permafrost. Sites with upland shrub can have thermokarst subsidence or occasional, but poorly developed, ice-wedge polygons. A veneer of peat is often present over mineral deposits, but is usually thinner than 40 cm. Sites with upland shrub have poor nutrients and a subhygric to hygric moisture regime. The active layer depth ranges from 25 to 67 cm (IOL et al. 2004).

Plant species found within this community type include:

Species	Scientific Name
Arctic Dwarf Birch (Dwarf Birch)	<i>Betula nana</i> (<i>B. glandulosa</i> , <i>Betula</i> × <i>eastwoodiae</i>)
Gray willow	<i>Salix glauca</i> (<i>S. cordiflora</i> ssp <i>callicarpea</i> and <i>glauca</i> ssp <i>stenolepis</i> ?)
Green Alder	<i>Alnus viridis</i> (incl <i>A. crispa</i>)
Rock Cranberry (Lingonberry)	<i>Vaccinium vitis-idaea</i>
Red Bearberry	<i>Arctostaphylos rubra</i>
Arctic Sweet Coltsfoot	<i>Petasites frigidus</i> (<i>P. arcticus</i> , <i>hyperboreus</i> , <i>palmaris</i> , <i>sagittatus</i> , and <i>vitifolius</i>)
Meadow Bistort	<i>Bistorta plumosa</i> (<i>Polygonum bistorta</i> ssp <i>plumosum</i>)
Tilesius Sagebrush	<i>Artemisia tilesii</i>
Black Crowberry	<i>Empetrum nigrum</i>
Steven Meadow-sweet (<i>Spiraea</i>)	<i>Spiraea stevenii</i> (<i>S. beauverdiana</i>)

Source: GNWT ENR 2009a

Of the non-vascular plant species likely to be found in the area, common lichens include reindeer lichens, *Cetraria* spp. and club lichens.

9.3.2.3 Cotton-Grass Tussock

The cotton-grass tussock community type is found on lower slopes and lowlands where ground water creates hygric-subhydryc soil moisture (Photo 9.3-7), particularly in the valley between the Storm Hills. The characteristic vegetation for this community type includes tussock cotton-grass.

The cotton-grass tussock community type is located mostly within fine-textured morainal and lacustrine landscapes. Drainage is usually imperfect to poor. Peat is often present as a thin veneer over mineral deposits. Sites with cotton-grass tussock can be subject to inundation or permafrost, and demonstrate features such as thermokarst subsidence and frost heave. Micro-topography is hummocky, with regional slopes less than 10%. Soils are typically either Terric Fibric or Mesic Organic Cryosols when there is more than 40 cm of

organic material, or Orthic Eutric Turbic Cryosols when there is less than 40 cm of organic material at the surface. The nutrient regime in this community type is typically considered to be poor with a moisture regime ranging from hygric to subhydryc. The active layer depth ranges from 11 to 75 cm (IOL et al. 2004).



Photo 9.3-7

Cotton-grass tussock communities are found on lower slopes and lowlands where ground water creates hygric to subhydryc soil conditions

Sheathed cotton-grass is the dominant species in this community type. It forms dense tussocks along with two sedges, *Carex lugens* and *C. consimilis*. In between the tussocks, sphagnum species thrive, whereas shrub species are less prominent because of the high moisture levels. Cloudberry is also found in the ground cover. Species potentially found within this community type include:

Species	Scientific Name
Arctic Dwarf Birch (Dwarf Birch)	<i>Betula nana</i> (<i>B. glandulosa</i> , <i>Betula</i> $\times$ <i>eastwoodiae</i>)
Tussock Cotton-grass	<i>Eriophorum vaginatum</i>
Rock Cranberry (Lingonberry)	<i>Vaccinium vitis-idaea</i>
Narrow-leaved Labrador Tea	<i>Ledum palustre</i> ssp <i>decumbens</i> (<i>L. decumbens</i>)
Bigelow's Sedge	<i>Carex bigelowii</i> (<i>C. consimilis</i> , <i>C. lugens</i> , <i>C. cyclocarpa</i> , <i>C. yukonensis</i> , <i>C. anguillata</i>)
Diamond-leaved Willow	<i>Salix planifolia</i> (incl <i>Salix tyrrellii</i>)
Black Crowberry	<i>Empetrum nigrum</i>
Cloudberry	<i>Rubus chamaemorus</i>

Source: GNWT ENR 2009a

Of the non-vascular plant species likely to be found in the area, *Cladonia* and *Cetraria* lichen species are sometimes present.

9.3.2.4 High-centered Polygons

High-centered polygons are found localized in depression areas and flats on the Tuktoyaktuk Peninsula, and have characteristic vegetation consisting of narrow-leaved Labrador tea and rock cranberry. They have large net-like patterns with high centers surrounded by water-filled troughs with ice bottoms (Photo 9.3-8). The centre of each polygon develops a dome of peat and is vegetated with upland species similar to the dwarf shrub heath community type.



Photo 9.3-8
High-centered polygons have large net-like patterns with high center surrounded by water-filled troughs with ice bottoms

In many high-centered polygons, a thick layer of strongly cryoturbated, mixed organic and mineral soil underlies surface peat deposits. The polygons are usually located in poorly drained areas that occupy low landscape positions such as depressions associated with thermokarst lakes or ponds, pingos, hollows or channel-like features. Sites with high-centred polygons occur in ice-rich, fine-grained soils with a silty clay loam to clay loam texture on the morainal landforms and small lacustrine basins. The organic layer on these soils is usually less than 50 cm thick. Soils are typically Terric Mesic Organic Cryosols and Orthic Dystric and Brunisolic Dystric Turbic Cryosols. The nutrient regime in areas with high-centred polygons is poor, and the moisture regime ranges from subhygric to hydric. The active layer depth ranges from 29 to 40 cm (IOL et al. 2004).

Plant species found within this community type include:

Species	Scientific Name
Narrow-leaved Labrador Tea	<i>Ledum palustre ssp decumbens (L. decumbens)</i>
Rock Cranberry (Lingonberry)	<i>Vaccinium vitis-idaea</i>
Cloudberry	<i>Rubus chamaemorus</i>
Black Crowberry	<i>Empetrum nigrum</i>
Red Bearberry	<i>Arctostaphylos rubra</i>

Source: GNWT ENR 2009a

Of the non-vascular plant species likely to be found in the area, Reindeer lichens are prominent and *Cetraria* and club lichens also occur on most sites with high-centred polygons.

9.3.2.5 Low-centered Polygons

Low-centered polygon communities are localized in depression areas and drained lake basins on the Tuktoyaktuk Peninsula, typically adjacent to areas of standing water (Photo 9.3-9). Characteristic vegetation for this community type includes dwarf birch, diamond-leaved willow, and tussock cotton-grass. Low-centered polygons often occur adjacent to high-centered polygons and are usually similar in pattern size. The centres of the polygons are depressed, often containing pond water and covered with wetland vegetation (predominantly peat moss).



Photo 9.3-9

Low-centered polygon communities are localized in depression areas and drained lake basins on the Tuktoyaktuk Peninsula, typically adjacent to areas of standing water

The polygons are bordered by soil ridges pushed up by ice wedges that are formed in cracks and develop during freeze-thaw cycles. Surface peat deposits are typically less than 60 cm thick, and are underlain by a thick layer of strongly cryoturbated, mixed organic and mineral soil. Leatherleaf is an indicative plant of this community type; however, it has a low percent cover value, being restricted to the outer soil ridges.

The polygons are usually located in poorly-drained areas that occupy low landscape positions such as depressions associated with thermokarst lakes or ponds, pingos, hollows or channel-like features. Sites with low-centred polygons occur in ice-rich, fine-grained soils with a silty clay loam to clay loam texture on the morainal landforms and small lacustrine basins. The organic layer on these soils is usually less than 50 cm thick. Soils are typically Terric Mesic Organic Cryosols and Orthic Dystric or Eutric Turbic Cryosols, and occasionally, Gleyed Turbic Cryosols. This community type is nutrient poor and has a moisture regime ranging from subhygric to hydric. The active layer depth ranges from 11 to 50 cm (IOL et al. 2004).

The drier ridges are dominated by dwarf shrub heath vegetation. Plant species found within this community type include:

Species	Scientific Name
Arctic Dwarf Birch (Dwarf Birch)	<i>Betula nana</i> (<i>B. glandulosa</i> , <i>Betula</i> × <i>eastwoodiae</i>)
Diamond-leaved Willow	<i>Salix planifolia</i> (incl <i>Salix tyrrellii</i>)
Green Alder	<i>Alnus viridis</i> (incl <i>A. crispa</i>)
Tussock Cotton-grass	<i>Eriophorum vaginatum</i>
Alpine Bilberry	<i>Vaccinium uliginosum</i>
Bigelow's Sedge	<i>Carex bigelowii</i> (<i>C. consimilis</i> , <i>C. lugens</i> , <i>C. cyclocarpa</i> , <i>C. yukonensis</i> , <i>C. anguillata</i>)
Narrow-leaved Labrador Tea	<i>Ledum palustre</i> ssp <i>decumbens</i> (<i>L. decumbens</i>)
Rock Cranberry (Lingonberry)	<i>Vaccinium vitis-idaea</i>
Cloudberry	<i>Rubus chamaemorus</i>
Black Crowberry	<i>Empetrum nigrum</i>
Pumpkin-fruited Sedge	<i>Carex rotundata</i>

Source: GNWT ENR 2009a

Of the non-vascular plant species likely to be found in the area, common lichen species include reindeer lichens and *Cetraria* spp.

9.3.2.6 Riparian Shrub

The riparian shrub community type is found along streams and drainage basins in the southern portion of the Highway corridor, comprising of taller shrubs such as diamond-leaved willow, Arctic dwarf birch, and green alder (Photo 9.3-10). This community type is most common on silty sand fluvial deposits associated with small streams. Topography is subdued and concave, with slopes up to 5%. Soils are usually moderately well to poorly drained, with a shallow permafrost table and water table near the surface. Seasonal or

occasional flooding deposits fresh silt and fine sand layers on the surface of the soils. Soils are commonly Regosolic Static Cryosols and occur close to the active river channel. Peat can be present as a veneer over mineral deposits in the areas above the flooding zone. Sites with riparian shrub have a poor to medium nutrient regime and the moisture regime ranges from hygric to hydric. The active layer depth ranges from 18 to 90 cm (IOL et al. 2004).

Species found within this community type include:

Species	Scientific Name
Diamond-leaved Willow	<i>Salix planifolia</i> (incl <i>S. tyrrellii</i>)
Arctic Dwarf Birch (Dwarf Birch)	<i>Betula nana</i> (<i>B. glandulosa</i> , <i>Betula</i> × <i>eastwoodiae</i>)
Green Alder	<i>Alnus viridis</i> (incl <i>A. crispa</i>)
Water Sedge	<i>Carex aquatilis</i>
Rock Cranberry (Lingonberry)	<i>Vaccinium vitis-idaea</i>
Narrow-leaved Labrador Tea	<i>Ledum palustre</i> ssp <i>decumbens</i> (<i>L. decumbens</i>)
Marsh Cinquefoil	<i>Comarum palustre</i> (<i>Potentilla palustris</i>)
Cloudberry	<i>Rubus chamaemorus</i>
Black Crowberry	<i>Empetrum nigrum</i>

Source: GNWT ENR 2009a

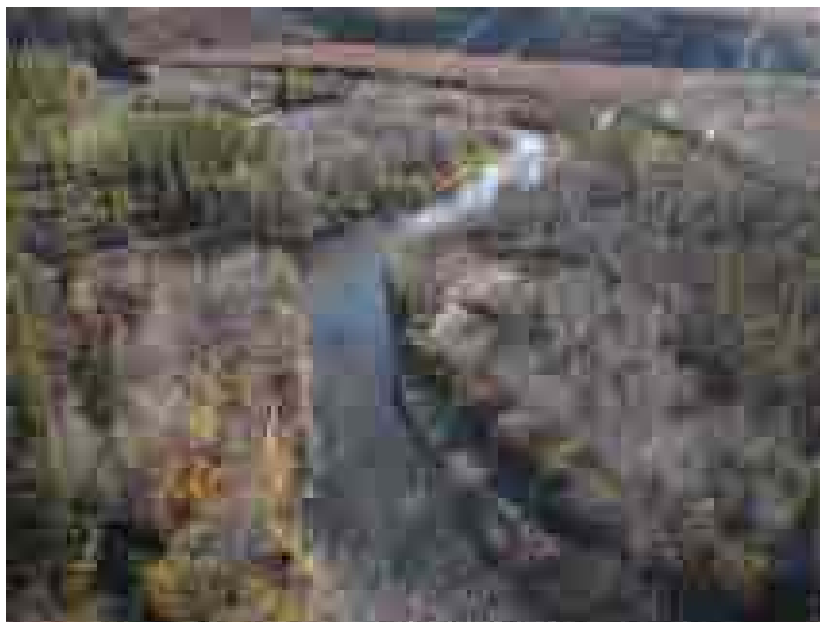


Photo 9.3-10
Riparian shrub communities are found along streams and drainage basins in the southern portion of the Highway corridor

9.3.2.7 Riparian Sedge - Cotton-Grass

The riparian sedge – cotton-grass community type occurs on the perimeters of small lake and ponds (Photo 9.3-11), and less commonly along small streams, in the Tuktoyaktuk Peninsula. The dominant vegetation is water sedge (*Carex aquatilis*). Indicator species for this community type include water horsetail and buckbean. Peat moss is the most prominent nonvascular component.



Photo 9.3-11

Riparian sedge – cotton-grass communities occur on the perimeters of small lakes and ponds

The riparian sedge – cotton-grass community type is most common on silty sand deposits associated with the small lakes and ponds. Topography is subdued with slopes up to 5%. Soils are usually imperfectly to very poorly drained, with a shallow permafrost table. Seasonal or occasional flooding deposits fresh silt sand fine sand layers on the surface of the soils and there is little to no organic material. Soils are most commonly Regosolic Static Cryosols, Gleyed Static or Turbic Cryosols. Parent material textures typically range between silty clay loam and loam. Sites with riparian sedge – cotton-grass have a poor nutrient regime and the moisture regime ranges from subhydric to hydric. The active layer depth ranges from 15 to 45 cm (IOL et al. 2004).

Species found within this community type include:

Species	Scientific Name
Water Sedge	<i>Carex aquatilis</i>
Water Horsetail	<i>Equisetum fluviatile</i>
Bog Buckbean	<i>Menyanthes trifoliata</i>

Source: GNWT ENR 2009a

9.3.2.8 Coastline Shrub

The coastline shrub community type occurs on floodplains and levees in the Mackenzie Delta that are frequently disturbed by floods and ice scour. It has a typically tall dense shrub layer and ground cover layer. Indicator species of this community type are tufted hair grass and meadow horsetail.

The coastline shrub community type is located on fluvial deltaic deposits associated with the lower Mackenzie Delta. Topography is typically level and soils are poorly to very poorly drained. Soils are usually Regosolic Static Cryosols. Parent material is silt to silt loam. Sties with coastline shrub have a poor nutrient regime with a moisture regime of subhydic to hydric. The active layer depth ranges from 22 to 110 cm (IOL et al. 2004).

Plant species found within this community type include:

Species	Scientific Name
Gray willow	<i>Salix glauca</i> (<i>S. cordiflora</i> ssp. <i>callicarpea</i> and <i>glauca</i> ssp. <i>stenolepis</i>)
Richardson Willow	<i>Salix richardsonii</i> (<i>S. lanata</i> ssp. <i>richardsonii</i>)
Dwarf Scouring-rush	<i>Equisetum scirpoides</i>
Water Sedge	<i>Carex aquatilis</i>
Narrow-leaved Cotton-grass	<i>Eriophorum angustifolium</i> (incl. <i>E. triste</i>)
Tufted Hair Grass	<i>Deschampsia cespitosa</i> (<i>D. caespitosa</i> , <i>D. glauca</i>)
Meadow Horsetail	<i>Equisetum pratense</i>
Ruap Indian Paintbrush	<i>Castilleja raupii</i>
Slim-stem Reed Grass	<i>Calamagrostis stricta</i> (<i>C. inexpansa</i> , <i>C. neglecta</i> and <i>C. chordorrhiza</i>)

Source: GNWT ENR 2009a

9.3.2.9 Coastline Sedge - Cotton-Grass

The [coastline] sedge – cotton-grass community type is widespread on wet floodplains of the Mackenzie Delta. The dominant species in the ground cover layer are water sedge (*Carex aquatilis*) and narrow-leaved cotton-grass (*Eriophorum angustifolium* (including *Eriophorum triste*)).

Topography is typically level, and soils are poorly to very poorly drained. Several soil subgroups can occur depending on the type of drainage channel and proximity to the channel. Mineral soils above the level of annual inundation are typically Orthic Regosols when permafrost is deeper than 1 m. Soils are Regosolic or Gleysolic Static Cryosols if permafrost is encountered within 1 m of the surface. Parent materials are typically fluvial with silt to loamy sand textures. Sites with coastline sedge – cotton-grass are poor in nutrients, and their moisture regime is subhydic. The active layer depth occurs at 60 cm (IOL et al. 2004).

Plant species found within this community type include:

Species	Scientific Name
Water Sedge	<i>Carex aquatilis</i>
Narrow-leaved Cotton-grass	<i>Eriophorum angustifolium</i> (incl. <i>Eriophorum triste</i>)

Source: GNWT ENR 2009a

9.3.2.10 Coastline Low-centered Polygons

[Coastline] low-centered polygons are abundant on the delta and coastline of the Peninsula, resembling tundra low-centered polygons. The centre of each polygon is depressed and covered with lowland vegetation such as water sedge, variegated horsetail, and narrow-leaved cotton-grass. The polygons outer ridges are dominated by upland vegetation such as Richardson's willow and [entire-leaved] mountain avens.

The nearly flat, low-lying, broad areas are composed of recent fluvial sediments. Soils are classified most commonly as Regosolic Static Cryosols, and occasionally as Gleysolic Static Cryosols. The centres of these polygons are wet, with standing shallow water during most of the thawed season. Subtle ridges that are pushed up by ice wedges formed under the through surround the middle of the low-center polygons. Flooding, either by salt water during storm surges, or by fresh water as the level of the Mackenzie River fluctuates, is common. Parent material texture is silt to loamy sand. Sites with coastline low-centred polygons have a poor to very poor nutrient regime and their moisture regime ranges from subhydryc to hydric. The active layer depth ranges from 22 to 43 cm (IOL et al. 2004).

Plant species found within this community type include:

Species	Scientific Name
Richardson Willow	<i>Salix richardsonii</i> (<i>Salix lanata</i> ssp. <i>richardsonii</i>)
Water Sedge	<i>Carex aquatilis</i>
Variegated Horsetail	<i>Equisetum variegatum</i>
Narrow-leaved Cotton-grass	<i>Eriophorum angustifolium</i> (incl. <i>Eriophorum triste</i>)
Entire-leaved Mountain Avens	<i>Dryas integrifolia</i> (incl. <i>Dryas chamissonis</i> , <i>Dryas sylvatica</i> , <i>Dryas crenulata</i>)

Source: GNWT ENR 2009a

9.3.2.11 Transition Forest

Inuvik is situated at the northern edge of the *Taiga Plains Ecozone*. The surrounding forest represents the transition zone between the forests found in the *Taiga Plains Ecozone* and the tundra habitat of the *Southern Arctic Ecozone*. In the northern part of this transition zone is a mixture of stunted spruce forest spruce forest and tundra vegetation, being highly variably depending upon elevation, micro-site topography and aspect.

The forest surrounding Inuvik is predominantly spruce, but changes to mixed forest to deciduous forest and shrub along the proposed Highway alignment to the northeast as the elevation increases (Photos 9.3-12 and 9.3-13). Closer to Inuvik, along the lower slopes, shrub communities, shrub fens, bogs and riparian white spruce or willow communities can be found. In the uplands white and black spruce, tamarack, dwarf birch are more common.



Photo 9.3-12

The forest surrounding Inuvik is predominantly spruce; however, it quickly changes to deciduous forest and shrub closer to the treeline



Photo 9.3-13

At the treeline, the deciduous forest becomes dominated by shrubs

This community type is associated with moderate to steeply sloping colluvial deposits. These deposits occur as a thin veneer over morainal material. Texture of the parent material is variable because of the colluvial origin. Drainage is moderately well to imperfect with a subhygric moisture regime and a poor nutrient regime. Soils are poorly developed and are commonly Regosolic Static Cryosols (IOL et al. 2004).

Plant species commonly found in the forested areas around Inuvik include:

Species	Scientific Name
White Spruce	<i>Picea glauca</i>
Dwarf Birch	<i>Betula glandulosa</i>
Prickly Rose	<i>Rosa acicularis</i>
Mountain Cranberry	<i>Vaccinium vitis-idaea</i>
Bog Bilberry	<i>Vaccinium uliginosum</i>
Black Crowberry	<i>Empetrum nigrum</i>
Narrow-leaved Labrador Tea	<i>Ledum decumbens</i>

Source: GNWT ENR 2009a

9.4 WILDLIFE

The Tuktoyaktuk Peninsula supports a wide variety of wildlife. As defined under the *Western Arctic Claim Inuvialuit Final Agreement As Amended* (1987), “wildlife” means all fauna in a wild state other than reindeer. While this distinction is recognized, the reader is advised that the Project Description Report contains information about wildlife and reindeer in the Tuktoyaktuk Peninsula and Delta area.

Approximately 23 species of terrestrial mammals potentially occur along the proposed Highway alignment (Table 9.4-1). 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.

TABLE 9.4-1: TERRESTRIAL MAMMALS OCCURRING ALONG THE PROPOSED HIGHWAY ALIGNMENT

Common Name	Scientific Name
Masked shrew	<i>Sorex cinereus</i>
Snowshoe hare	<i>Lepus americanus</i>
Arctic hare	<i>Lepus sp. arcticus</i>
Arctic ground squirrel	<i>Spermophilus parryii</i>
American red squirrel	<i>Tamiasciurus hudsonicus</i>
American beaver	<i>Castor canadensis</i>
Northern red-backed vole	<i>Clethrionomys rutilus</i>
Brown lemming	<i>Lemmus sibiricus</i>

TABLE 9.4-1: TERRESTRIAL MAMMALS OCCURRING ALONG THE PROPOSED HIGHWAY ALIGNMENT

Common Name	Scientific Name
Collared lemming	<i>Dicrostonyx torquatus</i>
Muskrat	<i>Ondatra zibethicus</i>
Meadow vole	<i>Microtus pennsylvanicus</i>
Tundra vole	<i>Microtus oeconomus</i>
Wolf	<i>Canis lupus</i>
Arctic fox	<i>Alopex lagopus</i>
Red fox	<i>Vulpes vulpes</i>
Grizzly bear	<i>Ursus arctos</i>
Ermine	<i>Mustela erminea</i>
Least weasel	<i>Mustela nivalis</i>
American mink	<i>Mustela vison</i>
Wolverine	<i>Gulo gulo</i>
River otter	<i>Lutra canadensis</i>
Moose	<i>Alces alces</i>
Caribou	<i>Rangifer tarandus</i>

Approximately 137 bird species have been recorded in the region of the Mackenzie Delta and Tuktoyaktuk Peninsula. Most of these bird species are migratory; however, 17 are year round residents, 101 nest and/or moult and remain during the summer and 19 are rare transients or visitors. In addition, a further 39 species have been reported but their occurrence has not been confirmed (Martell, 1984).

9.4.1 Barren-ground Caribou / Cape Bathurst and Bluenose-West Herds

There are eight major barren-ground caribou herds within the Northwest Territories (Working Group on General Status of NWT Species 2006), each of which are identified by the location of their calving grounds (Thomas 1969; Gunn and Miller 1986). Two caribou herds occur on the Tuktoyaktuk Peninsula: the Cape Bathurst and Bluenose-West herds. The Cape Bathurst and Bluenose-West caribou herds' annual range overlaps that of the proposed Highway alignment. Caribou are highly migratory and occupy different habitats during different seasons (IOL et al. 2004).

The Cape Bathurst caribou (Photo 9.4-1) herd was identified as a distinct herd from the Bluenose-West herd using genetic and radio-telemetry studies (Nagy et al. 1999). This is the primary caribou herd that utilizes the Tuktoyaktuk Peninsula. The herd calves and summers in the Brock, Hornaday and Horton River area (Community of Tuktoyaktuk et al. 2000), while rutting occurs east of Husky Lakes (IOL et al. 2004). The herd's winter range stretches from the Tuktoyaktuk Peninsula to the Mackenzie River in the west and the Husky Lakes in the south (IOL et al. 2004; GNWT ENR 2006a).

The GNWT Department of Environment and Natural Resources reports that the caribou migration from the Parsons Lake area to Cape Bathurst typically occurs in April. Caribou have been active in the Parsons Lake area, but a notable decline has been detected in the past three to four years (GNWT ENR, pers. comm. November 20, 2008).

The Bluenose-West caribou herd marginally overlaps with the proposed Highway alignment along the northwest corner of their annual range and a few individuals can be expected to be present from October to May. The Bluenose-West herd calving grounds are located east of Tuktoyaktuk Peninsula in the western Melville Hills in Tukut Nogait National Park, with high calving densities in the area west of the Hornaday River south to the Little Hornaday River.

The post calving range of Bluenose-West herd includes the Melville Hills from the coastal areas near Paulatuk, east to Bluenose Lake, south to the Little Hornaday River, and in the areas east of the Hornaday River. Rutting occurs in this area and as far west as the Kugaluk River and south to the Simpson and Horton lakes areas. The winter range of this herd includes the area from Eskimo Lakes and the Anderson River to the north and Colville and Great Bear lakes and Fort Good Hope to the south (Nagy and Johnson 2006).



Photo 9.4-1

Caribou were periodically seen during the aerial reconnaissance survey along the proposed road alignment. Here three bull caribou were seen grazing on sedges

The proposed road alignment is located south of the summer and fall caribou harvesting areas, sites 306C and 309C respectively (Community of Tuktoyaktuk et al. 2000). However, the proposed road corridor is located within the spring and winter caribou harvesting areas, sites 302C and 315C respectively (Figure 7.8-1; Community of Tuktoyaktuk et al. 2000). As well, the proposed road alignment occurs within the Bluenose-West Winter Range

management area, site 701B (Figure 7.4-2; Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000). This area provides important winter habitat for the Bluenose-West caribou herd, which are valued for subsistence harvesting year-round by Inuvialuit communities and other aboriginal communities outside the ISR (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

In 2005, Cape Bathurst and Bluenose-West caribou herds population estimates indicated that both herds were declining. In 2006, standard methods were used to conduct photo-census surveys on both herds to confirm population estimates obtained in 2005 and determine if herds had continued to decline. Surveys were also undertaken to estimate the number of caribou on the upper Tuktoyaktuk Peninsula. Analysis of the results provided a population estimate of approximately 18,050 for non-calf caribou for the Bluenose-West herd (Table 9.4-2; GNWT ENR 2006a). This population estimate was significantly lower than the 2005 estimate, indicating that the population of the herd had continued to decline.

The population estimate for the non-calf caribou for the Cape Bathurst herd was approximately 1,800 in 2006 (Table 9.4-2; GNWT ENR 2006b). This population estimate is significantly lower than that for 2005, indicating that this herd has also continued to decline. Researchers believe that the Cape Bathurst and Bluenose-West caribou herds continued to decline between 2005 and 2006 (Nagy and Johnson 2006).

The Cape Bathurst and Bluenose-West herds were surveyed in July 2009. In his October 2009 report to the GNWT Legislative Assembly of the NWT (Minister's Statement 9-16(4), October 21, 2009), Environment and Natural Resources Minister, Hon. Michael Miltenberger reported that the Cape Bathurst herd has remained stable at 1,800 animals and the Bluenose-West herd has remained stable at just under 18,000 animals. In light of populations decreasing elsewhere in the world, Miltenberger attributes the stability of these populations to the caribou harvesting restrictions implemented by the co-management boards in the Inuvialuit Settlement Region and the Gwich'in and Sahtu regions.

TABLE 9.4-2: CAPE BATHURST AND BLUENOSE-WEST CARIBOU HERD POPULATION ESTIMATES

Herd	Year	Population Estimate (non-calf)
Cape Bathurst Caribou	1987	14,529
	1992	17,521
	2000	10,013
	2005	2,400
	2006	1,821
Bluenose-West Caribou	1987	98,874
	1992	64,705
	2000	74,273
	2005	20,800
	2006	18,050
	2009 ¹	approximately 18,000

Source: GNWT ENR 2006a, 2006b

The barren-ground caribou is ranked by GNWT Department of Environment and Natural Resources as Sensitive under the general status program (GNWT ENR 2009a), i.e. a species not at risk of extinction or extirpation, but which might require special attention or protection to prevent them from becoming at risk (Working Group on General Status of NWT Species 2006). This species is not considered to be at risk under the *Species at Risk Act* (Working Group on General Status of NWT Species 2006) or the Committee on the Status of endangered Wildlife in Canada (COSEWIC 2009).

In addition to the two herds of barren-ground caribou, a privately owned reindeer herd has historically used portions of the upper Tuktoyaktuk Peninsula and Richards Island. More recently, the herd typically summers in the Richards Island area from about April to late November and the herd is moved south to an area of Crown Land extending from north of Parsons Lake to the Jimmie and Noell lakes area for the overwintering period. The location of the reindeer grazing allotment is illustrated in Figures 7.6-1 and 12.1-1 of this Project Description Report. According to Lloyd Binder, the custodian of the herd, the current population of the herd is around 3,000 animals.

9.4.2 Woodland Caribou

Woodland caribou in the Northwest Territories are divided into two ecotypes, the boreal population and the northern mountain population. These caribou have different habitat requirements, but are otherwise the same species. The woodland caribou, boreal population, is listed by SARA as Threatened (Government of Canada 2009), and is ranked by GNWT Department of Environment and Natural Resources as Sensitive under the general status program (GNWT ENR 2009a).

Mountain caribou are found primarily in the mountainous region of the Northwest Territories from Nahanni National Park Reserve in the South to the Richardson Mountains in the north. Boreal caribou are dispersed over a large area throughout the boreal forest, occurring along the Mackenzie Valley from the Northwest Territories/Alberta border north to the Mackenzie Delta (Olsen et al. 2001), and from the eastern edge of the Mackenzie Mountains to the Canadian Shield and Great Slave Lake (Government of Canada 2009). The town of Inuvik is located on the northern edge of their distribution.

Boreal caribou are not expected to be affected by the development of the proposed Highway since Inuvik is located on the edge of their range and the highway heads away to the northeast. Furthermore, that section of proposed Highway leading into Inuvik will be constructed along an already established road, and further out, through mixed forest. Boreal caribou typically prefer mature or old growth coniferous forests associated with bogs, lakes and rivers.

9.4.3 Moose

Moose occur in the Mackenzie Delta, but their distribution is restricted to patches of suitable habitat, which occurs along the proposed Highway corridor. The proposed 2009 Route is located slightly within the spring moose harvesting area (site 303B), near Husky Lakes (Figure 7.8-4; Community of Tuktoyaktuk 1993). In September 2009, during an

aerial reconnaissance along the proposed Highway alignment a total of 16 observations of moose were recorded consisting of seven bulls, five cows, three yearlings and one calf. In addition, two observations of moose tracks were documented. Moose or moose sign was present throughout the length of the proposed Highway alignment; however, 55% of the observations below the tree-line, near Inuvik, while 36% were near the southwest end of Husky Lakes, and finally, 9% were closer to Tuktoyaktuk, near granular source 177. Above the tree-line, moose observations were associated with tall shrubs that typically occur along rivers or creeks.

Moose distribution near the tree-line and on the tundra is scattered, with local concentrations associated with lush willow growth along rivers (Photo 9.4-2). South of the tree-line near Inuvik, moose are widely distributed, although typically occurring at low densities (5 to 15 moose per 100 km²), compared to other northern jurisdictions in the boreal forest. The best areas for moose are characterized by semi-open forest cover, an abundance of willow and aspen stands, and are located close to lakes, river valleys, and stream banks. They prefer deciduous shrubs for fall and winter food and thick conifers for winter cover. In the summer they can be found close to river valleys and lakes where they feed on aquatic vegetation. Moose tend to favour areas previously disturbed (15-30 years prior) by forest fires, as the natural regeneration meets their habitat requirements (GNWT ENR 2005a).



Photo 9.4-2

A number of moose were seen along the proposed road alignment,
in association with lush willow growth along rivers

9.4.4 Grizzly Bear

In the Inuvialuit Settlement Region, grizzly bears are co-managed under the Inuvialuit Final Agreement by the GNWT, Yukon Territorial Government, Hunters and Trappers Committees, Inuvialuit Game Council, Wildlife Management Advisory Council (NWT) and the Wildlife Management Advisory Council (North Slope). For the Tuktoyaktuk Grizzly Bear Management Area, there is an estimated 214 bears over the age of two, occurring at a density of six bears per 1,000 km², compared to a density of seven to eight bears per 1,000 km² in the Inuvialuit Settlement Region (IOL et al. 2004). There is a total allowable harvest of six bears per year.

In the Northwest Territories, the grizzly bear is ranked by GNWT Department of Environment and Natural Resources as Sensitive under the general status program (Working Group on General Status of NWT Species 2006; (GNWT ENR 2009a). Nationally, they have been assessed by COSEWIC as Special Concern (as of 2002), indicating that they are a species that might become threatened or endangered because of a combination of biological characteristics and identified threats (COSEWIC 2009). Grizzly bears do not have a special status under the federal *Species at Risk Act* (Government of Canada 2009).

Grizzly bear are known to occur throughout Tuktoyaktuk Peninsula (GNWT 2004). In particular, the Husky Lakes are an important habitat area (Community of Tuktoyaktuk et al. 2000). The proposed Highway corridor is within occupied grizzly bear habitat (Pearson and Nagy 1976; Nagy et al. 1983; Community of Tuktoyaktuk 1993). In particular, the proposed road alignment occurs within the Grizzly Bear Denning Areas, site 322C, during the period of October to May each year (Figure 7.4-2; Community of Tuktoyaktuk et al. 2000). According to Nolan et al. (1973) the habitat has a quality rating of Class 2 (common use, but less than optimum habitat). Grizzly bears in this region undergo six to seven months of hibernation (Nagy et al. 1983). No dens were identified near the proposed route alignment by Rescan (1999).

However, during discussions with Marsha Branigan of GNWT Department of Environment and Natural Resources in Inuvik (pers. comm. November 20, 2008), several potential grizzly bear denning areas were identified in the vicinity of the access road from Tuktoyaktuk to Source 177, which is located along the northern portion of the Tuktoyaktuk to Inuvik Highway. The GNWT Department of Environment and Natural Resources subsequently conducted an aerial bear den survey of this area on May 17, 2009 on behalf of the GNWT Department of Transportation and reported that there was no evidence of current grizzly bear activity in the area. In addition, no dens were found within 500 m of either side of the access road, or within Source 177 (GNWT ENR 2009c).

In addition, EBA indentified three freshly dug grizzly bear dens (Photo 9.4-3) and a number of old dens during an aerial reconnaissance flight in mid-September 2009. During this fieldwork, a single observation of an adult female grizzly bear accompanied by a cub-of-the-year was recorded along the northern edge of a granular deposit identified as Area 13 or 14 in the EBA map book (Appendix B). All dens were within a two km radius of each other

and approximately 3 km from the female and cub and, consequently, they were presumed to have been dug by that female bear. This information was conveyed to GNWT Department of Environment and Natural Resources.



Photo 9.4-3

A number of freshly dug grizzly bear dens were documented, such as this one found on a south facing slope hidden amongst shrubs

9.4.5 Black Bear

Black bears occupy much of the Northwest Territories, including the forested area around Inuvik. The size of the black bear population of the Northwest Territories is unknown, but is estimated conservatively to be 10,000 (GNWT ENR 2005b). Black Bear densities are unknown for the Northwest Territories but the estimated Canadian density is 10 to 40 bears per 100 km² (Barichello 1998). They can be expected to be found predominantly in forested habitats. Black bear distribution is generally linked to treed environments, which provide security from predators such as grizzly bears, wolves, and other black bears. During the active season trees provide security, as visual cover for hiding, and escape for climbing (Herrero 1978). Dense shrub communities are also important for security, and are also used for bedding (Jonkel 1978).

Black bear habitat quality is also primarily related to the abundance and availability of seasonally important food items. Their diet consists mainly of vegetation; however, meat, particularly winter-killed ungulates during spring, insects and possibly fish during the summer, may also be important.

After den emergence, bears favour areas with early-emerging vegetation such as wetlands dominated by sedges and cotton-grass. Grasses and horsetails are also important, and black

bears may be found on sites such as meadows. Black bears typically dig dens in till material available on eskers, stream banks, or in natural cavities such as an upturned tree roots, crevices or caves. Black bear denning habitat is limited to the forested area that occurs along the southernmost portion of the proposed Highway near Inuvik.

9.4.6 Wolf

Wolves are found in the vicinity of the proposed Highway. They are ecologically important predators and economically important furbearers. Wolf habitat and density is closely related to that of their prey, such as caribou and reindeer. They are often observed in association with barren-ground caribou, especially in the winter (Carruthers et al. 1986; McLean 1992; McLean and Jackson 1992). The wolf population appeared to decline in the 1950s, but recovered in the mid 1970s (Community of Tuktoyaktuk et al. 2000).

Habitat requirements include den sites, typically on steep slopes with stable soils, and as such, are susceptible to habitat displacement. In contrast to grizzly bears, roads may not cause wolves to avoid the area.

9.4.7 Red Fox and Arctic Fox

Foxes are important furbearers in the region. In the Mackenzie Delta area, red foxes are considered widespread below the tree-line, whereas Arctic foxes are widespread above the tree-line, often near coastal areas (Community of Tuktoyaktuk et al. 2000). However, red foxes do occur above the tree-line and four red foxes and one old den site were observed during the aerial reconnaissance in mid-September 2009 (Photo 9.4-4).



Photo 9.4-4

Red foxes commonly occur along the proposed road alignment. Four individuals and one old den site were observed during the aerial reconnaissance in September

Jim Raddi of Tuktoyaktuk, in a November 17, 2008 News/North NWT article reported that “I’ve never seen so many foxes going back and forth on evenings.” He added that family members were trapping one or two an evening by the ocean. Habitat requirements are linked to food sources, such as carrion, birds and small mammals. Denning habitat consist of well-drained, stable soils (Martell et al. 1984), with Arctic fox dens occurring in open areas with little relief. The proposed Highway corridor is located in good Arctic fox habitat.

9.4.8 Wolverine

Wolverines range throughout most of northern and western Canada, including the proposed Highway alignment. Wolverines are difficult to locate during snow-free periods, lead a largely solitary lifestyle, and have a lower population density than wolves or foxes. They have large home ranges and live at low densities even under optimal conditions (Banci 1994). Reproductive rates are low and sexual maturity is delayed, in comparison with some (or most) other carnivores. The population estimate for wolverines in the Northwest Territories is unknown; however, GNWT Department of Environment and Natural Resources estimates that there are 1.6 to 3.7 per 1,000 km² for males and lower for females (GNWT ENR 2005c).

Wolverines are scavengers and predators of birds and small mammals, relying on a diversity of foods to offset the uncertainty of availability in the harsh northern environment. There appears to be a correlation between wolverine numbers, ungulate populations, and the presence of more (successful) efficient predators such as wolves (Van Zyll de Jong 1975).

The wolverine (Western population) was assessed by COSEWIC as a species of Special Concern (as of May 2003) (COSEWIC 2009). The wolverine is ranked by GNWT Department of Environment and Natural Resources (2009) as Sensitive under the general status program.

No wolverines were observed during the aerial reconnaissance work in mid-September 2009. However, the proposed road is located within the winter wolverine harvesting area, site 314C (Figure 7.8-9; Community of Tuktoyaktuk et al. 2000).

9.4.9 Marten

The occurrence of martens in the Northwest Territories is linked to the northern boreal forest. The marten populations in the Northwest Territories is estimated to be between 40,000 and 400,000 based on densities ranging from 0.05 to 0.5 per km² (GNWT ENR 2009a). They occur throughout the forested portions of the Mackenzie Delta.

Martens are closely associated with late-successional stands of mesic (moist) coniferous forests, particularly those with complex arrangements of light gaps, dead and downed wood, varied shrub understory, and layers of overhead cover (Allen 1984; Buskirk and Powell 1994; Clark *et al.* 1987; Thompson 1994).

Threats to martens within the study area include potential localized over-trapping, particularly during cyclical lows (ENR 2005d). Weaver (2001) indicated martens are moderately resilient to human impacts. Although they require mature coniferous forest stands with complex downed and overhead structures, they are particularly vulnerable to logging. Weaver (2001) indicated martens have a moderate reproductive potential in appropriate habitat.

9.5 BIRDS

9.5.1 Waterfowl (Swans, Geese, Loons and Ducks)

The proposed Highway corridor is located in the vicinity of abundant waterfowl habitat, which is an important area for nesting and staging of geese and swans. Geese are an important source of food for the Inuvialuit while the down is also used for pillows and blankets (Community of Tuktoyaktuk et al. 2000).

Nesting habitat for Tundra Swans (*Cygnus columbianus*) can include wet sedge meadows and ponds, lakes and slow flowing rivers, with brood rearing occurring in deeper water (Palmer 1976).

Canada Geese (*Branta canadensis*) and Brant (*Branta bernicla*) prefer to nest on small islands in ponds, lakes and rivers; Brant also nest on the edge of freshwater or tidal pools (Bellrose 1976). White-fronted Geese (*Anser albifrons frontalis*) are secretive nesters, preferring dispersed, higher and drier nesting sites. Snow Geese (*Chen caerulescens*) are primarily colonial nesters, preferring low grassy tundra and islands in shallow lakes (Bellrose, 1976). Geese and swan populations are stable or increasing (Community of Tuktoyaktuk et al. 2000). The proposed Highway occurs within the spring goose harvesting area, site 304C, but not the summer or fall goose harvesting areas (sites 308C and 312C, respectively) (Figure 7.8-12; Community of Tuktoyaktuk et al. 2000).

Common Loon (*Gavia immer*), Yellow-Billed or King Loon (*Gavia adamsii*), Pacific Loon (*Gavia pacifica*) and Red-throated Loon (*Gavia stellata*) occur in the Mackenzie Delta area. All probably nest in the area, but the Pacific and red-throated loons also breed near the proposed Highway route. Nesting habitat consists primarily of shorelines of lakes and ponds.

Ducks are important to the Inuvialuit as a spring and fall food source. Several species occur and nest in the area of the proposed Highway, including King Eider (*Somateria spectabilis*), Common Eider (*Somateria mollissima*), Scaup, Mallard (*Anas platyrhynchos*), Scoters (Black duck; *Melanitta spp.*), Wigeon (Baldpate duck; *Anas americana*), Old Squaw (Long-tailed duck; *Clangula hyemalis*), and Pintail (*Anas acuta*) (Community of Tuktoyaktuk et al. 2000). Nests are dispersed and occur in low-lying to upland habitat and may be hundreds of metres from water. Diving ducks, such as Scaup, may nest on shorelines or in emergent vegetation. Eider nests are often found on small islands close to the coast or on inland tundra ponds (Bellrose 1976).

The Horned Grebe occurs in the area, specifically nesting on small ponds within the boreal forest portion of the Delta. The Horned Grebe (western population) has been assessed by COSEWIC as Special Concern (as of April 2009) (COSEWIC 2009). The range includes Yukon, the Mackenzie River Valley in the Northwest Territories, extreme southern Nunavut, and all of the Prairies, where it is most abundant (Sugden 1977; Godfrey 1986; Stedman 2000). In the Northwest Territories, the Horned Grebe nests in low densities throughout much of the boreal and subarctic regions. The highest documented densities (>4 birds/km²) have been observed in the southern Northwest Territories. Average grebe population densities throughout the rest of the boreal and subarctic Northwest Territories are apparently much lower (probably less than 0.1 bird/km² overall) (Stotts 1988; Fournier and Hines 1999; Canadian Wildlife Service 2007). No Horned Grebes were documented during the aerial reconnaissance work in mid-September 2009.

9.5.2 Raptors

The region of the proposed Highway corridor supports several species of raptors including Golden Eagle (*Aquila chrysaetos*), Rough-legged Hawk (*Buteo lagopus*), Northern Harrier (*Circus cyaneus*), Bald Eagle (*Haliaeetus leucocephalus*), Peregrine Falcon *anatum/tundrius* (*Falco peregrinus anatum/tundrius*), Gyrfalcon (*Falco rusticolus*), Short-eared Owl (*Asio flammeus*), and Snowy Owl (*Bubo scandiacus*). Within the boreal forest portion, the Northern Goshawk (*Accipiter gentilis*), Merlin (*Falco columbarius*), Great Horned Owl (*Bubo virginianus*), and Northern Hawk Owl (*Surnia ulula*) can occur. All these species potentially nest in the region wherever suitable habitat is available. Suitable habitats would typically include large trees and steep terrain such as cliffs, both of which do not exist in the vicinity of the Highway alignment.

Two raptors have been ascribed special conservation status: Peregrine Falcon (*anatum/tundrius*) and the Short-eared Owl. The Peregrine Falcon (*anatum/tundrius*) has been assessed by COSEWIC as Special Concern (as of April 2007) (COSEWIC 2009). The Peregrine Falcon (*anatum/tundrius*) is distributed generally throughout portions of the Northwest Territories below and above the tree-line, with a large population located along the Mackenzie River Valley. There are estimated to be more than 219 breeding pairs Peregrine Falcon (*anatum*) in northern Canada (Northwest Territories, Yukon, Nunavut, northern Quebec) (Johnstone 1997), which includes more than 80 pairs of known breeders in Northwest Territories (mainly along the Mackenzie Valley). Mackenzie River densities have been determined to be 0.7 nests per 100 km² (83 nests on a linear 600 km transects along the Mackenzie River) (Shank 1996). Peregrine Falcons have two main habitat requirements; access to optimal nesting habitat, which typically include cliffs adjacent to water, and an adequate supply of prey. Since no cliff areas are present in the vicinity of the proposed Highway alignment, all habitat surveyed along the proposed Highway alignment is considered to be suboptimal nesting habitat for Peregrine Falcons.

The Short-eared Owl is listed by SARA as Special Concern (Schedule III) (Government of Canada 2009), and is ranked by GNWT Department of Environment and Natural Resources as Sensitive under the general status program (Working Group on General Status

of NWT Species 2006; GNWT ENR 2009a). In the Northwest Territories, Short-eared Owls are found in low-arctic tundra, open areas, marshes, and prairie (Cadman and Page 1994; Godfrey 1986). The Northwest Territories Short-eared Owl population is unknown but estimated to be between 1,000 and 10,000 individuals (Carrière 2000). Short-eared Owls are found primarily in the Taiga Cordillera and Taiga Plains ecoregions and may occur across the Tuktoyaktuk Peninsula.

During the September aerial reconnaissance survey, two Golden Eagles, three Bald Eagles and one Short-eared Owl were observed.

9.5.3 Upland Birds

Upland birds make up the largest and most diverse group of birds occurring along the proposed Highway route. In particular, the passerines, also known as “perching” birds, include approximately three-fifths of all living birds (Terres 1982) ranging in size from the largest, the raven, to the smallest, the kinglets, warblers and sparrows. Passerines are widely distributed throughout the boreal forest and tundra, and occupy all terrestrial habitat types and, consequently, they represent a large and diverse group of birds, and each species has different food and cover requirements.

One species of passerine, the Rusty Blackbird (*Euphagus carolinus*), is listed by SARA as Special Concern (Government of Canada 2009), and is ranked by GNWT Department of Environment and Natural Resources as May Be At Risk under the general status program (GNWT ENR 2009a). Rusty Blackbirds nest in the boreal forest and favour the shores of wetlands such as slow-moving streams, peat bogs, swamps, and beaver ponds.

No Rusty Blackbirds were observed during the aerial reconnaissance work in mid-September 2009 and are unlikely to be associated with the area of the Highway corridor.

Ptarmigan are another upland bird species occurring along the proposed Highway route. Willow ptarmigan occur year-round within the area of the proposed Highway, particularly within the upland tundra (Photo 9.5-1). Nest sites are commonly located in shrub habitats, including dwarf shrub-heath and alder. Shrub communities are also important for winter habitat (Platt 1976). Ptarmigan are a food source for the Inuvialuit and other area residents (Community of Tuktoyaktuk et al. 2000). Their population varies from year to year.



Photo 9.5-1
Willow ptarmigan commonly occur along the proposed road alignment

9.6 HYDROLOGY

The proposed Highway will cross numerous ephemeral and permanent stream channels and wetland areas, and as such, will be affected by hydrological characteristics of the region. The alignment crosses through the Delta Hydrologic Region (IOL et al. 2004), which is characterized by very large numbers of shallow lakes and ponds that generally drain through small streams into either the Mackenzie River or the Husky Lakes. The hydrology of the northern portion of the route, which is now under construction, is described in Rescan (1999) and EBA (2008).

Hydrological characteristics of the area result primarily from climatic factors including long, cold winters, short cool summers, and relatively low precipitation, of which 45-70% falls as snow (IOL et al. 2004). In this area, not more than four months of the year have a mean temperature above 10° C. Based on Environment Canada meteorological data, the mean annual temperatures and precipitation values for Tuktoyaktuk and Inuvik are -10.5° C/142 mm and -9.5° C/257 mm, respectively. The wettest months normally occur in July and August, while the driest months are in March and April. Permafrost underlies the entire area, above which is an active layer that varies in depth.

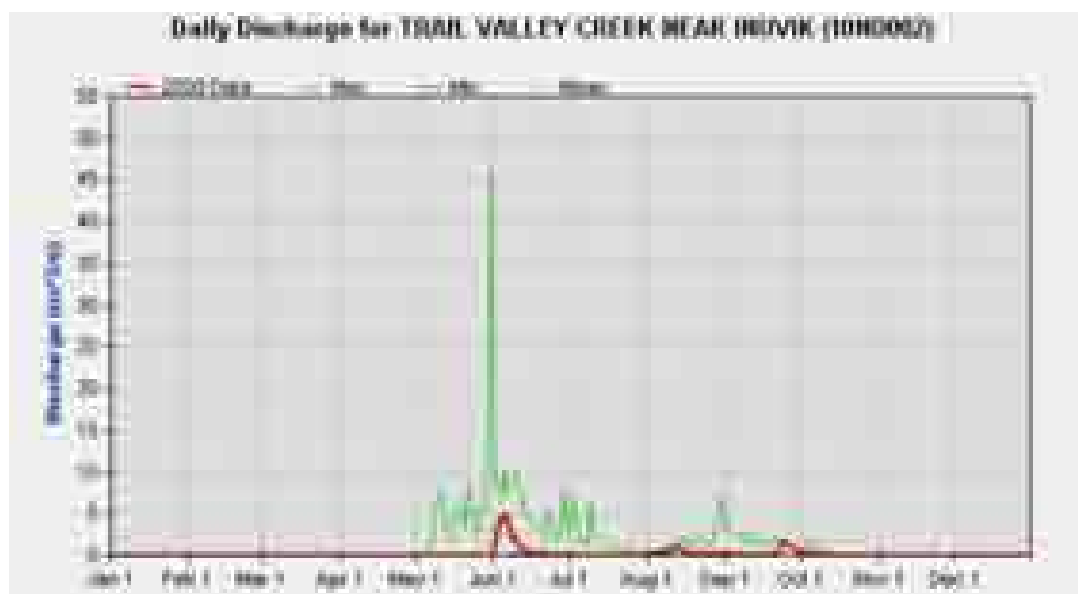
These climatic factors result in surface runoff patterns that are based on the annual freeze-thaw cycle, although summer rainstorms can cause rapid rises in water levels. Ice formation and deterioration follows an annual pattern, which is identified in Table 9.6-1 for the Inuvik and Tuktoyaktuk areas.

TABLE 9.6-1: APPROXIMATE FREEZE THAW DATES IN SUBARCTIC REGIONS

	Tuktoyaktuk ²	Inuvik ³
First ice	Sep 27	Oct 1
Freeze over	Oct 1	Oct 19
First ice deterioration	May 28	May 13
Clearing of rivers	June 19	June 5
River ice thickness	1.55 m	1.32 m
Lake ice thickness	1.75 m	1.73 m

Source: Allen (1977)

The time of ice melt in May and June results in sudden peaks in the hydrograph that follow a typical pattern, as described in Woo (1993). Meltwater fills the many depressions on the land surface and then flows over frozen ground in sheets or rills. Because the shallow, seasonally thawed suprapermfrost layer cannot retain much meltwater or rainwater, the water table rises rapidly so that water is delivered quickly to lower slopes and stream channels. Fairly rapidly, the active layer increases in depth due to increased solar radiation, causing the water table to drop below the surface and a corresponding decline in surface flows. The hydrograph for Trail Valley Creek near Inuvik (Figure 9.6.1; stream location shown at crossing 23 in the Inuvik to Tuktoyaktuk Highway Map Book, Appendix B) exemplifies this seasonal runoff pattern.



Source: Environment Canada (2006)

Figure 9.6-1
Hydrograph for Trail Valley Creek

² Unnamed small lake near Tuktoyaktuk

³ East Channel Mackenzie River

Ice decay in lakes begins once snow is melted from their surfaces. Increases in lake storage lag behind snowmelt due to melt-water retention within the snow cover and in small depressions which dot the land surface (Woo 1993). Generally, water levels in lakes during spring runoff initially rise beyond their outlet elevations due to snow dams. The breaching of these dams results in rapid increases in downstream discharges. Peak annual outflows occur at this time. The numerous tundra ponds in the Arctic are recharged during spring freshet that results from snowmelt. These freshets create surface flow connections between ponds, but such flow connectivity usually only lasts about 2 weeks. After that, the ponds become separated from lateral drainage (Woo and Guan 2006). The nival regime in the Arctic shows one major flood period in spring followed by a rapid recession to base flow interrupted by rainstorm generated peaks.

During the September, 2009, preliminary reconnaissance field survey, significant water flow was observed only in relatively few stream channels, in particular Zed Creek, Hans Creek, and Trail Valley Creek. These streams have relatively large catchments⁴, which results in active flows throughout the ice-free season. Most other streams within the proposed alignment footprint that were viewed during the preliminary reconnaissance survey appeared to be either ephemeral or contained slowly flowing or standing water in discrete pockets. It was further observed that the landform was etched with rills, signifying the myriad of runoff channels that carry meltwater in spring. Observations of flow characteristics at each stream crossing are provided in Section 10.6, Table 10.6-3. These observations were made during aerial reconnaissance, with the intent to confirm flow and channel characteristics during future field investigations.

The highway design will be influenced by the hydrologic patterns and characteristics of the project area. Stream crossing structures and cross drainage culverts will have to be appropriately sized to accommodate flash freshet flows, which can be sudden and intense, as shown in the Trail Valley Creek hydrograph (Figure 9.6-1). Hydrological conditions also govern fish presence, abundance, and behaviour in streams. The flow extremes that are characteristic of the project area diminish the availability and quality of stream habitats in most channels, since these generally carry significant volumes of water for only short periods of time. Such conditions also denote small drainage systems with shallow headwater lakes that generally do not provide suitable spawning, rearing, or overwintering habitat due to a variety of reasons, including extreme flow fluctuations, vegetation encroachment in streams, lack of winter flow, and oxygen deprivation during winter. In contrast, channels draining medium to large catchments, such as Zed Creek, Hans Creek, and Trail Valley Creek, retain flow throughout the ice-free months, and provide suitable habitat conditions to support spawning and rearing during late spring and summer.

⁴ Hans Creek watershed: 329 km², mean annual flow (MAF) 1.09 m³/s; Trail Valley Creek watershed: 68.3 km², MAF 0.2 m³/s

9.7 FISH AND FISH HABITAT

The proposed Inuvik to Tuktoyaktuk Highway will cross numerous ephemeral and permanent streams, and come near many lakes along its route. It is therefore important to identify the fish and fish habitat resources that these waterbodies sustain to develop suitable avoidance and mitigation strategies designed to protect fish populations that are ecologically important, and socially and economically valuable to northern residents. This section of the report identifies the species that may be encountered or affected by highway construction and operation, based on previous studies and preliminary reconnaissance observations of existing habitat characteristics. Future field work is required to document species presence and relative abundance. Section 10.6 provides discussion on the potential effects of the highway development and a description of protection measures.

The proposed Highway occurs slightly within and adjacent to the spring, summer, fall, and winter fish harvesting area near Husky Lakes, sites 305C, 307C, 310C, and 316C respectively (Figure 7.8-17; Community of Tuktoyaktuk et al. 2000). As well, the road occurs within the Fish Lakes and Rivers management area, site 704C (Figure 7.4-2; Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000). This area provides important fish habitat and historic and current subsistence harvest areas for people of Inuvik and Tuktoyaktuk (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

Limited fish surveys have been conducted previously in streams along the proposed Highway. Results of these surveys were summarized in Rescan (1999) and the Environmental Impact Statement (EIS) for the Mackenzie Gas Project (IOL et al. 2004). Generally, these surveys identified the following fish species as having the potential to utilize habitats in some streams along the proposed 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 any of the streams along the Highway route would provide overwintering habitat due to complete freezing.

Table 9.7-1 provides a generalized summary of habitat preferences and life cycle information for each of the major fish species likely utilizing stream habitats in the vicinity of the proposed Highway. Arctic grayling is the valued species most likely to be affected by Highway construction activities and stream crossing structures. This is because grayling utilize and are dependent upon stream habitats for spawning, juvenile rearing, and adult life stages, and require clean, well oxygenated gravel-cobble substrates to complete their life cycle (Table 9.7-1). As such, their productivity within a system is highly sensitive to perturbations that degrade or alter migration access or habitat quality.

The following sections provide brief life history and habitat preference information for each of the valued fish species that will possibly be encountered along the proposed Highway alignment.

9.7.1 Lake Whitefish

Lake whitefish (*Coregonus clupeaformis*; “Humpback”; “Crooked Backs”; “Pikuktuq”) are primarily a freshwater fish, inhabiting lakes and larger rivers. However, they will enter brackish water (Scott and Crossman 1973). Lake whitefish feed on aquatic insects, molluscs, amphipods and a variety of small fish and fish eggs. They are an important commercial and domestic fish in the north.

Lake whitefish are primarily a lake dwelling fish that prefer cool water. They generally move from shallow to deep water during the summer months, and then back into shallow water as the temperature cools. Spawning occurs in early fall, normally in shallow areas of lakes where the substrate is composed of cobble and gravel, and less frequently, sand. Whitefish may on occasion move into tributary streams to spawn. Eggs are broadcast over the substrate and hatch during the following spring. Larval fish tend to stay near steep shorelines, but as juveniles, move into deeper waters during summer.

9.7.2 Round Whitefish

Round whitefish (*Prosopium cylindraceum*) is primarily a freshwater species, although it is known to inhabit brackish estuarial waters, such as in the mouth of the Mackenzie River (Scott and Crossman 1973). Spawning normally occurs during October in northern latitudes, over the gravelly shallows of lakes or river mouths. Eggs hatch in spring. Round whitefish are predominantly found in moderate to deep lakes where they feed on benthic invertebrates. Given their habitat preferences, it is unlikely that these fish will be encountered in the small, shallow streams that make up most of the watercourses crossed by the proposed Highway.

9.7.3 Inconnu

Inconnu (*Stenodus leucichthys*; “Coney”; “Higaq”) are the largest and fastest growing member of the whitefish family. They are primarily anadromous (fish are that migrate from the sea to spawn in fresh water), migrating long distances up the Mackenzie River and its major tributaries to spawn just prior to freeze up in October. After spawning, inconnu move back downstream to the lower reaches of the Mackenzie River, Tuktoyaktuk Harbour and west along the Beaufort Sea coast to feed and overwinter (DFO 1998). At maturity, these fish are greater than a half-metre in length (Scott and Crossman 1973). Their size and preference for large tributaries for spawning suggests that they are unlikely to spawn in the small streams that predominate along the proposed Highway corridor

TABLE 9.7-1: LIFE HISTORY INFORMATION FOR COMMON FISH SPECIES IN STREAMS ALONG THE PROPOSED HIGHWAY

Fish Species	Migratory Behaviour	Spawning Period	Spawning Habitat	Hatching Period	Juvenile Freshwater Habitat Preferences	Adult Freshwater Habitat Preferences	Risk of Potential Effects from Road Construction
Burbot <i>Lota lota</i> "Tittaaaliq"	• Migrate to lake spawning areas in winter • Migrate to tributaries in late winter/early spring • Migrate to deep water in summer	• January-March • Water temp. 0-4° C	• Under ice in Lakes or river • Sand/gravel substrate • shallow (<3 m bays or on gravel shoals)	At ice-out	• Shallow waters • Debris cover • Rocky riffles • Pools or deeper water in lakes	• Mouths of creeks in fall • May be found during winter/spring in coastal embayments (brackish or freshwater) • Deep water in summer	Moderate
Lake whitefish <i>Coregonus clupeaformis</i>	Resident or anadromous	Late September-early October	• Lakes and large rivers • Hard or stony substrate • Water <7.5m	Late spring	• Larvae along steep shorelines • Juveniles move to deep water in summer	Deep water in lakes and large rivers.	Low
Round whitefish <i>Prosopium cylindraceum</i>	Limited migrations to lake shallows or upstream to rivers	Late September-October	Gravelly shallows of lakes or river mouths	Spring	Near or beneath rocks	Moderate to deep lakes	Low
Least cisco <i>Coregonus sardinella</i>	Migrate upstream to spawning grounds in fall	Early October	• Clear streams • Gravel substrates		Lakes, rivers, lowest reaches of tributary streams	• Lakes and streams • estuaries, plume of home river	Moderate
Inconnu (Coney) <i>Stenodus leucichthys</i> "Higaaq"	• Anadromous or lake dwelling. • Begin upstream migrations at spring break-up. • Return to coastal areas or lakes after spawning.	Late September to early October	• 1-3 m depth • Fast current • Gravel substrate	6 mos. after spawning	Fry washed downstream to coastal areas or lakes	Coastal areas or lakes	Low
Northern pike <i>Esox lucius</i> "Sinlik"	• Limited range • Move from deep water winter habitat to spawning habitat in spring	Early spring, occasionally before ice melt	• Grassy margins of lake shores • slow moving streams or sloughs	Spring, ~30 days after spawning	• Stream or lake margins • Slow flowing waters	• Lakes • Main river channels • Slack water areas in rivers	Moderate
Lake trout <i>Salvelinus namaycush</i> "Iqaluakpak"	• Limited migrations, usually within resident lake or large, deep river • Migrate to nearshore areas for spawning • Move into surface waters in winter • Move into deeper waters in summer	Early September	• Littoral areas of lakes • Cobble boulder substrates • 5-40 m water depth	May-June, depending on water temperature	Shallow, inshore waters	• Large deep lakes (common) • Large rivers (less common) • Little movement in summer	Low
Arctic grayling <i>Thymallus arcticus</i> "Hulukpaugaq"	• Can be highly migratory at all life stages or non-migratory • Usually migrate to winter habitat in early fall	Spring, just as ice breaks up	• Gravel substrate • <20-30% fines • Good flow (25-60 cm/s)	Hatch 3 weeks after spawning	Fry: quiet waters near site of hatching	• Clear small, shallow streams or medium rivers • groundwater fed springs • overwinter in lakes or lower reaches of rivers • segregate in streams by age	High
Slimy sculpin <i>Cottus cognatus</i>	Very limited movements	Spring, after breakup	Cobble in shallow water	Hatch 30 days after spawning	Gravel/cobble substrates in streams	Rocky or gravel substrates	Low
Ninespine stickleback <i>Pungitius pungitius</i>	Very limited movements	Summer	Male builds nests of vegetation and debris		Quiet, shallow waters in vegetated areas of streams or brackish waters	• Brackish or freshwater lakes and streams • Streams: vegetated areas in quiet waters	Low

9.7.4 Lake Trout

Lake trout (*Salvelinus namaycush*; “Iqaluakpak”) are representatives of the char family that live exclusively in deep, cold lakes throughout their life cycle. They spawn during early fall over clean cobble substrates in water that is generally less than 16 m deep (Marsden and Chotkowski 2001). Lake trout occur in several large, deep lakes on the Tuktoyaktuk Peninsula and on the Mackenzie Delta (Rescan 1999), as well as in large rivers and brackish waters (Community of Tuktoyaktuk et al. 2000). The Husky Lakes are important habitat areas for this species. Due to the preference of this species for lake habitats during all life stages, it is unlikely that spawning or rearing would take place in the relatively shallow streams that would be crossed by the proposed Highway.

9.7.5 Northern Pike

Northern pike (*Esox lucius*; “Siulik”) are highly carnivorous fish that prefer slow, meandering vegetated rivers or lakes. Spawning takes place in shallow, heavily vegetated areas (Scott and Crossman 1973) soon after ice-out. The eggs adhere to grass, rocks, or other debris. Incubation generally takes about 30 days in the north. Pike fry start life feeding on small crustaceans and insects, but begin eating smaller fish by the time they are only about 5 cm in length. As adults, these voracious feeders principally feed on fish but will also take shore birds, small ducks, muskrats, mice, shrews, and insects. In winter, pike will migrate to large rivers or lakes; smaller lakes are avoided due to the potential for oxygen depletion. Generally, pike migrations between summer and winter habitats are short. In summer, their movements from feeding habitat areas are minimal. Due to the habitats selected by pike, it is expected that the proposed Highway alignment will cross streams used by pike for spawning, rearing, and feeding.

9.7.6 Grayling

Arctic grayling (*Thymallus arcticus*; “Hulukpaugaq”), a cousin of the trout, are game fish of clear, cold streams known for their beautiful colours and flowing, sail-like dorsal fins. They can be highly migratory, or spend much of their lives within a fairly short distance of their preferred section of stream or lake. Generally, grayling spawn in clean, cool streams in spring at about the time of ice break-up, over silt free gravel substrates. They do not create nests (redds), which leaves the eggs vulnerable to high water velocities and streambed disturbances (Beauchamp 1990). During the fall, grayling will migrate to overwintering habitats in lakes or deep sections of slow flowing rivers. Due to their choice of stream habitats for spawning and rearing in summer, the proposed Highway route will inevitably cross streams that support these fish.

9.7.7 Burbot

Burbot (*Lota lota*; “Tittaaliq”) are unique in that they spawn in rivers and lakes during the winter under ice. Spawners tend to select shallow waters over gravel substrates. Eggs filter down into interstitial spaces where they develop for the next 4-5 weeks. The newly hatched larvae are only about 3-3.5 mm and are transported downstream into quiet waters where

they feed. In streams, young burbot seek out shallow waters that have vegetation and debris. As they grow they move to rocky riffles and then on to pools or beneath undercut banks. Adult burbot prey on smaller fish. The selection of stream habitats by some burbot for both spawning and rearing suggests that they may be encountered in streams crossed by the proposed Highway.

9.7.8 Least Cisco

Least cisco (*Coregonus sardinella*; “Big-Eye Herring”) inhabit the fresh and brackish waters of the Mackenzie Delta and also occur as inland, landlocked populations (Rescan 1999). They are less migratory than the Arctic cisco and tend to be associated with the plume of their home river. In freshwater, spawning migrations take place in the fall (late September-early October). Clear streams or lake shores with sand or gravel bottoms are their preferred spawning habitats. They are eaten by predacious coney, pike, and burbot, as well as other mammals and birds (Community of Tuktoyaktuk et al. 2000). The Inuvik Inuvialuit Community Conservation Plan (Community of Inuvik et al. 2000) identifies the inland lakes of the Mackenzie Delta-Tuktoyaktuk region as important least cisco habitat. However, since this species predominantly prefers lake habitats, it would be uncommon in the small streams that comprise most of the watercourses along the proposed Highway route.

9.7.9 Stream Crossing Site Investigations

A preliminary fish habitat reconnaissance field study was carried out in 2009 over a three day period, from September 15-17. The survey initially involved low level helicopter flights over the proposed and alternate routes to permit visual inspection of streams at stream crossing locations. The overview flights also afforded an opportunity to observe watershed conditions upstream and downstream of the crossing sites as an indication of the potential of these systems to support valued fisheries resources. Stream channels potentially possessing suitable fish habitat were further evaluated on the ground. Because the scope of the preliminary reconnaissance field survey was limited to an overview of channel characteristics along the proposed Highway route, time (and weather) constraints limited ground investigations to the specific stream crossing sites within these selected locations. At these sites, the following basic parameters were identified:

- wetted width;
- total channel width, determined from abrupt changes in elevation and from vegetation changes;
- water depth;
- substrate;
- cover (type and percent);
- flow/habitat characteristic (e.g. riffle, run, pool);
- water temperature; and,
- water velocity (using the timed float method, where there was a sufficient length of unobstructed channel).

The number of sites surveyed on the ground was limited by time and weather constraints, and does not necessarily indicate that these are the only locations potentially supporting fish populations. Some sites (e.g. stream crossing nos. 3 and 21 (Appendix B)) appeared from the air to have only limited habitat potential, although on closer inspection displayed stream characteristics suitable for fish passage, spawning, or rearing, which were obscured by heavy riparian overgrowths of willow (Photos 9.7.1-9.7.4). Further site investigations will be required to provide a more complete inventory of habitat conditions, as well as fish presence and relative abundance in streams that will be crossed along the proposed alignment.

Table 9.7.2 summarizes the information collected at the ten stream crossing locations assessed on the ground. Sampling locations were selected as close as possible to the originally identified proposed stream crossing locations. Stream crossing numbers conform to those identified in the Kiggiak-EBA Inuvik to Tuktoyaktuk Highway Map Book (Appendix B).



Photo 9.7-1
Stream Crossing 03 aerial view



Photo 9.7-2
Stream Crossing 03 ground view, looking upstream



Photo 9.7-3
Stream Crossing 21 aerial view



Photo 9.7-4
Stream Crossing 21 ground view, looking upstream

Location	Stream Crossing No.	Water Temp. (°C)	Wetted Width (m)	Total Width (m) ¹	Water Depth (cm)	Substrate	Overhead Cover		Instream Cover		Habitat Type	Water Velocity (m/s)	Comments
							Type	%	Type	%			
KM 2.5	03	5	2.6	10.5	0.61	silt	willow grass Birch	10 30 30	LWD SWD	20 10	rifle-pool	N/A	Crossing location at pool. Channel narrows and becomes shallower and faster flowing with a more complete canopy cover upstream. Velocity measurement not taken due to insufficient length of unobstructed stream. Substrate upstream appears to consist of gravel/cobble. Large upstream watershed. Good potential for spawning/rearing fish.
KM 26	18	8	3	15.5	0.43	gravel/cobble/silt	willow	100	LWD SWD	30 40	rifle	N/A	Major tributary to Jimmy Lake. Potential habitat productive capacity may be reduced due to heavy willow cover reducing light penetration, and because there are no major lakes upstream of the crossing. Fish from Jimmy Lake may migrate for spawning (grayling). Velocity estimated at 1 m/s. Could not be measured due to insufficient length of unobstructed stream for float.
KM 28	21	8	1.3	6	0.33	gravel/cobble/silt	willow /grass	80	LWD SWD	30 40	rifle	N/A	Well defined tributary to Jimmy Lake. Heavy canopy cover may restrict productivity. Medium sized lakes upstream. Fish from Jimmy Lake may migrate for spawning (grayling). Velocity approximated at 1 m/s. Could not be measured due to insufficient length of unobstructed stream for float.
KM 40	23a Trail Valley Creek	5	1.5	17	0.43	cobble	willow /grass	60	SWD	20	rifle	1	Well defined tributary to Husky Lakes. Very good habitat potential due to partial canopy, good flow, and cobble substrate. Habitat likely restricted to spawning and rearing for Husky Lakes' fish as there are no significant lakes upstream.
On PWC Route, ~KM 54.5	30 Hans Creek												Hans Creek. Accessed on ground. No measurements made due to high water/velocity that prevented wading. Similar in width and depth to Zed Creek. Appears to have gravel/cobble substrate. Known from previous reports to support Arctic grayling and sculpin.
KM 67.5	31 Zed Creek	8	9	29	0.43	gravel 75% cobble 25%	willow	5	N/A		rifle-run	1	Zed Creek (also called Parsons Creek). Excellent migratory, spawning, and rearing habitat. May have the potential for very high flows during freshet. Known (from previous reports) to support lake whitefish, round whitefish, lake trout, Arctic grayling, stickleback, and sculpin.
On PWC Route, KM 75	33	5	2.8	30	0.17	silt	willow	90	SWD	20	pool	N/A	Habitat is limited due to sluggish flow, silt substrate, and almost complete willow canopy cover. However, a juvenile grayling (tentative identification) was observed (~9cm) during the ground survey. This stream flows into Zed Lake, located a short distance downstream of the proposed crossing. The upstream watershed contains several small lakes. Stream has low-moderate fisheries potential.
On PWC Route, no kilometre marking	35	6	2.75	39	0.28	gravel/cobble	willow	65	SWD	10	rifle	N/A	Velocity was high; measurement not taken due to insufficient length of unobstructed stream. Downstream pool weedy and silted. From the air, several weedy, slow flowing areas identified as having good potential for northern pike spawning, rearing, and feeding habitat. Faster flowing area has good potential for grayling spawning, and grayling/whitefish rearing. Total length of channel is less than 2 km. It drains a series of mid-size lakes and flows into an arm of Husky Lakes. Subsequent to the field investigation, the crossing location was moved further upstream to an area just below the source lake (Stream Crossing 35a) for this stream. No ground-truthing was carried out at that site. However, the stream channel was observed from the air to be wider than at Stream Crossing 35 with considerably less overhead cover.
On PWC Route, no kilometre marking	38	5	1.9	20	0.36	gravel/cobble/silt	willow	80	SWD	10	glide/pool	0.13	Channel has sluggish flow, but may provide limited spawning/rearing habitat for upstream spawning migrants (grayling). Stream flows into a small lake and then into Husky Lakes. Subsequent to the field investigation, the crossing location was moved upstream to Stream Crossing 38a (not ground-truthed), located just downstream of a mid-size lake. Observations from the air suggest that the stream at that location is made up of a series of heavily overgrown, weedy pools. That habitat, in proximity to the lake, may be suitable for pike spawning, if the lake is of sufficient depth to provide overwintering.
KM 106	39	7	5.3	12	0.26	silt	willow	60	SWD	10	glide/pool	0.15	Channel connects a large lake system to the Husky Lakes. Substrate varies with stream width and water velocity. Gravel dominates the area just downstream of the crossing site. Stream has good habitat potential. Stickleback observed.
KM 109.5	39a	6	0.7	11	0.11	gravel	willow	100	SWD	10	rifle/run	N/A	Potentially good habitat, with good flow. Flows into Husky Lakes. Subsequent to the field investigation, the crossing location was moved further upstream in the same drainage. That crossing is over a short length of stream connecting two small lakes. That section of stream was not ground-truthed, but shows to be a well defined channel on a Google Earth image.

¹ Wetted width was measured as the horizontal distance between the edge of water on both sides of the stream, measured perpendicular to the direction of flow.

² Total width was measured between the tops of the banks on each side of the stream, measured perpendicular to the direction of flow. Top of bank was determined as a distinct change in gradient or by a change in vegetation.

³ LWD=large woody debris (dead wood >5 cm diameter over a minimum 2 m length; SWD=small woody debris (dead wood smaller than LWD).

Results of previous stream surveys along the proposed Highway route were summarized in Rescan (1999) and the Environmental Impact Statement (EIS) for Mackenzie Gas Project (IOL et al. 2004). Rescan (1999) reported that fish had been sampled in Jimmy Creek (Stream Crossing 'N'), Hans Creek (Stream Crossing 30; Photo 9.7.5), and Zed Creek (a.k.a. Parsons Creek; Stream Crossing 31; Photo 9.7-6). Sampled fish included lake whitefish, round whitefish, lake trout, Arctic grayling, ninespine stickleback, and slimy sculpin. IOL et al. (2004) provided sampling results for Zed Creek, Hans Creek, Jimmy Creek, and in a stream crossed twice at crossings 'L' and 'M' along the original PWC 1977 route (Appendix B). That survey identified the following fish species as having the potential to utilize habitats in streams along the proposed route: northern pike, lake whitefish, round whitefish, Arctic grayling, lake trout, burbot, ninespine stickleback, and sculpin.



Photo 9.7-5
Stream Crossing 30, Hans Creek, looking upstream



Photo 9.7-6
Stream Crossing 31, Zed Creek, looking upstream

Actual species presence would be dependent on several habitat and watershed characteristics. As indicated earlier, it is unlikely that any of the stream locations along the highway route would provide overwintering habitat due to complete freezing. Similarly, many of the small, shallow headwater lakes within the watersheds crossed by the proposed route would freeze either to the bottom or to a sufficient depth to preclude the possibility of overwintering, partly due to a diminishment of oxygen to lethal levels (Cott et al. 2008b).

9.8 HUMAN ENVIRONMENT

9.8.1 Tuktoyaktuk (Community Profile)

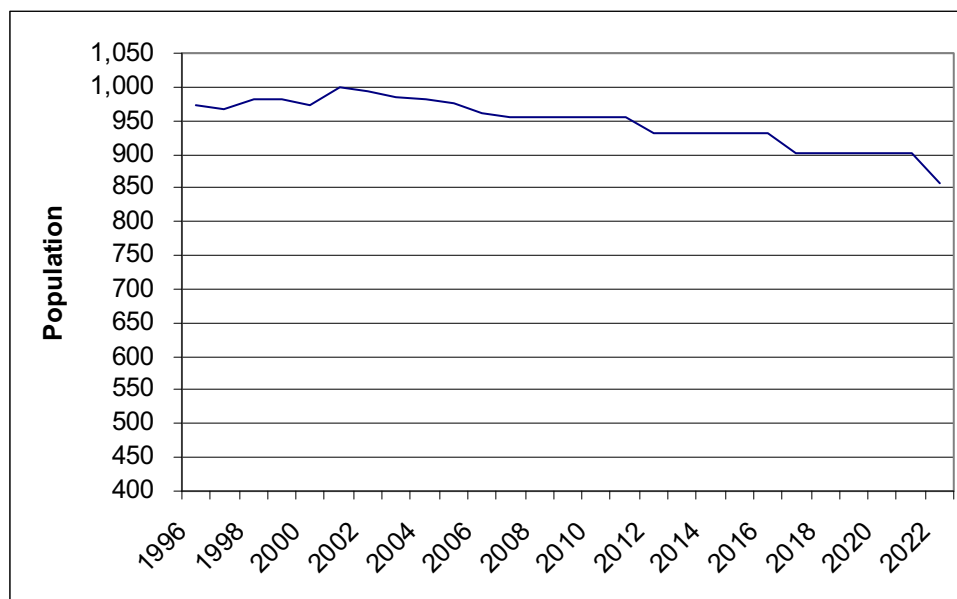
9.8.1.1 Background

The Hamlet of Tuktoyaktuk is located on the shores of the Arctic Ocean, on the Tuktoyaktuk Peninsula at 69°27'N and 133°02'W. The community is the most northerly community on mainland Canada and is located approximately 137 km north of Inuvik and 1,130 km northwest of Yellowknife. Tuktoyaktuk is accessible by air, winter ice road, and water during the ice free period.

9.8.1.2 Population

The majority of the Tuktoyaktuk population is Inuvialuit. Approximately 97% of Tuktoyaktuk's population is Aboriginal (NWT Bureau of Statistics 2008a).

The historic and projected population of Tuktoyaktuk is provided in Figure 9.8-1. Tuktoyaktuk's population has generally decreased from 972 to 956 between 1996 and 2007, indicating a declining average annual growth rate of -0.2 (NWT Bureau of Statistics 2008a). In 2001, the population peaked at 1,001. At the moment, the population is projected to decrease to 930 by 2012 and 858 by 2022.

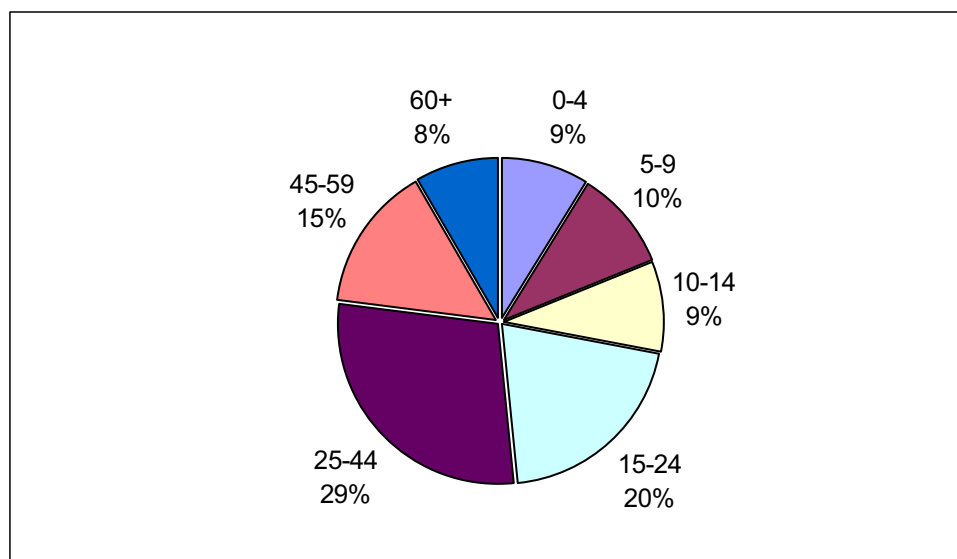


Source: NWT Bureau of Statistics (2008a)

Figure 9.8-1
Tuktoyaktuk Historic and Projected Population, 1996 - 2022

From 1996 to 2005, there were 14 to 25 births each year, with an average of 19.4 births per year over the ten year period. The number of teen births has ranged between 1 and 6 per year between 1996 and 2005, with an average of 3.7 teen births per year. The annual death rate has ranged between 1 and 10 deaths per year between 1996 and 2005.

The population by age and gender is described in Figure 9.8-2 and Table 9.8-1, respectively. Data indicate that 48% of the population is aged 24 or younger. There are a slightly greater number of males than females in the community.



Source: NWT Bureau of Statistics (2008a)

Figure 9.8-2
Tuktoyaktuk Population by Age Group, 2007

TABLE 9.8-1: TUKTOYAKTUK POPULATION BY GENDER, 2007		
Gender	Population	Percent
Male	499	52%
Female	457	48%

Source: NWT Bureau of Statistics (2008a)

9.8.1.3 Employment

Community employment data are provided in Figure 9.8-3. In 2006, 625 residents were aged 15 years and older. Employment data indicate that of those aged 15 years and older, 245 residents were employed, 120 residents were unemployed, and 265⁵ residents were not in the labour force. Of the 365 residents in the labour force, this translates into a participation rate of 58.4% and an unemployment rate of 32.9%. Both employment and unemployment rates have fluctuated between 1986 and 2005. The overall trend in employment is a slight increase, while unemployment shows a slight decrease.

⁵ The NWT Bureau of Statistics do not provide an explanation for the discrepancy in the data provided (i.e., the number of unemployed, employed and not participating in the labour force do not equal the number of residents over the age of 15).

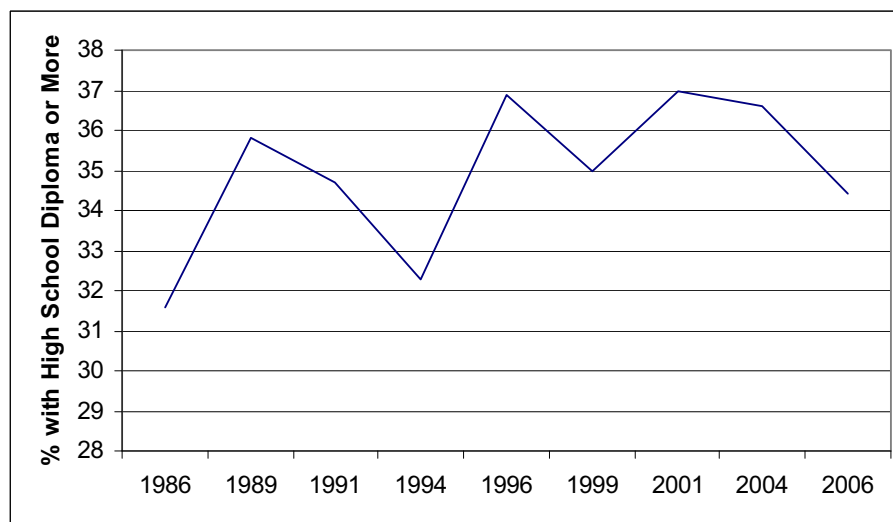


Source: NWT Bureau of Statistics (2008a)

Figure 9.8-3
Tuktoyaktuk Employment and Unemployment Rates, 1986 - 2006

9.8.1.4 Education

The percent of residents achieving a high school diploma has generally increased since 1986 (Figure 9.8-4). In 1986, 31.6% of the population had completed high school, compared to 34.4% in 2006. Data for specific educational levels, such as trade, technical, and university certificates and diplomas were unavailable.



Source: NWT Bureau of Statistics (2008a)

Figure 9.8-4
Tuktoyaktuk Educational Level, 1986 - 2006

9.8.1.5 Traditional Activities

According to the NWT Bureau of Statistics (2008a), the level of involvement in traditional activities recorded in 2003 was:

- 56.9% of residents hunted and fished;
- 8.4% of residents trapped; and
- 49.5% of residents consumed country foods.

In comparison, the level of involvement in traditional activities in 1994 was:

- 53.5% of residents hunted and fished; and
- 13.4% of residents trapped (NWT Bureau of Statistics 1994).

Data regarding consumption of country foods are not available for 1994.

9.8.1.6 Language

The percentage of Tuktoyaktuk's population that speaks an Aboriginal language has been slowly declining. In 1984, 35.8% of the Inuvialuit population could speak Inuvialuktun, but this subsequently declined to 28.3% in 2004 (NWT Bureau of Statistics 2008a).

9.8.1.7 Community Services

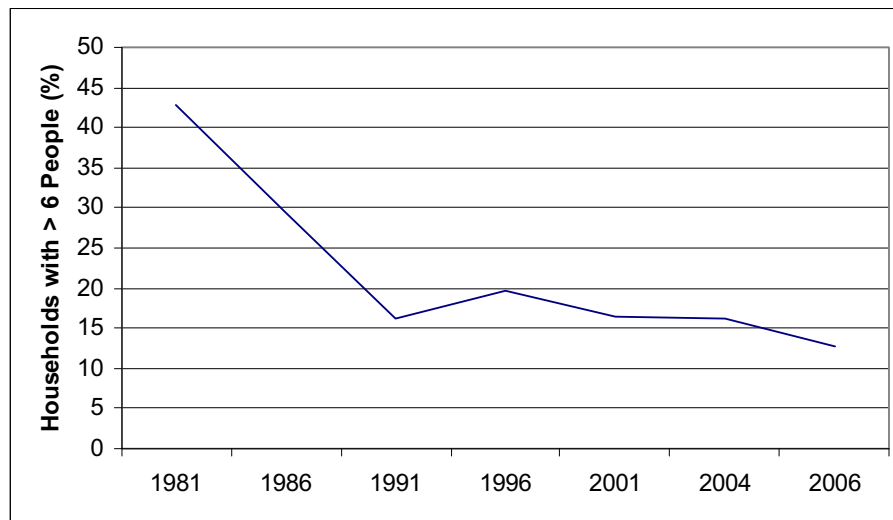
Several community services are offered in Tuktoyaktuk through the Beaufort-Delta Health and Social Services Authority. Services include the Crisis Centre for Family Violence, the Rosie Owayouk Health Centre, and the Tuktoyaktuk Social Services Office (Northwest Territories Health and Social Services 2009). A post office and RCMP detachment in Tuktoyaktuk; however, no banks are located there (NWT Infrastructure n.d.(a)).

Other community services include recreation facilities, school (to grade 12), grocery stores, and accommodations. Municipal services include sewage and solid waste collection and public works (NWT Infrastructure n.d.(a)).

9.8.1.8 Housing

In 2006, there were 270 houses in the community. Of these, 95 were owned and 180 were rented⁶. The percentage of households with more than six people has declined since 1981 (Figure 9.8-5). In 1981, 42.9% of households had more than six people living in the household; by 2003, this percentage had declined to 12.7% (NWT Bureau of Statistics 2008a).

⁶ The NWT Bureau of Statistics do not provide an explanation for the discrepancy in the data provided (i.e., the number of owned and rented houses exceed the total number of houses).

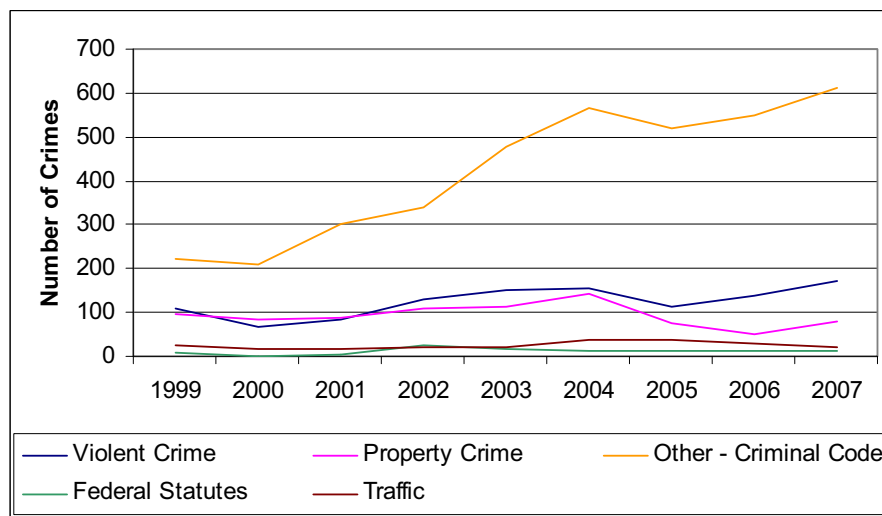


Source: NWT Bureau of Statistics (2008a)

Figure 9.8-5
Tuktoyaktuk Households with More Than Six People, 1981 - 2006

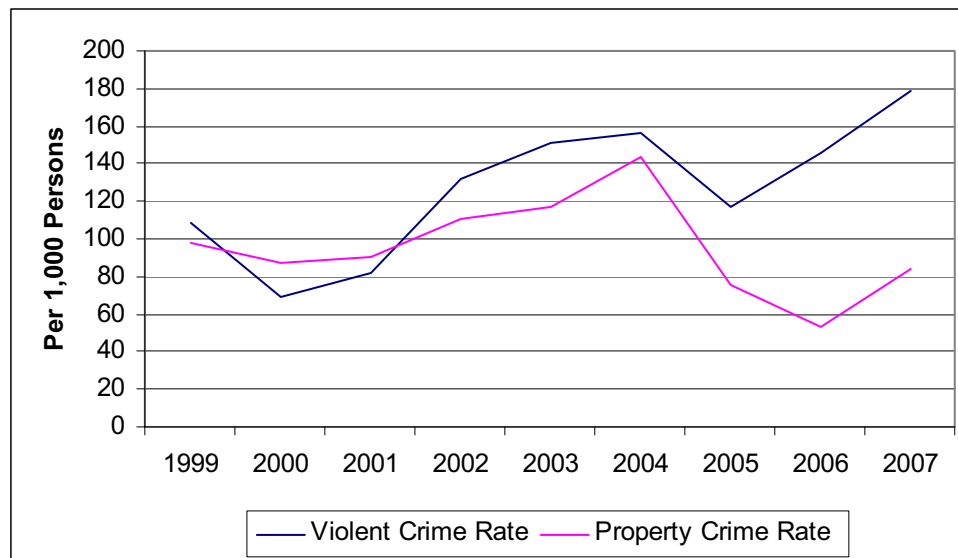
9.8.1.9 Crime

The Tuktoyaktuk RCMP detachment reports on crime statistics. Crime levels have generally increased since 1999, with noticeable increases in crimes recorded between 2002 and 2004 with a slight decline in 2005, followed by an increasing trend (Figure 9.8-6). Similar trends occurred with the violent crime rate and property crime rate per 1,000 persons (Figure 9.8-7).



Source: NWT Bureau of Statistics (2008a)

Figure 9.8-6
Tuktoyaktuk Crimes, 1999 - 2007

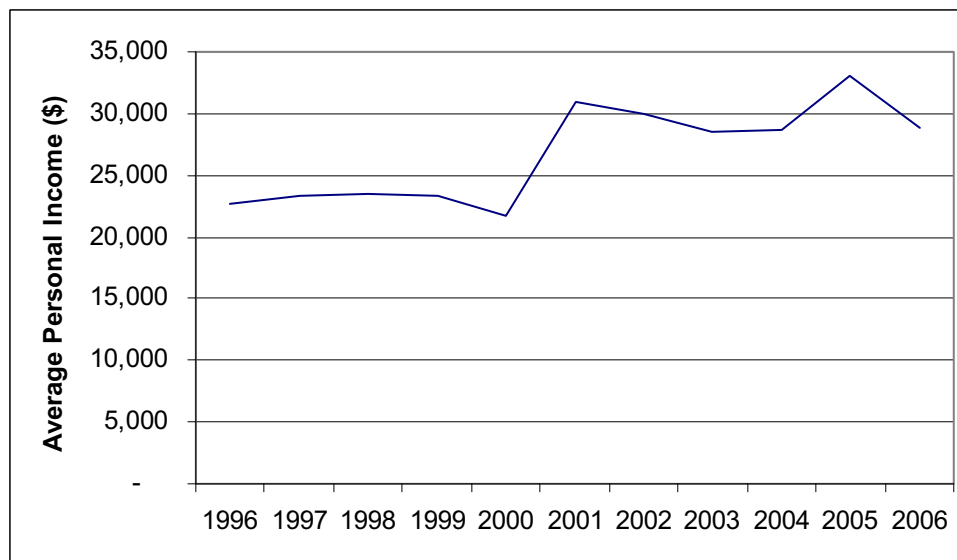


Source: NWT Bureau of Statistics (2008a)

Figure 9.8-7
Tuktoyaktuk Violent Crime and Property Crime Rates, 1999 - 2007

9.8.1.10 Income

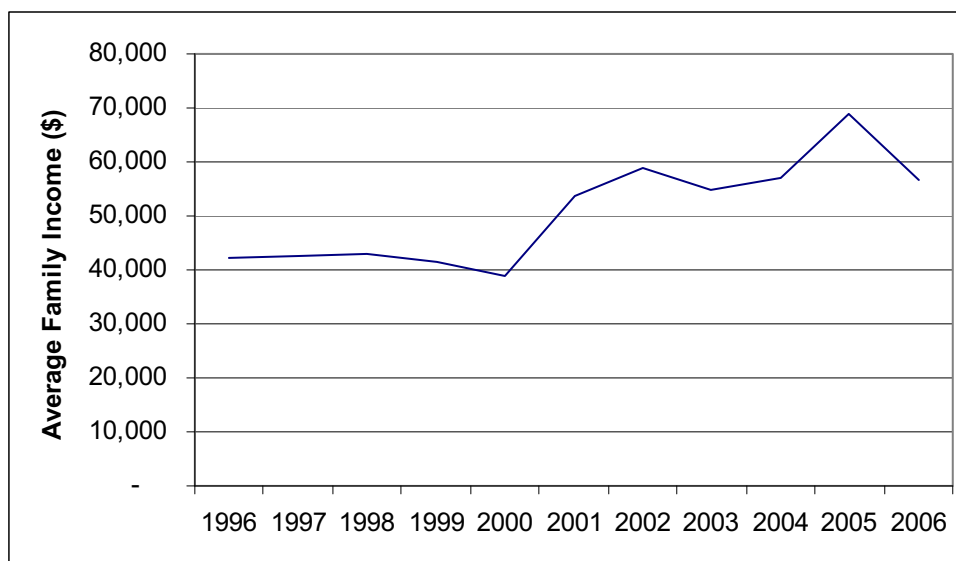
The average personal income for residents of Tuktoyaktuk has increased since 1996 (Figure 9.8-8). Average income in 1996 was \$22,740 and had increased to \$28,902 by 2006.



Source: NWT Bureau of Statistics (2008a)

Figure 9.8-8
Tuktoyaktuk Average Personal Income, 1996 - 2006

Similarly, the average family income had generally increased since 1996 (Figure 9.8-9). In 1996, the average family income was \$42,114 and had increased to \$56,724 by 2006.



Source: NWT Bureau of Statistics (2008a)

Figure 9.8-9
Tukttoyaktuk Average Family Income, 1996 - 2006.

9.8.2 Inuvik (Community Profile)

9.8.2.1 Background

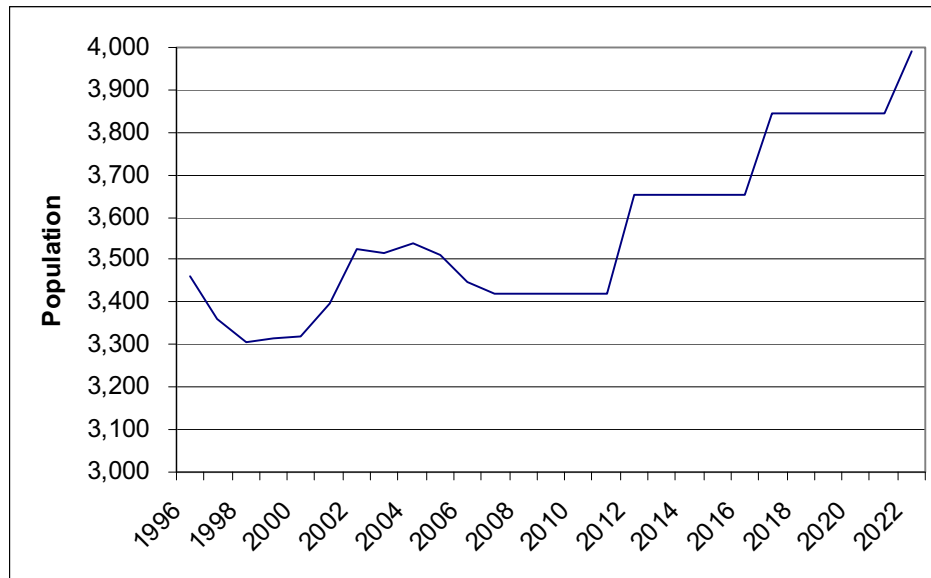
The Town of Inuvik is located on the Mackenzie River Delta at 68°21'N and 133°43'W. The community is located approximately 1,086 km northwest of Yellowknife. Inuvik is accessible year-round by air or all-weather road (Dempster Highway) and by water during the ice free season.

Inuvik is the 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/Mackenzie Delta (Town of Inuvik 2009). The airport, government services, recreational programs and hospitality industry attract residents from neighbouring communities and those traveling to and from other communities.

9.8.2.2 Population

The majority (58.4%) of the Inuvik population is Aboriginal (Inuvialuit and Gwich'in) (NWT Bureau of Statistics 2008b).

The historic and projected population of Inuvik is provided in Figure 9.8-10. Inuvik's population has fluctuated between 1996 and 2007 with an overall population decrease of 3,462 to 3,420, indicating a declining average annual growth rate of -0.1 (NWT Bureau of Statistics 2008b). Despite this, the NWT Bureau of Statistics projects that the population will increase to 3,654 by 2012 and 3,992 by 2022.

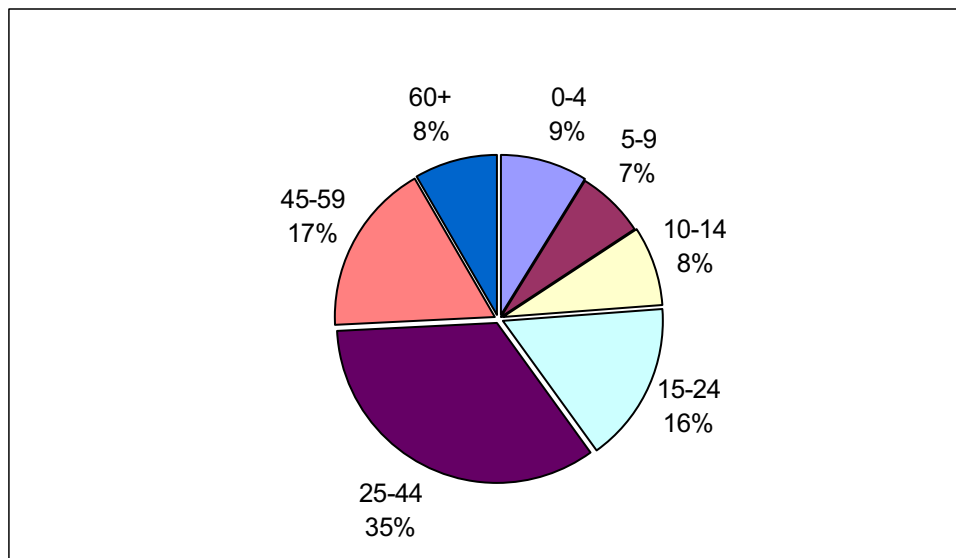


Source: NWT Bureau of Statistics (2008b)

Figure 9.8-10
Inuvik Historic and Projected Population, 1996 - 2022

From 1996 to 2005, there were 48 to 88 births each year, with an average of 65.6 births per year over the ten year period. The number of teen births has ranged between 3 and 13 per year between 1996 and 2005, with an average of 7.8 teen births per year. The annual death rate has ranged between 9 and 21 deaths per year between 1996 and 2005.

The population by age and gender is described in Figure 9.8-11 and Table 9.8-2, respectively. Data indicate that there are fairly even proportions of each group, with declining proportions for older age groups. There are a slightly greater number of males than females in the community.



Source: NWT Bureau of Statistics (2008b)

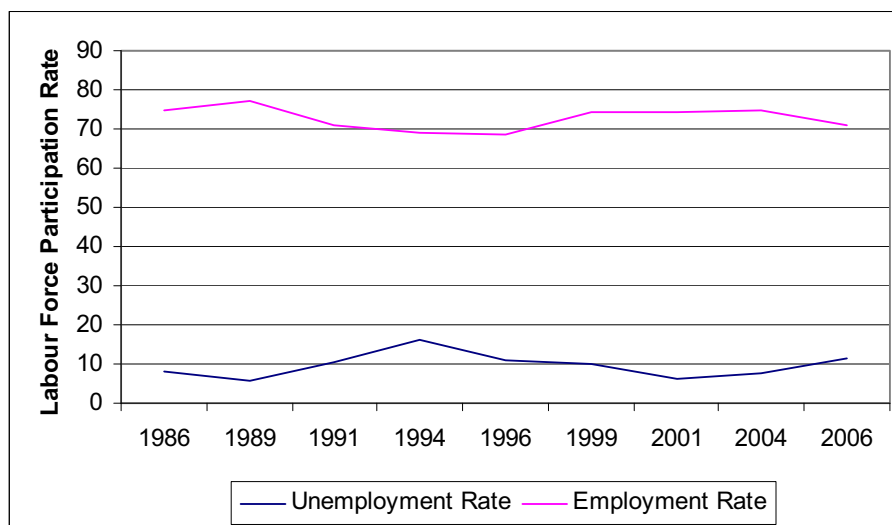
Figure 9.8-11
Inuvik Population by Age Group, 2007

TABLE 9.8-2: INUVIK POPULATION BY GENDER, 2007		
Gender	Population	Percent
Male	1,759	51%
Female	1,661	49%

Source: NWT Bureau of Statistics (2008b)

9.8.2.3 Employment

Community employment data are provided in Figure 9.8-12. In 2006, 2,570 residents were aged 15 years and older. Employment data indicate that of the population aged 15 years and older 1,825 residents were employed, 230 residents were unemployed, and 515 residents were not in the labour force. Of the 2,055 residents in the labour force, this translates into a participation rate of 80.0% and an unemployment rate of 11.2%. Both employment and unemployment rates have remained relatively stable between 1986 and 2005, with some fluctuations from 1991 to 1996.

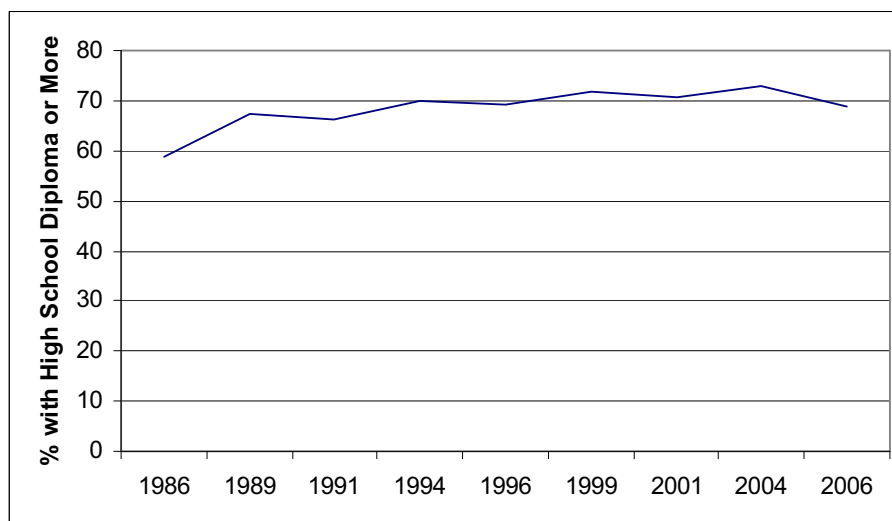


Source: NWT Bureau of Statistics (2008b)

Figure 9.8-12
Inuvik Employment and Unemployment Rates, 1986 – 2006

9.8.2.4 Education

The percent of residents achieving a high school diploma has generally increased since 1986 (Figure 9.8-13). In 1986, 58.7% of the population had completed high school, compared to 68.8% by 2006. Data for specific educational levels, such as trade, technical, and university certificates and diplomas were unavailable.



Source: NWT Bureau of Statistics (2008b)

Figure 9.8-13
Inuvik Educational Level, 1986 - 2006.

9.8.2.5 Traditional Activities

According to the NWT Bureau of Statistics (2008b), the level of involvement of Inuvik residents in traditional activities recorded in 2003 was:

- 32.6% of residents hunted and fished;
- 7.2% of residents trapped; and
- 17.7% of residents consumed country foods.

In comparison, the level of involvement in traditional activities in 1994 was:

- 9.8% of residents hunted and fished; and
- 6.9% of residents trapped (NWT Bureau of Statistics 1994).

Data regarding consumption of country foods were not available for 1994, nor is there an explanation for the significant increase in percentage of residents that hunted and fished from 1994 to 2003.

9.8.2.6 Language

The percentage of Inuvik's Aboriginal population that speaks an Aboriginal language (Inuvialuktun and Gwich'in) is slowly declining. In 1984, 35.2% of the Aboriginal population could speak an Aboriginal language, this has since declined to 17.6% in 2004 (NWT Bureau of Statistics 2008b).

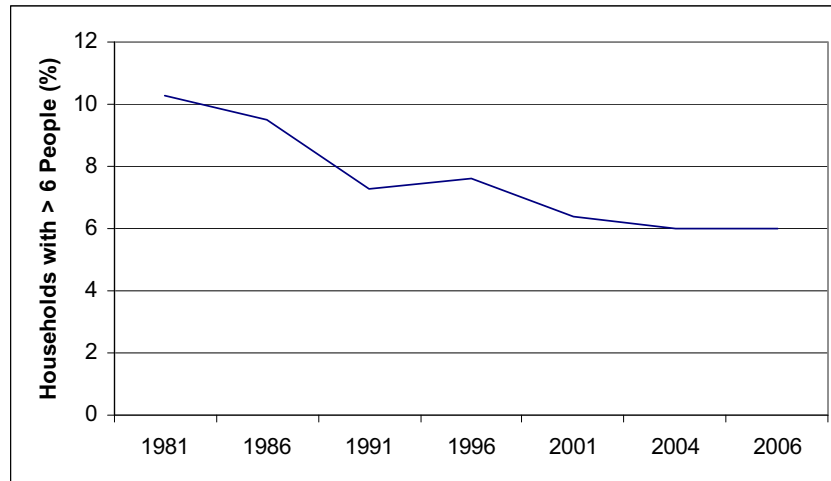
9.8.2.7 Community Services

Several community services are offered in Inuvik through the Beaufort-Delta Health and Social Services Authority. Services include the Billy Moore Home and Charlotte Vehus Group Home (adult handicapped group homes), Inuvik Regional Hospital, Public Health Unit, Senior Citizens Centre, Transition House (women/ children shelter), Reliance Group Home (child welfare facility), and Inuvik Social Services Office (Northwest Territories Health and Social Services 2009). An RCMP detachment is also located in Inuvik (NWT Infrastructure n.d.(b)).

Other community services include recreation facilities, chartered bank, primary and secondary school, Aurora College, grocery stores, restaurants and accommodations. Municipal services include trucked/ piped sewage, solid waste collection and public works (NWT Infrastructure n.d.(b)).

9.8.2.8 Housing

In 2006, there were 1,245 houses in the community. Of these, 420 were owned and 820 were rented, and 5 were not classified. The percentage of households with more than six people has declined since 1981 (Figure 9.8-14). In 1981, 10.3% of households had more than six people living in the household; by 2003, this percentage had declined to 6.0% (NWT Bureau of Statistics 2008b).

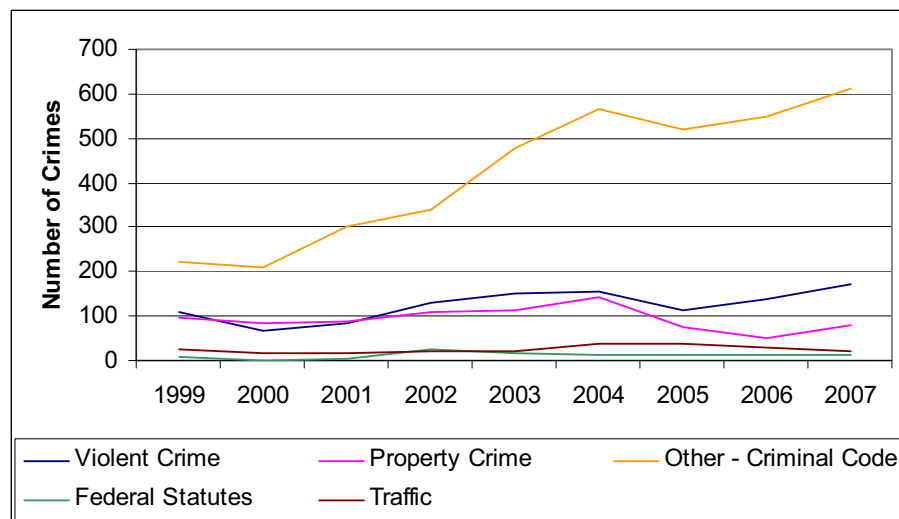


Source: NWT Bureau of Statistics (2008b)

Figure 9.8-14
Inuvik Households with More Than Six People, 1981 - 2006

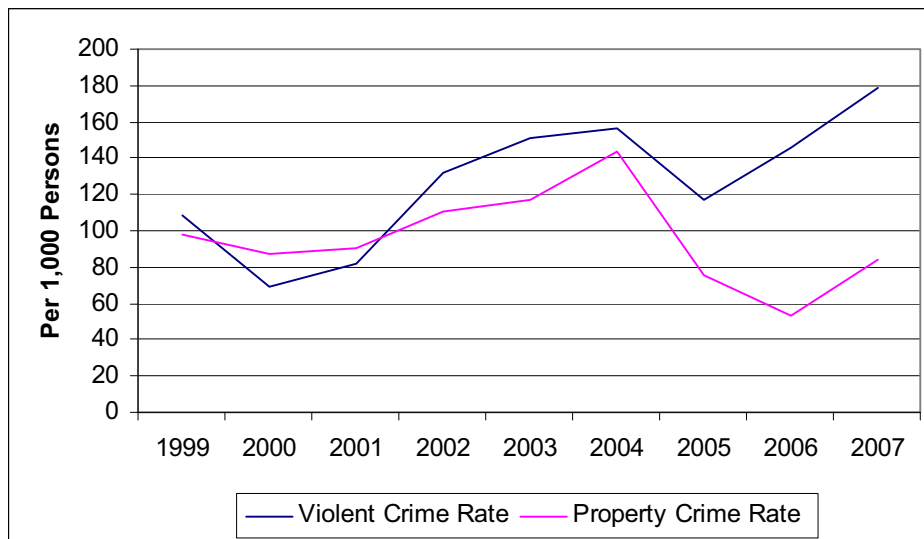
9.8.2.9 Crime

The Inuvik RCMP detachment reports on crime statistics. Crime levels have generally increased since 1999, with noticeable increases in crimes recorded between 2002 and 2004, with a slight decline in 2005 to 2006, followed by an increase (Figure 9.8-15). Similar trends occurred with the violent crime rate and property crime rate per 1,000 persons (Figure-9.816).



Source: NWT Bureau of Statistics (2008b)

Figure 9.8-15
Inuvik Crimes, 1999 - 2007

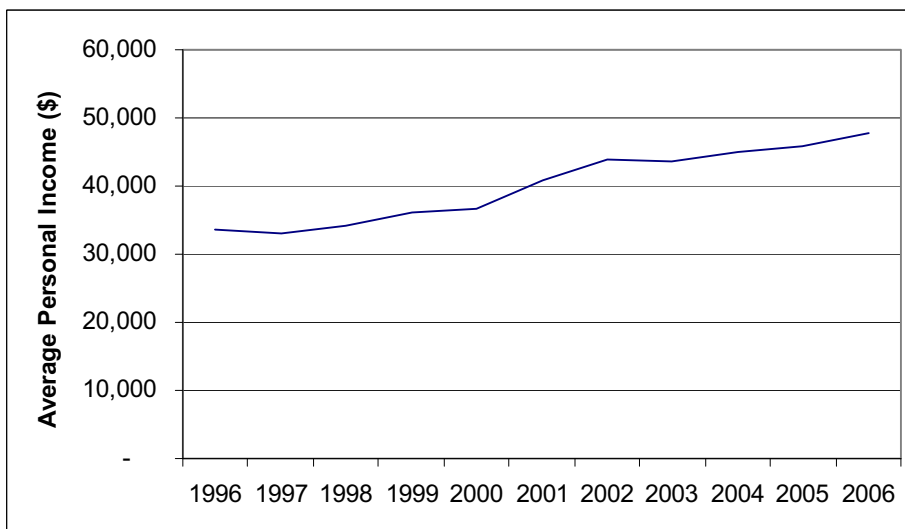


Source: NWT Bureau of Statistics (2008b)

Figure 9.8-16
Inuvik Violent Crime and Property Crime Rates, 1999 - 2007

9.8.2.10 Income

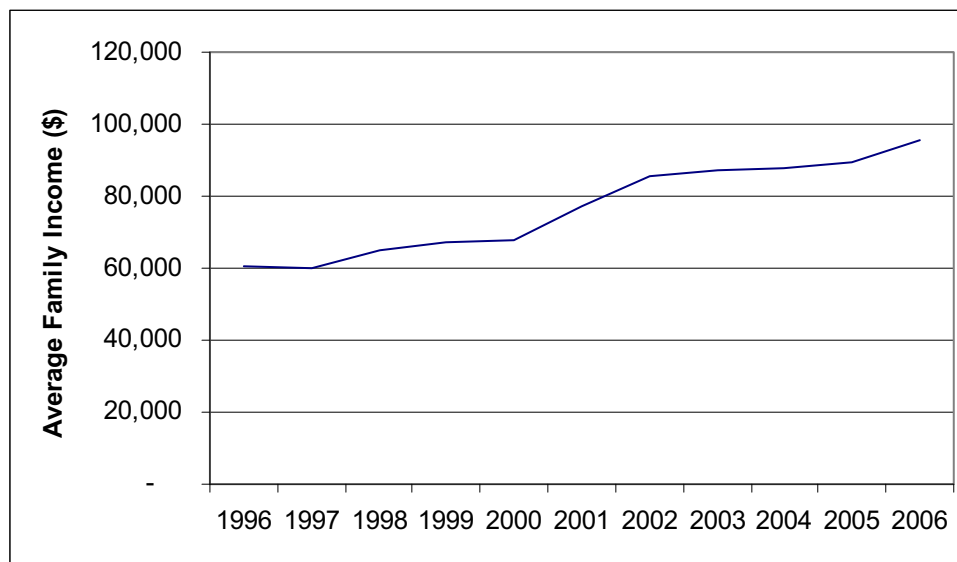
The average personal income for residents of Inuvik has increased since 1996 (Figure 9.8-17). Average income in 1996 was \$33,657 and has increased to \$47,665 by 2006.



Source: NWT Bureau of Statistics (2008b)

Figure 9.8-17
Inuvik Average Personal Income, 1996 - 2006

Similarly, the average family income has generally increased since 1996 (Figure 9.8-18). In 1996, the average family income was \$60,497 and had increased to \$95,392 by 2006.



Source: NWT Bureau of Statistics (2008b)

Figure 9.8-18
Inuvik Average Family Income, 1996 - 2006

10.0 ANTICIPATED ENVIRONMENTAL EFFECTS AND PROPOSED MITIGATION

The following section reviews the proposed project activities, potential environmental effects and mitigation measures associated with the construction of the proposed Inuvik to Tuktoyaktuk Highway.

10.1 APPROACH TO ENVIRONMENTAL MANAGEMENT

The Partners are committed to constructing the proposed Inuvik to Tuktoyaktuk Highway, borrow sources, and associated winter access roads in a safe and environmentally responsible manner. Extensive environmental studies have been conducted in the area for previously proposed roads and oil and gas development. The Partners are committed to incorporating existing information and building upon this knowledge base.

The existing framework for environmental management of the highway construction project consists of:

- Regulatory and other management instruments that define environmental terms and conditions, including:
 - EISC Screening Decision Report, including recommended Terms and Conditions;
 - ILA Land Use and Quarry Permit Terms and Conditions;
 - INAC Land Use Permit Conditions;
 - Northwest Territories Water Board Licence Terms and Conditions;
 - Navigable Waters Protection Act Approvals Terms and Conditions;
 - Conformance with DFO Operational Statements, Letters of Advice and potential Fisheries Authorization(s); and
 - HTC and Co-Management Body directions.
- Use of experienced, local construction contractors.
- Avoidance and protection of sensitive terrain and habitats.
- Avoidance of identified heritage and archaeological sites.
- Construction environmental and wildlife monitoring.

A requirement for contractors to be selected regarding environmental management for the Highway construction project will include the provision and implementation of the following management plans:

- Contractor health, safety and environment (HSE) manuals including general spill contingency and emergency response plans.
- Contractor work procedures documents.
- Site-specific health and safety plans.
- Site-specific spill contingency plans.

A copy of a typical contractor's spill contingency and emergency response plan is provided in Appendix C. The development of site-specific plans will take place in the future upon award of contracts to the successful contractors. However, examples of the noted health, safety, and environmental management plans can be made available upon request.

This section of the Project Description Report focuses on the anticipated environmental effects associated with the relatively short-term construction and how these effects can and will be mitigated. Issues that may arise in the future because of proposed operational changes related to the highway are also discussed.

10.2 AIR QUALITY AND NOISE

Dust, air emissions and noise associated with the relatively short-term construction of the highway and aggregate borrow sources are expected to have limited, localized and generally temporary effects on air quality and the sound environment in the vicinity of the highway.

Dust particles of various sizes are expected. Larger particles (> 44 microns diameter) are typically associated with nuisance issues, while smaller particles (< 10 microns diameter) can potentially create human health issues at elevated levels in populated areas. Emissions from diesel engine combustion exhaust (CO, NO_x, SO₂ and PM) during construction and operation are also expected to be generated.

10.2.1 Air Quality

During aggregate borrow activities and the highway construction phase, typical dust sources will include: heavy equipment movements, loading and unloading of raw materials, crushing, screening, blasting, erosion from sand and gravel stockpiles, etc. The application of water from nearby, suitable lakes, as per the GNWT *Guideline for Dust Suppression* (GNWT 1998), will be effective during summer in controlling dust created by loading and unloading materials, stockpiling and wind erosion. Any water extracted for dust control or other purposes will be undertaken in accordance with Northwest Territories Water Licence requirements and DFO water withdrawal criteria.

Emissions from diesel engine combustion exhaust during the construction phase are considered to be relatively minor. Construction-related emissions are expected to be localized, short-term and intermittent.

10.2.2 Noise

Highway construction activities will be intermittent, temporary and transient in nature. Most of the noise during the construction phase will be associated with equipment operation and, if required, blasting activities to break up the frozen borrow material during excavation. Although 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 will be timed to avoid periods when sensitive wildlife species are in the area. Prudent design, best management

practices and mitigation can be combined to minimize sound levels during the construction phase.

Trucks will typically be dump trucks or other haul trucks, operating at slow speeds. Noise levels associated with such trucks are typically within 78-82 dBA at 15 m from the truck, which would not be expected to create excessive noise levels near the highway. These levels will be intermittent.

Aggregate borrow activities, including blasting will be intermittent and temporary in nature. Most of the noise will be associated with earth-moving equipment operation during periods of aggregate borrow activity. Best management practices and mitigation measures will be applied to reduce the effect of noise.

Examples of prudent design and management practices include:

- Limitation of construction activity during sensitive to minimize effects on wildlife;
- Effective logistics planning such as the use of vans or extended cab pick-up trucks to transport workers to minimize vehicle movements; and,
- Regular maintenance of equipment and provision of appropriate mufflers for all internal combustion engines.

10.3 SENSITIVE TERRAIN

The highway will traverse tundra and will be constructed using end dumping methods to initially lay down the borrow material on geotextile followed by placement of the finer surfacing material for the highway. A detailed discussion of sensitive terrain features is provided in Section 5.6.2 and further baseline information is provided in Section 9.2.2.3.

The highway will be constructed in the winter months to minimize ground disturbance that could cause permafrost degradation. The highway will be constructed with sufficient cross drainage to prevent or minimize potential water ponding. Ponding conditions could lead to permafrost thaw which could cause ground disturbance, changes to existing drainage conditions and slope instability.

Activities that will affect the terrain during highway construction include the removal of overburden at borrow sites, the excavation of highway construction material from the borrow sources, the construction of the highway, and the re-contouring of construction sites and associated facilities.

As previously indicated in Section 5.3 of this Project Description Report, the average width of the highway footprint will be 20 to 28 m (depending on the surface finish width) including the embankment. Considering the full 137 km length of the preferred highway alignment the total highway footprint would directly impact approximately 329 ha of terrain and associated vegetation.

Borrow sources will be located as close to the highway route as possible to minimize haul distances. The borrow sources will be operated and reclaimed in a manner consistent with ILA and INAC permit requirements and existing environmental standards and guidelines. To further minimize potential impacts on terrain and associated vegetation, temporary winter access roads, constructed of snow and ice over the frozen ground, will be employed for access to the borrow sources.

Site-specific reclamation plans will be prepared and approved prior to the commencement of operations at each borrow source. All borrow source sites will be permanently reclaimed when use of that source is complete in accordance the applicable reclamation plan. Progressive reclamation will occur to ensure that only areas with active borrowing will be disturbed. Mined out areas will be recontoured and revegetated, if possible to mimic the surrounding terrain upon completion of borrowing activities.

The potential effects of activities on terrain can be related to surface disturbance during construction that can cause damage to soils, permafrost, cause erosion and alter landforms. Mitigation strategies to reduce effects on soils and landforms include:

- Reducing surface disturbance;
- Controlling potential erosion;
- Stabilizing slopes, if required; and
- Revegetation, if possible.

To minimize impacts on the existing terrain of the project area, the footprint of the highway, the temporary construction camps, and the borrow sources will be confined to the extent possible. With the application of the proposed mitigation measures, the effects of the highway and associated borrow activities on the terrain of the project area are generally expected to be limited to the physical footprint and are considered to be minor in the context of the overall project area.

10.4 VEGETATION

10.4.1 Footprint

As previously indicated, the average width of the highway footprint will be 20 to 28 m (depending on the surface finish width) including the embankment. Considering the full 137 km length of the preferred highway alignment the total highway footprint would directly impact approximately 329 ha of terrain and associated vegetation.

10.4.2 Construction

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 impact the vegetation cover by direct removal at the borrow sites and the burial of vegetation beneath the Highway right-of-way.

As described in Section 10.2.1 construction activities are expected to generate dust at times which could affect the vegetation cover in areas adjacent to the applicable activities. The application of water from nearby, suitable lakes, as per the GNWT *Guideline for Dust Suppression* (GNWT 1998), will be effective during summer in controlling dust created by loading and unloading materials, stockpiling and wind erosion. Any water extracted for dust control or other purposes will be undertaken in accordance with Northwest Territories Water Licence requirements and DFO water withdrawal criteria.

In wet lowland areas, the placement of the highway has the potential to affect local surface water hydrological conditions, which could, in turn, affect the aquatic vegetation communities of these areas. To assist in mitigating this potential concern, culverts will be used, where appropriate, to maintain existing hydrological conditions and to avoid or minimize ponding along the Highway or the drying out of isolated sections of potentially affected wet lowland.

10.4.3 Equipment Traffic

Construction activities will be limited, to the extent possible, to the planned footprint of the highway. All care will be taken during the operations to ensure that travel by heavy equipment and trucks will take place only within the right-of-way or snow compacted and flooded accesses and turn-arounds. 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 assist in minimizing potential impacts on terrain and associated vegetation.

10.4.4 Mitigation Measures

Consistent with the approach being taken with the Tuktoyaktuk to Source 177 Access Road construction project, geotextile fabric will be used as an underlay to protect the terrain and permafrost. By design, the project will avoid disturbing vegetation and permafrost. The design avoids the use of “cut” slopes as a means of reducing grades because the goal is to construct the highway in a way that protects the permafrost underlying the Highway. The fill that will be used will be placed to an adequate depth to protect the permafrost.

Snow removal and grading will be necessary during winter operations. The build-up of snow on the sides of the highway has the potential to affect the vegetation community adjacent to the highway due to delayed melting in spring.

Potential strategies for mitigating potential effects on the vegetation communities in the vicinity of the highway and associated borrow operations are provided in Table 10.4-1. 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.

TABLE 10.4-1: POTENTIAL EFFECTS AND MITIGATION STRATEGIES FOR VEGETATION ALONG THE HIGHWAY

Potential Effect	Potential Consequence	Mitigation
Vegetation Infill	Loss of vegetation; increase in ecosystem fragmentation; loss of ecosystems with restricted distribution	Minimize footprint; minimize development on ecosystem types with restricted distribution; avoid sensitive ecosystems; minimize off-site activities such as ATV use; reclaim to viable and wherever practical, self-sustaining ecosystems.
Alteration of Surface Hydrology	Change in water flow, quantity and direction	Ensure adequate drainage in wet lowland areas through the installation of culverts as necessary.
Dust	Temporary seasonal effects on vegetation in adjacent areas	Diligent application of water as per the GNWT <i>Guideline for Dust Suppression</i> (GNWT 1998)

10.5 WILDLIFE

Roads can affect wildlife in several possible ways. Roads can be considered habitat when they provide wildlife with some requisites for survival such as food or shelter (e.g., insect relief for caribou). A road is a conduit when wildlife moves along it (e.g., a wolf traveling on a wind-swept road during winter). Roads may be barriers or filters if wildlife movements across them are blocked completely or selectively, respectively. Roads may act as sources (provide habitat) if wildlife living in the corridor disperses into surrounding habitat (e.g., small mammals such as ground squirrels). Alternatively, they may act as sinks if wildlife is attracted and dies as a result (e.g., collisions).

The physical existence of the Highway, the habitats it traverses, patterns and intensity of use by wildlife, and patterns and intensity of vehicle traffic all play major roles in determining the extent to which a road may affect wildlife. Wildlife responses to the construction activities of the proposed Highway and its associated borrow source developments, the physical presence of the proposed Highway, and human activity along the proposed Highway depend, in part, on whether or not they are resident, seasonally resident or migratory. Species are likely to exhibit some degree of habituation to activities associated with the all-weather operation of the proposed Highway.

Two of the most important wildlife species to stakeholders are caribou and grizzly bears. Caribou are a central link in the food chain for other wildlife species and are relied upon by the communities as a source of food. Grizzly bears are a concern as they are considered a vulnerable species and are known to be potentially dangerous in certain human/ bear encounters. However, other ecosystem components are also important and include furbearers, birds and small mammals. Furbearers such as wolves and wolverine are of economic importance. Birds occupy a tremendous variety of ecological niches, and some, mainly waterfowl species, are an important source of food for the communities. Small mammals are an important component of the biodiversity of arctic ecosystems and comprise part of the prey base for carnivorous mammals and birds.

The majority of disturbances to wildlife will be of a temporary nature. Biological effects experienced during construction of the proposed Highway and the physical existence of the Highway afterwards are not anticipated to affect the ecological integrity of the local or regional area.

10.5.1 Potential Effects on Wildlife and Wildlife Habitat

Effects on wildlife associated with the construction of the proposed Highway and its associated borrow sources can be in the form of impacts on habitat and impacts on wildlife. Habitat effects refer to the loss and degradation of habitat. Habitat may be lost or degraded, reducing its value for wildlife. Habitat loss will occur primarily during the construction phase. Degradation of habitat is a secondary effect of habitat loss during construction and operation. The majority of construction for the proposed Highway and excavation of the associated borrow sources will occur during the winter period, a time when most wildlife are not in the area. Consequently, impacts from construction activities will be mainly temporal and limited.

Impacts on wildlife from construction of the proposed Highway and its associated borrow sources, the physical existence of the proposed Highway, and vehicular traffic include, physical and physiological disturbance, displacement and habituation. Wildlife may respond in the following primary ways:

- Move away from the proposed Highway;
- Increase activity and energy expenditure near the proposed Highway;
- Delay crossing or fail to cross the proposed Highway;
- Reduce use of habitats adjacent to the proposed Highway;
- Be injured or killed by collisions with vehicles;
- Be killed as a result of hunting and trapping along the proposed Highway; and
- Be attracted and become habituated to human food at camps and garbage along the proposed Highway.

Potential wildlife issues that are common to most of the species are classed as direct habitat loss, disturbance, mortality, habituation and attraction and increased harvesting pressure. These are discussed in the following sections. Wildlife and wildlife habitat issues and their respective mitigation measures are discussed in Section 10.5.2.

10.5.1.1 Habitat Loss

Roads eliminate the habitat upon which they are built by burying the vegetation that it covers. Potential impacts of a road are dependent on the road route and the type of construction. The footprint of this proposed Highway is anticipated to be approximately 137 km long by 12-15 m wide. The amount of habitat lost to the Highway is estimated to approximately 329 ha.

Although habitat is lost by road construction, roads can also change habitat from one form to another. As a terrain feature in the environment, the physical presence of a gravel road is roughly analogous to natural features such as eskers, kames and gravel bars on stream flood plains. Such habitats may attract caribou seeking insect relief and small mammals such as ground squirrels, mice etc. for burrowing and dens.

The majority of the proposed Highway alignment is situated on upland tundra habitats, which are generally poorer quality wildlife habitat than the lower lying, more productive wetlands or riparian zones. While they represent a loss, in particular for small mammals, some bird species and ground squirrels, this loss is small compared to the amount of similar habitat available. The amount of wetland and shrub riparian habitat along the corridor is minimal and surrounded by poorer habitat in the form of upland habitat. The more productive habitats are found in the form of wetland areas and riparian tall shrub communities. Wherever possible, these habitats will be avoided during Highway construction.

Borrow excavation activities may cause some localized, temporary habitat loss. Because these activities will be generally limited to the winter period, effects on wildlife habitat are anticipated to be minimal. Progressive reclamation will occur to ensure that only active areas will be disturbed. Areas will be re-contoured and revegetated, if possible to match the surrounding terrain upon completion of excavation activities.

Wildlife will experience some negligible to minor habitat loss associated with the proposed Highway and associated borrow sources. Minimization of habitat loss combined with employee education on wildlife issues will reduce the potential for wildlife impacts. Particular attention will be focused on the protection of caribou and grizzly bears.

Mitigation measures consist of consideration of habitat quality during design of the Highway. Important habitats, where possible, will be avoided and habitat loss minimized. For example, deposits used as sources of sand and gravel will be assessed for their use and importance for grizzly bear denning.

10.5.1.2 Habitat Degradation

Habitat degradation resulting from the project may include damage to local vegetation, either physically or through the effects of dust or other contaminants. Nitrous oxides and sulphur dioxide emitted from power generators and construction equipment are potential sources of environmental effects.

Air emissions associated with the project are unlikely to affect feeding habitats for wildlife. Air quality effects associated with particular project activities and local meteorological conditions will be minimal and temporary.

Dust created by road traffic during the summer months is expected to settle within 300 m of roads. The quantity of dust is unlikely to have a major effect on vegetation and wildlife and water will be employed to minimize potential issues associated with dust. The accidental spillage of fuel, lubricants and/or anti-freeze at a work site or during

transportation represents a potential hazard. In the event of a spill, cleanup measures will be implemented immediately. All spills greater than 5 litres will be reported to the GNWT Spill Line and other appropriate agencies.

10.5.1.3 Disturbance

Certain species can be sensitive to disturbance, and displacement from habitat adjacent to roads has been widely reported. Habitat displacement can result in reductions in access to security areas and in the efficiency of foraging strategies, with possible population-level consequences. Disturbance can affect wildlife within a zone of influence (ZOI) around the source. However, habitat within the ZOI is not lost; it is just reduced in effectiveness.

The ZOI is a horizontal measure of the area in which wildlife could be affected by an activity. Many factors affect the distance of ZOI such as topography and the presence of security cover. Environmental conditions such as wind and snow cover can also affect ZOI ratings. How wildlife respond to various stimuli is influenced by the degree of habituation of the individual involved.

Habituation of wildlife to traffic and industrial activity can be beneficial as it reduces the intensity of displacement from those disturbances. Some wildlife may habituate fairly quickly to predictable disturbances, as long as they are not associated with strongly negative consequences such as shooting or direct harassment. In the case of the proposed Highway, it is likely that wildlife will initially behave warily, but will habituate over time.

10.5.1.4 Wildlife Mortality

Hunting

Wildlife mortality could increase through hunting and/ or road kills. The proposed Highway will allow hunters and trappers more ready access to harvesting areas and, consequently, human-induced mortality for caribou, furbearers, and waterfowl may potentially increase. The proposed Highway could also assist in providing trappers with access into previously more remote areas along the corridor.

Residents of Tuktoyaktuk have expressed concern that hunting pressure on caribou and other wildlife may increase as a direct consequence of building the Highway. To protect wildlife, organizations such as the ILA, HTC, ITC, WMAC, and GNWT Department of Environment and Natural Resources will need to continue to work together to develop guidelines and conditions for use of the Highway. The consultant's discussions with these agencies identified a shared view that the success of this approach would require a high level of voluntary compliance from the users of the proposed Highway and a public awareness program that would include signage along the Highway alignment highlighting hunting restrictions and discouraging excessive hunting along the corridor.

For the period July 1, 2008 to June 30, 2009, Area I/BC/07, which includes the area of the proposed Highway, was closed to the hunting of barren-ground caribou for all hunters.

Road Kills

Traffic-related mortality can be linked to several factors including traffic density, vehicle speed and/ or road width. Any of these factors can directly affect the success of an animal reaching the opposite side of the road, with an increase in any factor reducing the probability of an animal crossing safely.

The Inuvik to Tuktoyaktuk Highway is expected to have low levels of traffic (in the order of 60 vehicles per day) at most times. Such low levels of traffic would be expected to reduce the occurrence of potential traffic-related mortality along this Highway.

10.5.1.5 Carnivore Dens

Construction and operation of the Highway may potentially affect carnivore denning activities through Highway traffic, noise and vibration. There is some evidence that bears in their dens can be disturbed by human activity, leading to den abandonment, cub mortality and decreased survival (Goodrich and Berger 1994). Linnell et al. (2000) reported that grizzly bears might abandon dens in response to activity within 1 km, and especially within 200 m, but that responses were variable. However, Reynolds et al. (1986) found that no bears deserted their dens despite seismic activity within 800 m and the passage of a supply train within 100 m. Results are too few to generalize. The amount of snow cover for insulation and proximity of activities (Blix and Lentfer 1992), and the type, intensity and duration of activities may be factors contributing to whether bears in dens are disturbed.

Discussions with GNWT Department of Environment and Natural Resources in 2008 (P. Voudrach and M. Branigan, pers. comm. November 20, 2008) identified several areas in the vicinity of the proposed Highway that provide suitable south-facing cutbanks or slopes that may be suitable for grizzly bear denning. Monitors will be made aware of these areas, and will assist with identifying habitat use for the purposes of avoidance and worker safety. The GNWT Department of Environment and Natural Resources subsequently conducted an aerial bear den survey of this area on May 17, 2009 on behalf of the GNWT Department of Transportation and reported that there was no evidence of current grizzly bear activity in the area. In addition, no dens were found within 500 m of either side of the access road, or within Source 177 (GNWT ENR 2009c).

10.5.2 Wildlife Protection and Mitigation Measures

10.5.2.1 Wildlife Protection

Management decisions related to the protection of wildlife and wildlife habitat for the Inuvik to Tuktoyaktuk Highway are based on background information; field investigations; inputs from the Tuktoyaktuk and Inuvik Hunters and Trappers Committees; and the application of, appropriate best management practices. The primary wildlife species of concern to the operation of the proposed Highway are caribou, moose, wolves, wolverines, foxes, grizzly bears, and the high value fur-bearers, such as lynx and marten. 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;
- Minimize attractants at camps through responsible waste management and effective environmental awareness programs;
- Minimize the volume, duration, and frequency of noise producing activities;
- Selective timing of Project activities to avoid critical periods for wildlife;
- Conform with pre-determined setback distances from key wildlife habitat features;
- Ensure proper storage, transportation and disposal of wastes;
- Ensure Project personnel have appropriate levels of wildlife training and awareness; and
- Encourage agencies such as the HTC's, WMAC 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.

10.5.2.2 Mitigation Measures

The following section summarizes the types of mitigation measures that can be undertaken to minimize potential impacts on wildlife species. The GNWT Department of Transportation's operational policies are designed to mitigate potential impacts on wildlife and wildlife habitat. Three types of reduction measures exist: spatial, temporal and operational. Spatial measures are designed to reduce impacts through avoiding important habitat areas such as wetlands used by staging waterfowl; temporal measures are designed to reduce disturbance during critical periods such as avoiding areas during northern migration; and, operational measures are designed to embrace good work practices such as alerting drivers to the presence of caribou in the area of a road or the proper procedure for waste disposal.

Tables 10.5-1, 10.5-2, and 10.5-3, adapted from GNWT Department of Transportation (2009), present the typical types of mitigation measures that have been or can be integrated into the project design, construction and anticipated future operational practices to reduce or minimize potential impacts of the proposed Highway on wildlife including mammals and birds.

TABLE 10.5-1 SUMMARY OF WILDLIFE-RELATED PROJECT DESIGN MITIGATION MEASURES

Potential Effect	Design Mitigation
Habitat Disturbance / Deterioration	• Project footprint has been minimized and previously disturbed areas will be used, wherever possible. • Access to the Project site will be shared, wherever possible. • Waste will be trucked out, rather than using a sump.
Sensory and other Disturbances	• Wherever possible, technologies to minimize sound disturbance have been incorporated into Project design. • Blasting activities, if required, will be limited to borrow sites and will only be undertaken during the winter period.
Wildlife Incidents	• Provide field workers with education and awareness of the Wildlife Management Plan guidelines and programs. • The Field Supervisor and Safety Advisor will educate all field workers on the applicable practices contained within the Wildlife Management Plan. • The Field Supervisor and Safety Advisor will provide all field workers with Bear Aware training and general wildlife awareness. • Implement wildlife-human interaction procedures, which will include Bear Aware training and safe working distances from wildlife. • Workers must avoid all interactions with wildlife unless crew safety is at risk. • Field workers will not feed, harass or approach wildlife. • Birds, nests and eggs must be left intact. If an active nest is directly near or in the path of the borrow source site a no-work zone will be established and crews will work in another area within the approved borrow site until birds have vacated the nests. • All human/wildlife conflicts and incidents will be reported to the Field Supervisor and Safety Advisor and documented. • Access to the surface facilities will be limited. • All significant wildlife features, such as nests and dens will be documented and reported. • Implementation of No Firearms and No Hunting/Fishing policy for field workers. • Firearms will not be allowed on-site except for firearms in the possession and control of the authorized wildlife monitors. • No hunting or fishing by Project-related employees will be permitted. • All food and stored garbage should be kept in bear-proof areas or bear proof containers. • Any grease, oils, fuels stored on-site must be stored in bear-proof areas or containers. • Operators will implement the Observe, Record and Report Policy, encouraging workers to report any suspicious activities related to wildlife. The Field Supervisor and Safety Advisor will be responsible for obtaining and reporting this information to the appropriate responsible agency • Wildlife sightings will be recorded (including GPS location data if possible) to be submitted to the GNWT Department of Transportation Planning, Policy and Environmental Division and GNWT Department of Environment and Natural Resources Inuvik office upon completion of the project.

TABLE 10.5-1 SUMMARY OF WILDLIFE-RELATED PROJECT DESIGN MITIGATION MEASURES

Potential Effect	Design Mitigation
Wildlife Attraction to Site and Waste Management	- Waste Management that minimizes and disposes of attractants to wildlife such as garbage, food wastes and other edible and aromatic substances will include the following measures: - Minimize and dispose of attractants to wildlife such as garbage, food wastes and other edible and aromatic substances. - Store all food and garbage in either: airtight sealed container, bear proof containers or in an enclosed bear proof area. - Store on-site grease, oils, fuels in bear-proof areas or containers. - No waste will be incinerated on- or off-site. Waste will be transported and disposed of at the Tuktoyaktuk and/or Inuvik municipal solid waste facilities in accordance with the municipalities' terms and conditions for usage of the facilities. The following will be identified: - List of hazardous, non-hazardous waste and any wastes of special concern, if any. - Waste types and volumes expected to be produced - List of storage and transport methods and disposal locations for these wastes. - List of odorous wastes that may attract wildlife, and the identification of its storage and method of transport to prevent wildlife attraction. - Indicate whether odorous waste is stored for the purpose of on- or off-site disposal (i.e. road or air transport).
Wildlife Mortality	- Immediately consult with appropriate territorial (ENR) and federal (CWS) wildlife authorities. Any key species mortality will be reported to ENR and CWS. - Situation and site will be assessed, including potential for further wildlife mortality. Consider increased wildlife deterrent mechanisms and security, including fencing and lights to ensure wildlife and personnel safety. - Multiple mortalities of other species should be reported to CWS (e.g. multiple birds striking infrastructure over several months, or single incident of a large flock of migratory birds striking infrastructure).
Spills of Hydrocarbons or Toxic Substances Resulting in Injury to Wildlife and/or Wildlife Habitat	- Territorial (ENR) and federal (CWS) authorities will be contacted immediately to determine appropriate course of action, which may include capturing, relocating or treating contaminated wildlife. - Spill response and containment will be completed expeditiously in accordance with the site-specific spill contingency plan and the contractor's HSE manual and procedures. - The spill area will be monitored closely by the environmental monitor and appropriate deterrents (e.g., warning noises, flagging) employed to discourage wildlife from entering the affected area and ingesting toxic substances or becoming covered in spill material.

Source: GNWT DOT 2009

TABLE 10.5-2 SUMMARY OF MITIGATION MEASURES FOR TERRESTRIAL MAMMALS

Project Activity	Potential Effect	Mitigation Measures	Frequency
All Activities	Disturbance to wildlife: Disturbance or injury to wildlife and their habitat.	Project personnel will be provided with wildlife awareness training.	Ongoing throughout the life of the Project.
All Activities	Disturbance of denning mammals: Denning bears or wolverines could be disturbed and could abandon den sites near Project activities during the winter. Presence of key wildlife feature (e.g., nest, den).	- If active bear or wolverine dens are discovered within 500 m of Project sites, ENR will be contacted immediately to determine the appropriate course of action. Activities may be temporarily suspended pending consultation with ENR. - ILA wildlife monitors will be on-site during construction to monitor wildlife and manage risks. - Personnel are to maintain a minimum distance of 300 m between sighted and/or known bear den sites for the duration of the Project. - If a den is identified, the animal may be hazed away (permit required) to discourage it from continuing to construct a den there. This action will be taken in consultation with ENR and will involve the wildlife monitor. - If a key wildlife feature of a Species at Risk is discovered, ENR will be contacted. Activities may be temporarily suspended pending consultation with these agencies.	Continuous throughout the life of the Project.
All Activities	Disturbance of denning and other mammals by workers walking off-site may disturb denning bears during the winter months or other mammals (e.g., fox, wolverine) year-round.	- Workers will not walk off-site onto land at any time of year, unless there is a specific requirement (i.e., waste recovery), and these activities will be scheduled to avoid sensitive wildlife periods. - All workers will receive, at minimum, a basic wildlife orientation, and will be instructed not to disturb any wildlife. - Personnel are to maintain a minimum distance of 300 m between sighted and/or known bear den sites for the duration of the Project.	Ongoing throughout the life of the Project while personnel are onsite.
All Activities	Wildlife incident or mortality: wildlife (e.g., grizzly bear, polar	ENR will be contacted if an active grizzly bear or wolverine den is identified within 500 m of Project activities to determine appropriate course of action. Any polar bear	Ongoing throughout the life of the Project while personnel

TABLE 10.5-2 SUMMARY OF MITIGATION MEASURES FOR TERRESTRIAL MAMMALS

Project Activity	Potential Effect	Mitigation Measures	Frequency
	bear) may approach sites while workers are present potentially resulting in a wildlife incident or mortality.	observed within 1 km of Project sites will be reported to ENR and CWS. The wildlife monitor and designated, trained staff will have access to bear deterrent materials including bear spray, cracker shells, and a 12 gauge shotgun with plastic slugs. All work crews will have at least one can of bear spray during periods when bears may be present. The use of any deterrent method will be reported to ENR.	are onsite.
All Activities	Wildlife incident or mortality: Wildlife (e.g., grizzly bear, polar bear) may approach sites while workers are present potentially resulting in wildlife incident or mortality.	- Suitable hazing/herding techniques (permits required) will be used to move wildlife from Project facilities, as per consultation with ENR and CWS. The wildlife monitors will advise personnel regarding the appropriate course of action. - Snow will be removed around buildings and work areas to increase visibility. - Adequate lighting will be installed in areas where it is essential to detect bears that may be in the vicinity. - Camps and associated infrastructure will be designed to incorporate proper bear safety, including avoiding blind corners, installing adequate lighting, incorporating proper waste management, cleaning and maintaining the kitchen and dining area, fencing, and wildlife detection.	Ongoing throughout the life of the Project while personnel are onsite.
Waste Storage	Wildlife incident or mortality: poorly secured waste can blow off site and pose risk of mortality to wildlife	- All waste products will be properly secured, stored and transported. This includes the use of bear-proof storage containers that reduce odours at all times. - Waste removal crews will be sent out to areas surrounding each construction site before the arrival of breeding birds in the spring to collect and properly dispose of any waste material that have blown off site. - Fencing will be considered around areas that might attract wildlife (i.e., waste and food storage facilities). - The main wastes produced during the construction of the Highway will be typical domestic garbage and sewage.	Ongoing throughout the life of the Project.

TABLE 10.5-2 SUMMARY OF MITIGATION MEASURES FOR TERRESTRIAL MAMMALS

Project Activity	Potential Effect	Mitigation Measures	Frequency
Vehicle/ Equipment Use	Wildlife incident or mortality: spills or leaks may harm wildlife.	• Best management practices, mitigation measures, emergency response and spill contingency plans will be implemented where necessary to prevent and address leaks and spills (details will be outlined in the contractor's emergency response and spill contingency plans). • All vehicles will be equipped with spill kits. • Drip trays will be placed under all vehicles and equipment when such vehicles and equipment are parked. • All fuel tanks and sumps used on the project will be double-walled with 100% containment. • All fuelling locations will be at appropriate distances from waterbodies with strategically placed berms. • Equipment used in or near water will be clean and free of oil, grease or other deleterious substances. • In the event of a spill, all efforts will be made to properly contain and manage the spill, including wildlife removal and treatment if necessary. • As per the contractor's emergency response and spill contingency plan, the spill area will be monitored closely and appropriate deterrents (e.g., warning noises, flagging) employed to discourage wildlife from entering the affected area and ingesting toxic substances or becoming covered with spill material.	Ongoing throughout the life of the Project while personnel are onsite.
All Activities	Disturbance to barren-ground caribou	• No person shall hunt barren-ground Caribou in the Aklavik/ Inuvik/ Tuktoyaktuk Barren-Ground Management Area I/BC/07 • Maintain a minimum distance of 500 m between field operations and barren-ground caribou for the duration of the project.	Ongoing throughout the life of the Project while personnel are onsite.

Source: GNWT DOT 2009.

TABLE 10.5-3 SUMMARY OF MITIGATION MEASURES FOR BIRDS

Project Activity	Potential Effect	Mitigation Measures	Frequency
Off-site Activities	Wildlife incident or mortality: Workers walking off-site may disturb nesting songbirds, shorebirds and waterfowl during the breeding season and cause nest abandonment and chick/egg mortality.	- Workers will not walk off-site onto land at any time of year, unless there is a specific need (e.g., waste clean-up, emergency). - Planned activities will be scheduled to occur outside of peak breeding times. - All workers will be instructed not to disturb any birds or nests observed. - Where practical, workers will avoid conducting project activities within 500 m of an active raptor nest during nesting season. - If active nesting sites are discovered within 500 m of Project sites, ENR and CWS authorities will be contacted immediately to determine the appropriate course of action. Activities may be temporarily suspended pending consultation with ENR. - ILA wildlife monitors will be on-site during construction to monitor wildlife and manage risks. - If a key wildlife and nesting feature of a Species at Risk is discovered, both ENR and CWS will be contacted. Activities may be temporarily suspended pending consultation with these agencies.	Ongoing throughout the life of the Project while personnel are onsite.
Waste Storage	Wildlife incident or mortality: poorly secured waste can blow off site and pose risk of mortality to nearby nesting or foraging songbirds, shorebirds and waterfowl through the ingestion of wastes or entanglement in waste materials; poorly secured waste can attract predators, which may increase predation pressure on nearby nesting songbirds, shorebirds and waterfowl.	- All waste products will be properly secured, stored and transported. This includes the use of bear-proof storage containers that reduce odours at all times. - Waste removal crews will be sent to areas surrounding each construction site before the arrival of breeding birds in the spring to collect and properly dispose of any waste material that has blown off site. - The main wastes produced during the construction of the Highway will be typical domestic garbage and sewage.	Ongoing throughout the life of the Project.
Vehicle/ Equipment Use	Wildlife incident or mortality: Spills or leaks may harm wildlife.	Best management practices, mitigation measures, emergency response and spill contingency plans	Ongoing throughout the life of the Project.

TABLE 10.5-3 SUMMARY OF MITIGATION MEASURES FOR BIRDS

Project Activity	Potential Effect	Mitigation Measures	Frequency
		will be implemented where necessary to prevent and address leaks and spills (details will be outlined in the contractor's emergency response and spill contingency plans). • All fuelling locations will be appropriate distances from waterbodies with strategically placed berms	
Vehicle/ Equipment Use	Wildlife incident or mortality: Spills or leaks may harm wildlife.	• Equipment used in or near water will be clean and free of oil, grease or other deleterious substances. • In the event of a spill, all efforts will be made to properly contain and manage the spill, including wildlife removal and treatment if necessary. The spill area will be monitored closely and appropriate deterrents (e.g., warning noises, flagging) employed to discourage wildlife from entering the affected area and ingesting toxic substances or becoming covered with spill material.	Ongoing throughout the life of the Project.

10.5.3 Mitigation Measures for Species at Risk

Table 10.5-4 outlines mitigation measures for Species at Risk. Species that may occur within the project corridor that are protected by Species at Risk Act (SARA) include the Woodland caribou (Boreal Population) (listed as Threatened April 2007) and the Eskimo curlew (listed as Endangered November 2009) (Government of Canada 2009). The Rusty Blackbird is listed by SARA as Special Concern (Schedule 1) (Government of Canada 2009). Species listed as Special Concern under Schedule 1 do not benefit from full legal protection under the Act. However a management plan for the conservation of the species of Special Concern and its habitat must be prepared within three years. The Short-eared Owl and Peregrine Falcon (*Falco peregrinus tundrius*) are listed by SARA as Special Concern (Schedule 3) and are not afforded protection under SARA (Government of Canada 2009). The wolverine and grizzly bear have been assessed by the COSEWIC as Special Concern (COSEWIC 2009) and are not afforded protection under SARA.

Project activities have the potential to adversely affect these species through direct habitat loss, sensory disturbance and accidental mortality. The contractors will be required to employ an adaptive management approach to ensuring sensitive species/ species at risk are adequately protected during all phases of road construction and borrow source work.

The mitigation measures outlined in Tables 10.5-1 to 10.5-4 will be implemented to mitigate potential impacts on all wildlife, including Species at Risk.

TABLE 10.5-4 SUMMARY OF MITIGATION MEASURES FOR SPECIES AT RISK	
Activity/Potential Effect	Mitigation Measure
Eskimo Curlew - SARA Schedule 1 – Endangered; ENR - At Risk under their general status program Rusty Blackbird – SARA Schedule 1 - Special Concern; ENR – May Be At Risk under their general status program	
Birds may be at risk of mortality from leaks and spills. Nests may be abandoned due to disturbance from Project activities.	- The prevention and response measures to manage spills and leaks will be outlined in the contractor's emergency response and spill contingency plans. - In the event of a spill, all efforts will be made to properly contain and manage the spill, including wildlife removal and treatment if necessary, as per the contractor's emergency response and spill contingency plans. The spill area will be monitored closely and appropriate deterrents (e.g., warning noises, flagging) employed to discourage wildlife from entering the affected area and ingesting toxic substances or being covered with spill material. - Appropriate federal (CWS) and territorial (ENR) authorities will be contacted immediately before continuing work if a nest is identified within predetermined set-back distances (as determined through consultation with CWS/ENR).
Short-eared Owl - SARA Schedule 3 - Special Concern; ENR – Sensitive under their general status program	
Nest sites may be abandoned due to disturbance from Project activities.	- Activities that cannot be conducted between October and April will be scheduled to occur outside the sensitive nesting period in June. Project activities scheduled for June are of intermittent continuation of grading and compaction. This precludes emergency activities. - Appropriate federal (CWS) and territorial (ENR) authorities will be contacted immediately before continuing work if a nest of a key wildlife species is identified within predetermined set-back distances (as determined through consultation with CWS/ENR).
Birds may be at risk of mortality from leaks and spills.	- The prevention and response measures to manage spills and leaks will be outlined in the contractor's emergency response and spill contingency plans. - In the event of a spill, all efforts will be made to properly contain and manage the spill, including wildlife removal and treatment if necessary, as per the Emergency Preparedness and Response Plan. The spill area will be monitored closely and appropriate deterrents (e.g., warning noises, flagging) employed to discourage wildlife from entering the affected area and ingesting toxic substances or being covered with spill material.
Birds may be at risk of mortality	The prevention and response measures to manage spills and leaks will be outlined in the contractor's emergency response and spill contingency plans.

TABLE 10.5-4 SUMMARY OF MITIGATION MEASURES FOR SPECIES AT RISK

Activity/Potential Effect	Mitigation Measure
Peregrine falcon (<i>F. p. tundrius</i>) – SARA Schedule 3 - Special Concern; ENR – Not Assessed under their general status program	
Birds can collide with communication towers and other facilities, especially during the migration period.	Guy wires will not be used.
Lighting of communication towers and other facilities can attract birds at night, especially during the migration period, resulting in injury or mortality.	Lights will be positioned to shine down or 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 unmanned); this may include the use of remote control of lighting, motion detectors, etc.
Wolverine - COSEWIC - Special Concern; ENR – Sensitive under their general status program	
Wolverines and/or wolverine denning sites may be disturbed by Project activities.	- All staff will receive, at minimum, an orientation to this Wildlife Management Plan and the Bear Response Guidelines. Wildlife monitors will be onsite at all times during construction activities to report and advise as needed. - If, for any reason, spring disturbance is unavoidable, pre-disturbance surveys will be conducted in cooperation with ENR, as required. If a den is found, it will be reported immediately to ENR and a 500 m set-back will be in place around an active den during activities. If a wolverine, not denning, is identified within 500 m, ENR will be contacted to determine an appropriate course of action.
Grizzly Bear – COSEWIC - Special Concern; ENR – Sensitive under their general status program	
Grizzly bear and/or grizzly bear denning sites may be disturbed by Project activities.	- ENR will be contacted prior to construction start-up to determine locations of any known denning sites near the Project area. Ongoing consultation with HTC and IGC will occur to ensure awareness of Project activities and obtain any local knowledge. - If possible, no activities will take place within 500 m of an active den during the denning period, between October and April. If active dens or if a grizzly bear are observed within 500 m of the site during activities, territorial (ENR) and federal (CWS) agencies will be contacted immediately and an appropriate course of action will be determined. - All staff will receive at minimum a wildlife orientation and basic wildlife training. Wildlife monitors will be onsite for the duration of the seasonal construction program.

10.6 FISH AND FISH HABITAT

10.6.1 Construction Effects and Mitigation

The assessment of the potential effects of road construction on aquatic resources, including fish and fish habitat, and the development of effective avoidance or mitigation measures, are major components of the environmental assessment of the proposed Inuvik to Tuktoyaktuk highway. 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 utilized by fish for any part of their life cycles;
- Migratory channels: ephemeral and perennial (except in winter) streams that are utilized 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 utilized by one or more life cycle stages of fish during open water periods, in addition to migration.

Table 10.6-1 identifies the principal fish habitat issues which must be considered as part of the regulatory approval process. The appropriate crossing structures and avoidance or mitigation measures designed to achieve no net loss (NNL) of productive capacity of fish habitat will be guided in part by the designated category of stream for each site. Table 10.6.1 provides generalized avoidance or mitigation measures to minimize adverse effects. However, more complete site specific measures will be developed based on individual conditions and requirements, and appropriate DFO timing windows (DFO 2009a) will be consulted to avoid instream work in fish bearing streams during critical time periods.

TABLE 10.6-1: EFFECTS OF CONSTRUCTION AND OPERATION OF THE PROPOSED HIGHWAY ON FISH AND FISH HABITAT		
Activity	Potential Effect	Avoidance or Mitigation
Bridge construction	• Direct loss of riparian habitat due to abutments	• Minimize riparian disturbance
	• Direct loss of instream habitat due to piles/piers	• Construct clear span bridges • Minimize instream work • Implement erosion and sediment control measures
	• Flow changes due to stream constriction	• Abutments to be placed at a sufficient distance from active stream channel
Culvert installation	• Direct loss of habitat	• Avoid critical habitats
	• Migration barrier	• Employ best management practices for culvert installation • Annual monitoring to detect culvert

TABLE 10.6-1: EFFECTS OF CONSTRUCTION AND OPERATION OF THE PROPOSED HIGHWAY ON FISH AND FISH HABITAT

Activity	Potential Effect	Avoidance or Mitigation
		subsidence or lifting
	Sediment release during construction	Employ sediment and erosion control measures
	Changes in stream flow patterns	Appropriate sizing of culverts based on hydrological assessments.
Use of heavy equipment	Soil erosion and sedimentation	Employ erosion and sediment control measures
	Fuel, lubricant spills	- Regular maintenance of equipment away from water bodies - On-site spill containment equipment
Highway design	Direct loss of habitat	- Avoid critical habitats - Design appropriate crossing structures based on site conditions
	Erosion and sedimentation	- Maintain sufficient distance from lakes, if possible - Install sediment control in ditches and cross drainage channels
Quarry development	Erosion and sedimentation	- Maintain sufficient distance of undisturbed land between quarry and any waterbody - Apply erosion and sediment control measures and best management practices
Water extraction	- Oxygen level depression - Exposure of eggs and larvae - Reduction of available habitat for spring spawners	Follow DFO Protocol for Winter Water Withdrawal
Public access	Increased exploitation due to improved access to remote fishing areas	Public education

10.6.1.1 Stream Crossings

Among other factors, consideration will be given to the category of stream in determining the type of crossing structure at each location that would be best suited to avoid the harmful alteration, disruption, or destruction (HADD) of fish habitat, as prohibited by Section 35. (1) of the *Fisheries Act*. Table 10.6-2 provides general guidance in this regard, although site specific conditions may dictate alternative measures:

TABLE 10.6-2: GENERALIZED STREAM CROSSING STRUCTURE AND MITIGATION RECOMMENDATIONS

Stream Category	Stream Crossing Guide
Non-fish bearing	<i>Culvert</i> . Apply sediment and erosion control best management practices during construction.
Migratory channels	<i>Culvert</i> ⁷ . Sizing and placement of culvert is critical to avoid excessive velocities. Culvert should be set into the substrate to prevent erosion at downstream invert. Where possible, culvert should be installed in areas having a hard (gravel/cobble) bottom. Where culvert twinning is required, only one culvert should be set to permit fish passage at low flows. Apply sediment and erosion control best management practices during construction. Follow the DFO Operational Statement for Temporary Stream Crossings (DFO 2009b) where these are necessary.
Spawning/rearing/feeding streams	<i>Clear span bridge</i> . Follow DFO Operational Statement for Clear Span Bridges (DFO 2009c). Apply sediment and erosion control best management practices during construction.

Table 10.6-3 provides a summary of the stream crossing structures recommended at each crossing location, based solely on fish and fish habitat considerations. As indicated in the table, there are a number of crossing locations requiring further field investigation to remove uncertainty regarding the quality of available fish habitat and the type of structure that should be constructed. Ground surveys will provide information on fish and habitat presence or potential, and hence, the appropriate construction and environmental management measures that should be adopted at each site. The locations where clear span bridges are recommended due to known fish presence and/or habitat quality are identified in the route map shown in Figure 10.6-1.

The preliminary reconnaissance findings indicate that the majority of channels 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. Appropriately sized culverts (800-900 mm diameter) installed at these locations will require the implementation of appropriate erosion and sediment control measures to protect downstream habitats, but would not directly impact fish or fish habitat.

⁷ Open bottom culverts are normally preferred where culverts must be installed in fish bearing streams in lieu of clear span bridges. It is understood that open bottom culverts are not suitable for use along the proposed Highway corridor for geotechnical reasons.

TABLE 10.6-3: PRELIMINARY STREAM CROSSING STRUCTURE RECOMMENDATIONS¹ BASED ON STREAM AND FISH HABITAT CHARACTERISTICS OR POTENTIAL

Crossing No./ Kilometre Post	Culvert (no fish habitat)	Culvert (moderate or seasonal fish habitat)	Bridge(good or known fish habitat)	Comments
01	✓			Ephemeral, no headwater lakes
02	✓			Ephemeral, very small drainage
03			?	Good habitat. Stream crossing structure to be determined.
04			?	Good habitat. Similar to crossing #04.
05	✓			Ephemeral, very small headwater lakes
06	✓			Ephemeral, short runoff channel
07	✓			Ephemeral, short runoff channel
08		?		Requires field check
09	?			Appears from preliminary aerial reconnaissance to be ephemeral. Requires field check.
10	✓			Ephemeral, no headwater lakes
11	✓			Ephemeral, no headwater lakes
12		?		Small, flowing channel. Requires field check.
13	✓			No visible stream channel.
13a (KM 17)			✓	Short, wide migration channel between lakes. Likely migration corridor.
14	✓			Ephemeral, very short drainage channel draining small headwater lake.
15	✓			Ephemeral. Drains small upstream headwater lake.
16	✓			Ephemeral. Drains small upstream headwater lake.
17	✓			Ephemeral. Very small drainage.
18 (KM 26)			✓	Good habitat. Tributary to Jimmy Lake.
19	✓			Ephemeral drainage channel.
20	✓			Ephemeral drainage channel.
21a			?	Good habitat with perennial flow.
21a	✓			Ephemeral. Drains small lakes in upper portion of watershed.
22a		?		Requires field check
23a (KM 40)			✓	Good perennial habitat. Trail Valley

TABLE 10.6-3: PRELIMINARY STREAM CROSSING STRUCTURE RECOMMENDATIONS¹ BASED ON STREAM AND FISH HABITAT CHARACTERISTICS OR POTENTIAL

Crossing No./ Kilometre Post	Culvert (no fish habitat)	Culvert (moderate or seasonal fish habitat)	Bridge(good or known fish habitat)	Comments
				Creek
24a	✓			Ephemeral. Very small drainage.
25	✓			Ephemeral. Very small drainage. No lakes upstream.
26	✓			Ephemeral. Very small drainage.
27a	✓			Ephemeral. Very small drainage. Only one small pond upstream.
27b	✓			Short drainage channel.
28a		✓		Short connection channel between lakes. Migration corridor.
29	✓			Short runoff channel in headwaters.
29a (KM 55.5)			✓	Drains small headwater lake. Tributary to Hans Creek.
30a (KM 56.5)			✓	Hans Creek. Known fish habitat.
31 (KM 67.5)			✓	Zed Creek. Known fish habitat.
32	✓			Ephemeral. Headwater tributary to Zed Creek.
33		✓		Small perennial stream. Known fish habitat (fish observed).
34a	✓			Ephemeral drainage channels from small headwater lakes.
34b	✓			Not shown in map book. NW of km 89 on alternate route. Appears to be ephemeral on Google Earth.
34e	✓			Ephemeral, short channel draining very small upstream lakes.
35a (KM 89.5)			✓	Good habitat, perennial flow.
38a		✓		Perennial stream. Moderate to poor habitat conditions.
39 (KM 109)			✓	Good habitat. Perennial stream, large drainage.
39a			?	Short, wide channel between 2 lakes. Requires field check.

¹ '?' Indicates uncertainty related to the quality of fish habitat and the type of crossing structure required. Further field investigation is required.

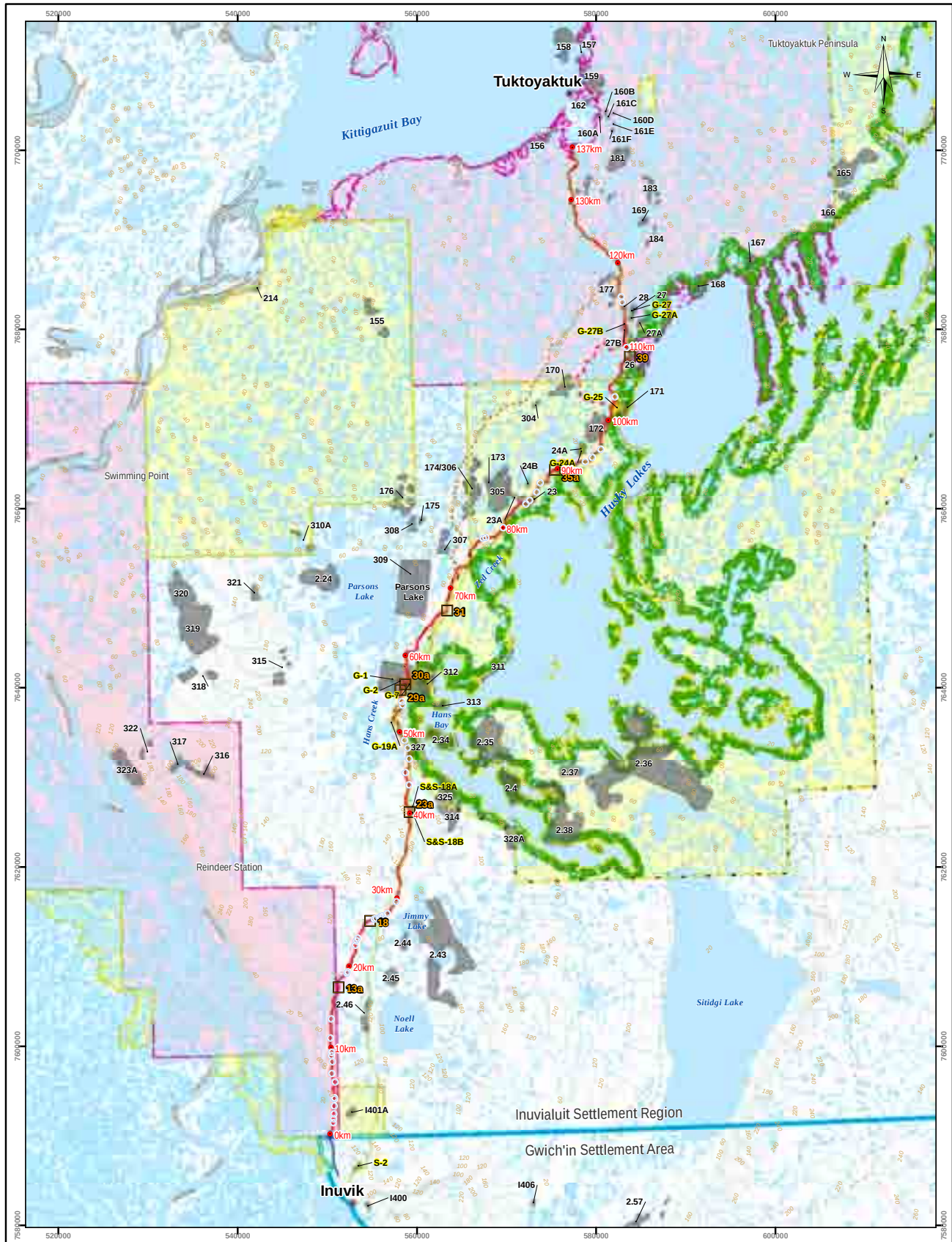
10.6.1.2 Sediment Control

By their nature, road construction activities have the potential to cause erosion and the consequent sedimentation of receiving streams and lakes. Sediment released to streams and lakes, both in suspended and settled forms, presents a serious risk to fish and fish habitat. The effects of sediment on fish and their habitat includes, but is not limited to: degradation of potential spawning areas; smothering of eggs and the benthic invertebrate food supply; reduction in feeding efficiency; avoidance of potentially suitable habitats; and, abrasion of fish tissues (Birtwell 1999; Lloyd et al. 1987). For example, Arctic grayling have been found to be displaced downstream of their preferred habitats at suspended sediment levels greater than 100 mg/L (McLeay et al. 1987); Scannell (1988) determined that only 10% of Arctic grayling food supply would be available at suspended sediment concentrations of about 63 mg/L; and, Birtwell (1999) reports dramatic decreases in salmonid egg survival with increasing levels of fine sediments in the gravel.

Sediment releases from road and aggregate borrow source development originate from exposure of soils during site preparation and grubbing, the erosion of particulates that make up the highway surface and slopes, and the erosion of soils in unstable ditches, which is then carried in runoff. In recognition of the potential adverse effects of sediment, it is recommended that an environmental management plan (EMP) be prepared prior to construction and approved by regulators, to provide specific and detailed guidance to avoid sediment releases to the aquatic environment. The EMP should refer to appropriate erosion and sediment control guidelines, best management practices, and measures outlined in the DFO (1993) Land Development Guidelines for the Protection of Aquatic Habitat.

Some of the important measures to be followed include:

- limiting the use of construction equipment to the immediate footprint of the highway or quarry;
- minimizing vegetation removal and conducting progressive reclamation at the quarry sites;
- keeping ice bridge and ice road surfaces free from soils and fine gravel that may be tracked out of the quarry by vehicles;
- avoiding the use of heavy equipment in streams or on stream banks and the adherence to the DFO Operations Statement for Temporary Stream Crossings, where these are deemed necessary;
- installation of silt fencing and/or check dams, and cross drainage culverts as necessary to minimize siltation in runoff near water bodies; and,
- appropriate sizing and installation of culverts to avoid backwatering and washouts.



LEGEND

- Stream Crossing
- Stream Crossing - Potential Bridge
- 2009 Route
- - - Other Alignments
- - - Considered
- - - Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Highway Borrow Sources
- Borrow Sources
- - - Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

NOTES

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

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Stream Crossing Field Assessment Sites September 2009

PROJECTION UTM Zone 8	DATUM NAD83	Scale: 1:400,000	
5 2.5 0 5 10 Kilometres		FILE NO. V23201098_PDR-Map006-Fish-StreamX.mxd	
PROJECT NO. V23201098	DWN KWM	CHK DM	REV 1
OFFICE EBA-VANC	DATE January 14, 2009		

Figure 10.6-1

ISSUED FOR USE

10.6.1.3 Water Extraction

Considerable amounts of water will be required for highway construction and associated aggregate borrow activities. It is proposed that water for these purposes will be extracted from lakes in proximity to the highway corridor. Since construction will take place in winter, water will necessarily be pumped from water beneath ice cover. It is anticipated that water requirements will exceed 300 m³/day, which will trigger the need for a NWTWB Type A Water Licence.

The extraction of water from ice covered lakes can potentially contribute to lethal and sub-lethal effects on fish due to depression of dissolved oxygen concentrations, exposure or freezing of littoral spawning beds due to falling water levels, and loss of important habitats for spring spawning fish (e.g. northern pike) if water levels do not sufficiently rebound to flood critical spawning habitats (Cott et al. 2008a; Cott et al. 2008b). As a result, DFO, in conjunction with other regulators and industry, has developed the *Protocol for Winter Water Withdrawal in the Northwest Territories* (DFO 2005), for projects where a water withdrawal of greater than 100 m³ is required from any individual waterbody that has the potential to provide fish habitat. Based on recent research in NWT lakes, this protocol sets limits to water withdrawal as a percentage of available under ice water volume, with consideration given to latitude and maximum lake water depth (Cott et al. 2008b). Those water withdrawal thresholds for the region encompassing the Inuvik to Tuktoyaktuk Highway are:

- 0% for lakes with less than 1.5 m of free water below the maximum ice thickness (i.e. 2 m);
- 10% of available under ice water volume for lakes with a minimum depth of ≥ 3.5 m;
- 100% if the maximum depth of the water body is less than the predicted maximum ice thickness (implying no available overwintering fish habitat).

In addition, the protocol directs that water be withdrawn from areas of a lake that are greater than 2m below the ice surface to avoid removing the more highly oxygenated water that tends to collect at the water-ice interface. Water intake screening with mesh of 2.5 mm should be used to avoid entrainment of fish (DFO 1995).

To conform to the thresholds set out in the DFO Protocol, it may be necessary to carry out bathymetric surveys on some of the lakes proposed for water extraction. Minimum requirements for the collection and submission of bathymetric survey information are provided in the Protocol, and are further detailed in Cott et al. (2005).

10.6.2 Monitoring

Compliance monitoring during construction is normally required to ensure that prescribed mitigation measures and best management practices are implemented, and to detect and correct unanticipated problems. Monitoring of the highway construction will be carried out by trained ILA environmental and wildlife monitors. During Highway construction, wildlife and environmental monitors will be onsite. The wildlife monitors will be individuals

authorized by the local HTC's and employed by the Contractor. Environmental monitors will be employed by and under the direction of the ILA. As previously stated, monitors will be on-site at all times during any time that construction activities are being undertaken.

10.7 CONSEQUENCES OF ACCIDENTS OR MALFUNCTIONS

Accidents or malfunctions can be associated with any human activities, including those associated with the short-term construction periods projected for the 138 km 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 minimize risks of accidents or malfunctions occurring and to minimize possible risks to the environment from such potential accidents or malfunctions, a number of preventative and mitigation measures will be employed. The overriding preventative and mitigation measures to be employed include:

- Implementation of best management and industry practices as appropriate to prevent or minimize the occurrence of accidents or malfunctions;
- Ensuring that all contractors onsite 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 ILA and INAC Land Use Permit and Borrow Permit requirements and conditions issued for the construction project;
- Conformance with existing applicable GNWT and Workers Compensation Board standards;
- Fuel and other hydrocarbons will be stored in accordance to storage tank regulations under the Canadian Environmental Protection Act and the CCME's environmental code of practice for storage of these products (CCME 2003);
- All vehicles and equipment will be refueled at least 30 m from water bodies following DIAND fuel storage guidelines;
- Any uncontrolled discharge will be immediately managed to stop discharge and begin the mitigation process. Spills will be reported to the 24-hour Spill Report Line (867-920-8130) according to current guidelines; and
- Spill containment and cleanup activities will be implemented in accordance with the site-specific spill contingency plans that will be developed by the prime construction contractors selected for the Inuvik to Tuktoyaktuk Highway Project (e.g. Appendix C).

The key strategy will be to prevent accidents from occurring through education and enforcement. With the application and implementation of the preventative and mitigation

measures as outlined, no significant fuel, chemical or other product spills are expected to occur.

The vast majority of the proposed activities will be conducted on the proposed Highway itself and negligible or minor environmental effects are anticipated. The Construction Team will work closely with the ILA environmental and wildlife monitors present when the proposed Highway is being constructed.

10.7.1 Fuel Storage

Fuel needed for the aggregate borrow and highway construction activities will be stored in double-walled fuel storage units. All fuel will be stored in accordance with CCME (2003) as previously indicated.

10.7.2 Refuelling Operations

All vehicles and equipment will be refueled at least 30 m from water bodies following DIAND fuel storage guidelines.

10.7.3 Waste Management

The main wastes produced during the construction of the Inuvik to Tuktoyaktuk Highway will be typical domestic garbage and sewage. The intent is to haul all garbage and other solid wastes to either Inuvik or Tuktoyaktuk for disposal in approved facilities. The camps will use Pacto toilets, which collect sanitary waste in plastic bags, or other accepted sewage management practices. The bags will be subject to hygienic handling procedures and will be incinerated at off-site incinerator units located in Inuvik or Tuktoyaktuk.

10.8 EFFECTS OF ENVIRONMENT ON PROJECT - CLIMATE CHANGE

Climate Change is occurring and the effects are already observed in some regions. As previously discussed in more detail in Section 9.1.5, projections show that increase of ground and air temperatures due to climate change is expected to be most significant in Canada's northern territories.

The stability of permafrost and the stability of infrastructure built on it depend on maintaining ground temperatures to minimize the thickness of the active layer, and to impede thaw. The proposed Highway is located within the permafrost region and stability of highway structure will be dependent on maintaining the perennially frozen ground.

The frozen ground has variable proportions of ground ice. When thaw occurs, the excess water is expelled and consolidation produces substantial settlements. The thermal stability of the frozen ground is sensitive to minor changes in heat transfer at the ground surface. These minor changes in heat transfer alter the surface heat balance, initiating thaw and increased active layer thickness. Such heat transfer and potential settlement due to thaw is possible in permafrost regions even without climate warming. Subtle increases in

temperature and extreme weather events that result in extreme precipitation and rapid snow melt can contribute to the thaw and accelerate it.

A risk-based approach for incorporating climate change into design of highway infrastructure on permafrost is now recommended practice. The challenge for design and construction over thaw-sensitive permafrost terrain is to assess the capital cost of constructing the Highway and the long term maintenance implications. The design parameters and construction techniques take into account consideration of 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 between the existing ground and the embankment, and maintaining minimum height, based on terrain type, to mitigate heat gain that can result in thawing of the permafrost.

Other risk factors that are related to climate uncertainty are precipitation, including both summer rain and winter snow. Building conservatism into a design to account for climatic warming is more complex than simply projecting air temperature trends into the future. The greatest risk is often associated with extreme events that are now being observed in the northern Canada. Unprecedented warm winters are often followed by rapid and early thaw. High snow cover years are resulting in extreme snow drifting that blankets the downwind sideslopes, insulating the surface and raising the ground temperature under the fringes of the embankment. Standing water against the sideslopes retards winter freezeback of the active layer and can accelerate thaw below the sideslopes.

Key mitigative measures that 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 include:

- thick embankments that insulate and stabilize the active layer and the use of non-woven geotextiles for reinforcement;
- where available, use of porous embankment materials such as coarser gravels to reduce the risk of ponding along the toe of the embankment;
- where such material is not available, the use of culverts to balance surface flow has been included; and
- adoption of construction methods that eliminate cuts and minimize disturbance of the natural vegetation before fill is placed.

Of greater importance is what activities are undertaken after the Highway is put into operation. 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. There will also be a greater need for additional resources for maintenance and rehabilitation in the face of potential permafrost degradation.

11.0 ANTICIPATED HUMAN ENVIRONMENT EFFECTS AND PROPOSED MITIGATION/ MANAGEMENT MEASURES

The purpose of this section is to present the current socio-economic realities, identify potential effects and mitigation measures, and the significance of any residual effects. The Inuvik to Tuktoyaktuk all-weather Highway will be the first all-weather highway connection in Canada to the Arctic Ocean, and is expected to provide substantial benefits at the national, regional and local levels.

The socio-economic issues evaluated for the Project are the potential effects on:

- The regional economy;
- Infrastructure;
- Individual, family and community wellness;
- Traditional culture;
- Non-traditional land and resource use; and
- Heritage resources.

The study area for the socio-economic effects assessment is limited to the Town of Inuvik, Hamlet of Tuktoyaktuk, and the area between the two communities, including the Husky Lakes area.

11.1 REGIONAL ECONOMIC EFFECTS

11.1.1 Capital and Operating Expenditures

The Project will generate a demand for goods, services and labour during the construction phase and an ongoing demand for labour and services during the operations phase. It is anticipated that local and regional suppliers, contractors and residents will be able to provide the overwhelming majority of construction and related services. Should it be necessary, supply requirements will be fulfilled from beyond the region.

It is anticipated that the overwhelming majority of the project investment will occur within the Inuvialuit Settlement Region.

A study titled “Benefit-Cost and Regional Economic Impact Analysis: Inuvik to Tuktoyaktuk Highway” was conducted by Nichols Applied Management for GNWT Department of Transportation in March 1999. Nichols Applied Management (1999) concluded that local hiring of construction workers; spending on wages, materials and equipment during construction of the all-weather highway; and increased tourism; would result in regional impacts of \$77 million of business and labour income, and 600 person-years of employment. It should be noted that other benefits, such as benefits from potential oil and gas exploration and development, were not quantified in the study. Since 1999, when Nichols Applied Management conducted the study, more opportunities for benefits have become available as prime construction and subsequent operations and maintenance contractors are now located in the region. Therefore, it is anticipated that the

regional economic impact of this Project will be greater than \$200 million in business and labour income.

On a national scale, economic spinoffs of the Highway would accrue to other parts of Canada since the highway construction and maintenance equipment is manufactured mainly in central Canada (Ontario and Quebec). In addition, the federal and territorial governments will benefit from the business and personal taxes generated by economic developments in the region.

11.1.2 Employment

Direct employment during the construction phase is identified in Section 5.9.5. As indicated in Table 11.1-1, the number of personnel requirements will vary per spread.

TABLE 11.1-1: ESTIMATED PERSONNEL REQUIREMENTS	
Activity	Personnel
I. Winter Highway Construction	120 to 140
II. Winter Gravel Haul	220 to 260
III. Summer Grade and Compact (June 1 – Sept. 1, 2009/2010)	40 to 60
IV. Fall/Early Winter Aggregate Pit Development and Material Production	60 to 80

Indirect employment opportunities will be derived from increased tourism to Tuktoyaktuk and Inuvik, and additional employment opportunities from anticipated expanded oil and gas development, and other possible developments identified in this study.

Table 11.1-2 describes the potential available labour supply (as of 2004). Potential available labour supply refers to those persons who are unemployed. They can be classified into various categories, including those who would want to do rotational work, gender, ethnicity, or level of schooling (NWT Bureau of Statistics 2008a; 2008b)

TABLE 11.1-2: POTENTIAL AVAILABLE LABOUR SUPPLY (2004)		
	Inuvik	Tuktoyaktuk
Number of Unemployed	155 in 2004 230 in 2006	117 in 2004 120 in 2006
% Willing to Do Rotational Work	65.2	76.1
% Male	52.3	60.7
% Aboriginal	83.9	98.3
% Less than High School Diploma	30.3	69.2

Source: NWT Bureau of Statistics (2008a; 2008b).

11.1.3 Labour Income

Project-related construction employment will lead to increased household income in the region throughout the construction period. This will be comprised of direct project-related

income and indirectly by those producing goods and services for the Project and its employees. It is anticipated that the local Project employees will spend a portion of their incomes at local businesses that will create secondary and tertiary economic benefits in the region as local businesses procure goods and services from other local and regional businesses. During the construction phase of the project, labour income effects will be positive over the short-term.

During the maintenance and operation phase, fewer people will be employed to maintain and operate the highway. However, it is anticipated that all of the employment created for highway maintenance will be supplied by the Mackenzie Delta communities. Therefore, labour income effects will be positive over the long-term as well.

11.1.4 Demography and Population Mobility

Most of the labour supply for the project will come from either Inuvik or Tuktoyaktuk residents. In past years, many Inuvialuit have moved to other regions for employment opportunities. It was observed during the construction of the Tuktoyaktuk to Gravel Source 177 Access Road that many Inuvialuit living in other regions returned to the community to work on the project. Based on this experience, in-migration to the by returning residents is anticipated. This project may also reduce out-migration as more opportunities for local and regional employment become available.

It is anticipated that some people may migrate into these communities to fill indirect and induced employment opportunities in other goods and services sectors. However, this is not anticipated to have much overall significance.

11.2 INFRASTRUCTURE

11.2.1 Transportation

The Project will significantly improve transportation infrastructure between Inuvik and Tuktoyaktuk through the development of the all-weather highway instead of a seasonal, winter-only road. This will enable easier transportation of goods, services, and people into and out of Tuktoyaktuk. Furthermore, it will facilitate commercial and recreational access to the region and completes the highway to the arctic sea coast.

The Project is expected to cause some seasonal increases in the traffic using the Dempster Highway, as people travel north to the Beaufort Sea.

The proponents of the Project include the Town of Inuvik, Hamlet of Tuktoyaktuk and the GNWT Department of Transportation. Therefore, any necessary agreements regarding coordination of highway maintenance activities or use of the highway will be arranged. No mitigation measures are anticipated to be required.

11.2.2 Energy and Utilities

During the construction and operations phases, the Project will have no effects on the energy and utilities systems of any community, as the Project will use its own generators for power. Accordingly, there is no need to detail project effects on energy and utilities infrastructure during either phase. All communities have sufficient capacity to accommodate any foreseeable, minor energy demands created by the projected level of temporary workers that may be in the area over the short-term.

11.2.3 Housing

Project effects on housing and accommodations will include direct demands for short-term accommodation. Demands for short-term accommodation will be reduced by providing project construction camps. As the labour supply will be primarily from Inuvik or Tuktoyaktuk, limited short-term pressures may occur only during the construction phase and no long-term pressures for accommodation are expected to arise during the long-term maintenance and operation phase.

11.3 INDIVIDUAL, FAMILY AND COMMUNITY WELLNESS

This section is focused on the possible effects of the project construction phase, when there will be higher levels of employment and income, and the project operations phase, when there will be year-round mobility between communities, which may affect individual, family, and community wellness. When the construction phase concludes, there will be a decline in short term construction related employment and income to the level that will remain during the operations phase. Highway maintenance and operations personnel will be stationed primarily in Inuvik and Tuktoyaktuk.

11.3.1 Cost of Living

As described in Section 5.1, the presence of the Highway is expected to significantly reduce the cost of living for Tuktoyaktuk residents as goods may be shipped overland year-round. To give an example: according to the latest figures published by NWT Bureau of Statistics (2004), the 2004 Food Price Index for Tuktoyaktuk is 206, compared to 140 for Inuvik (Yellowknife being 100). Thus, food in Tuktoyaktuk is 47% more expensive than in Inuvik. The Highway will allow year road trucking of most of the items that currently must be flown in during the majority of the year. This is expected to provide long-term positive effects on the communities, community members, and local businesses.

Any negative impacts on the airline industry are anticipated to be temporary and the economic stimulus provided by roads to previously isolated communities is expected to create more business for the airline and barge services over the long term.

11.3.2 Community Wellness and Delivery of Social Services

Some of the issues that community wellness centers deal with in the communities include substance abuse and violence. There are two commonly held views regarding the link

between increased incomes and potential links to substance abuse and violence. The first view is that increased incomes from project employment could potentially contribute to substance abuse-related problems, and to the burdens on social workers who try to deal with the problems in the communities. The second view is that increased individual incomes and overall community wealth may lead to a decrease in social problems by providing opportunities, options and, therefore, choices for individuals. This improves self-esteem, self-worth and self-sufficiency.

A review of the substance abuse and violence statistics in communities such as Tuktoyaktuk indicate that incidences of violence and other criminal behaviour typically seems to decrease significantly during periods of economic activity. Such potential effects will be primarily limited to the construction phase, as there will be more employees hired at that time.

The Town of Inuvik has a number of available community wellness services, and it is likely that these services will be used. The effect of the Highway may also have a positive effect by providing more direct access to community wellness services for Tuktoyaktuk residents.

In terms of recreational opportunities, the ability to travel year-round between communities will provide new recreational opportunities for all residents. In particular, this will significantly increase the recreational opportunities for regional school and youth teams to interact and/or use other community's facilities more frequently due to the reduced transportation costs. This may affect the existing recreational facilities by having more people use them, but this may also be a positive benefit associated with promoting family and community interactions.

11.3.3 Training

For the construction of the Tuktoyaktuk to Source 177 Access Road, a number of training programs were implemented. For example, the contractor conducted a successful heavy equipment operator course. Likewise, the ILA sponsored an environmental monitor training program.

For the Inuvik to Tuktoyaktuk Highway project, it is anticipated that additional funds for training programs will become available in association with the Project. This training will be beneficial for the Project and for the region as it increases the overall skill and competence of the workforce.

11.3.4 Health Conditions and Health Care Services

Overall health conditions are expected to improve due to the presence of the highway. The Husky Lakes area is a popular fishing, hunting, and recreational area. The Highway will provide easier and cheaper access to primary health centers in Tuktoyaktuk or Inuvik, as well as medical transfer between communities.

According to IOL (2004), the most serious threats to health in communities continue to be posed by substance abuse and derivative accidental or violent injuries. It is not anticipated

that the proposed project will place significant additional pressures on the Tuktoyaktuk health center or Inuvik Hospital.

11.3.5 Human Health Risks

The project will have no significant effects on air, water or soil quality during the construction or operations phases that could induce potentially adverse effects on the health of humans, plants or animals harvested by the local population.

11.3.6 Public Safety and Protection Services

There are RCMP detachments in Tuktoyaktuk and Inuvik. Controlling alcohol and drug abuse will be the most effective way to mitigate many policing issues. Levels of crime in each community have been increasing. The proposed Highway may facilitate easier access between communities, but the Highway itself will not be the cause of the crime.

11.3.7 Education Attainment and Services

Education attainment in the region is not anticipated to be affected negatively by the Highway. The short-term construction jobs are not anticipated to induce adolescents to leave school prematurely. To ensure this, a minimum employment age for the project should be put into effect.

Education attainment for residents of Tuktoyaktuk may be positively affected due to the increased access to the education services in Inuvik. If this occurs, there may be a minor effect on the demand exists for educational facilities and services in Inuvik.

11.4 TRADITIONAL CULTURE

11.4.1 Traditional Harvesting and Land Use

Many community members continue to hunt and fish. Project employment may affect harvesting due to the time needed for employment. Some Aboriginal workers may find the paid work rewarding; however, Aboriginal workers may be adversely affected due to potential effects on their traditional lifestyle. Any potential effects on the ability to harvest would be short-term in nature, and likely limited to the construction phase. Due to the proximity of the project site to Tuktoyaktuk and Inuvik, it is anticipated that Aboriginal employees will have sufficient time off during the days that they are not working on the project, to continue their traditional harvesting pursuits. Most construction will take place during the winter period; therefore, construction activities should not affect traditional harvesting activities, which generally occur during spring, summer and fall.

The presence of the Highway is expected to provide easier access to harvesting areas. This may be considered either a positive or a negative effect, depending on the person asked. As with other public highways, the project proponents have limited responsibility for managing the activities of people using the Highway.

11.4.2 Preservation of Traditional Language and Culture

The proposed Highway is expected to facilitate family interactions by providing year-round access between the communities. Tuktoyaktuk, until now, has been isolated from other communities for much of the year, with access only by air and water during periods when the winter road is not open. The development of the Highway will allow the residents of Tuktoyaktuk to be less isolated from the other Delta communities, and from the rest of Canada.

The project is not anticipated to affect the transference of traditional language skills, knowledge of and identification with traditional culture. It is anticipated that a large proportion of the employees will be Aboriginal, and that there will be opportunities to use traditional language while on the work-site. Assuming that more tourists visit Tuktoyaktuk and Inuvik, this will provide new and greater opportunities for the community to market their local crafts.

11.5 NON-TRADITIONAL LAND AND RESOURCE USE

Potential project effects from the Project on land, resources, commercial and recreational activities were assessed. Effects were considered during the planning, construction and operations phase of the Project.

11.5.1 Protected Areas

The Northwest Territories Protected Area Strategy has been reviewed and considered in the assessment of potential Project effects. The proposed Highway avoids all protected areas and generally conforms to the extent possible with the Husky Lakes criteria for the protection of this critically important area. To further mitigate effects, Highway construction will occur primarily during the winter period.

11.5.2 Granular Resources

The proposed Highway will use a large quantity of the known granular resources, but the majority of these granular resources will remain intact. The proposed Highway will facilitate year-round access to additional granular resources for community use and for future development, if needed. The Project Partners are committed to ensuring that adequate granular resources will remain available for community use for the foreseeable future.

11.5.3 Oil and Gas Activities

By facilitating all-weather access, the Highway could contribute to reduced costs for future onshore and offshore oil and gas exploration and development in the area between Inuvik and Tuktoyaktuk. The oil and gas companies will need to determine if and how they may choose to benefit from the existence of the proposed Inuvik to Tuktoyaktuk Highway.

11.5.4 Tourism Activities

The proposed Highway will provide all-weather access from southern Canada to the Beaufort Sea. This will likely attract tourists to the area, and generate positive effects for the existing businesses and commercial activities over the long term. In particular, the hospitality and tourism industries are likely to be positively affected. Assuming that more tourists visit Tuktoyaktuk and Inuvik, this will provide new and greater opportunities for the community to market their local crafts.

11.5.5 Commercial Activities

The connection of Tuktoyaktuk to Inuvik and the Dempster Highway will provide opportunity for year-round business expansion into the Yukon Territory, and/or potentially reduce overhead transportation costs.

The Highway will open up year-round business opportunities in the rest of the region for the Tuktoyaktuk businesses and service providers. It will also allow the Inuvik and other regionally based businesses to compete for resource related and government business opportunities in the area between and within Inuvik and Tuktoyaktuk. This enhanced competition will lead to higher quality and lower cost services for government and resource development sectors.

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 also provide important year-round employment and training opportunities for local Inuvik and Tuktoyaktuk residents.

11.6 NATIONAL SOVEREIGNTY

Construction of the Inuvik to Tuktoyaktuk Highway will demonstrate to the international community that Canada is prepared to make significant financial investments to protect Canadian sovereignty. 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.

Nationally, the Inuvik to Tuktoyaktuk Highway will establish a permanent transportation link to a formerly remote community and Canada's arctic coastline.

11.7 POLLUTION PREVENTION AND SPILL RESPONSE IN THE ARCTIC OCEAN

The presence of the Highway can potentially contribute to the effectiveness of the Canadian Coast Guard's Tuktoyaktuk-based arctic pollution prevention and spill response planning and operations. The Highway would facilitate transportation of equipment and materials required to respond to potential spills in the summer/fall Arctic shipping season; at present any emergency equipment and supplies must be flown to Tuktoyaktuk.

12.0 CUMULATIVE EFFECTS

Cumulative effects are 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 2003). Overall cumulative effects are effects of all land or water uses on a Valued Ecosystem Component (VEC), including effects caused by the project.

An assessment of cumulative effects provides a more complete understanding of what might happen to VECs beyond the influence of the project alone. This is useful for regulatory decision-makers and land and resource managers as they review and plan future development. Thus, an assessment of cumulative effects provides a glimpse into environmental and socio-economic conditions now and how they may change in the future with development. This contributes to a better understanding of what might or might not happen if the project proceeds.

Typically, cumulative effects assessments address effects that:

- extend over a larger area;
- are of longer term duration;
- act in conjunction with other projects/activities on the same VECs; and
- are reasonably probable, considering possible future projects/activities and impacts.

For the proposed Inuvik to Tuktoyaktuk Highway Project, the assessment of cumulative effects has involved the application of four basic questions as outlined by Kavik-Axys (2002) for proposed developments in the Inuvialuit Settlement Region.

- Is the project likely to have negative environmental effects on VECs in the ISR?
- If so, will the residual negative environmental effects that remain after mitigation, combine with the effects of other projects, past, present, or future?
- What is the significance of the overall cumulative environmental effects, including the effect of the project?
- If this project, in combination with other projects in the area, is likely to create a “significant negative cumulative effect”, are there further mitigation measures that could reduce or eliminate the project’s contribution to these effects so that the combined effect does not threaten the VEC?

As noted in the Environmental Effects and Mitigation Measures section of this Project Description Report (Section 10.0), it has been determined that, with the application of proposed mitigation measures, for all environmental VECs, the residual environmental effects associated with the construction and future operation of the Inuvik to Tuktoyaktuk Highway Project are anticipated to be low in magnitude and local in extent.

However, while individually no significant effects are anticipated, it is the role of the cumulative effects assessment (CEA) to consider the potential additive and synergistic

effects of overall residual effects, in combination with past, existing or known planned activities in the vicinity of the proposed Inuvik to Tuktoyaktuk Highway Project.

Thus in accordance with the EISC/EIRB guide for conducting cumulative effects assessments in the Inuvialuit Settlement Region (Kavik-Axys 2002) the following assessment has considered and addressed the following key questions:

- Is the project likely to have negative environmental effects on VECs in the ISR?
- If so, will the residual negative environmental effects that remain after mitigation combine with the effects of other projects, past, present or future?
- What is the significance of the overall cumulative environmental effects, including the effect of the project?
- If this project, in combination with other projects in the area, is likely to create a “significant negative cumulative effect”, are there further mitigation measures that could reduce or eliminate the project’s contribution to these effects so that the combined effect does not threaten the VEC?

12.1 SPATIAL BOUNDARIES

For purposes of this CEA, the spatial boundaries include the portion of the Mackenzie Delta and the Tuktoyaktuk Peninsula in the general vicinity of the proposed Inuvik to Tuktoyaktuk Highway corridor, extending between Inuvik and Tuktoyaktuk, including alternate alignments considered (as illustrated in Figure 12.1-1). The easterly boundary extends from the westerly shores of the Husky Lakes to the westerly boundary, which extends from the eastern side of the Mackenzie River. This general area encompasses the entire proposed Highway, the range of environments that could be impacted by the Highway, and the past, present and future projects that may have a potential to contribute to potential cumulative effects.

12.2 TEMPORAL BOUNDARIES

For purposes of this CEA, the temporal (time frame) for the assessment will be the next three (3) to ten (10) years, during which time construction of the proposed Highway is anticipated to be completed and the highway will potentially have been in operation for more than five (5) years. It remains unknown at this time whether construction of other proposed future projects, in particular, the Mackenzie Gas Project and the Tuktoyaktuk Harbour Project will have commenced or not within this 10 year time-frame.

12.3 PAST, PRESENT AND FUTURE PROJECTS / ACTIVITIES CONSIDERED

During the October 2009 community and regulatory consultations, a number of possible projects and activities were identified that should be considered in the CEA. In addition, several other projects and/or activities warranted consideration based on the Project Team’s understanding of past, existing, and potential future projects and activities in the area of interest. The projects and activities considered in this CEA include:

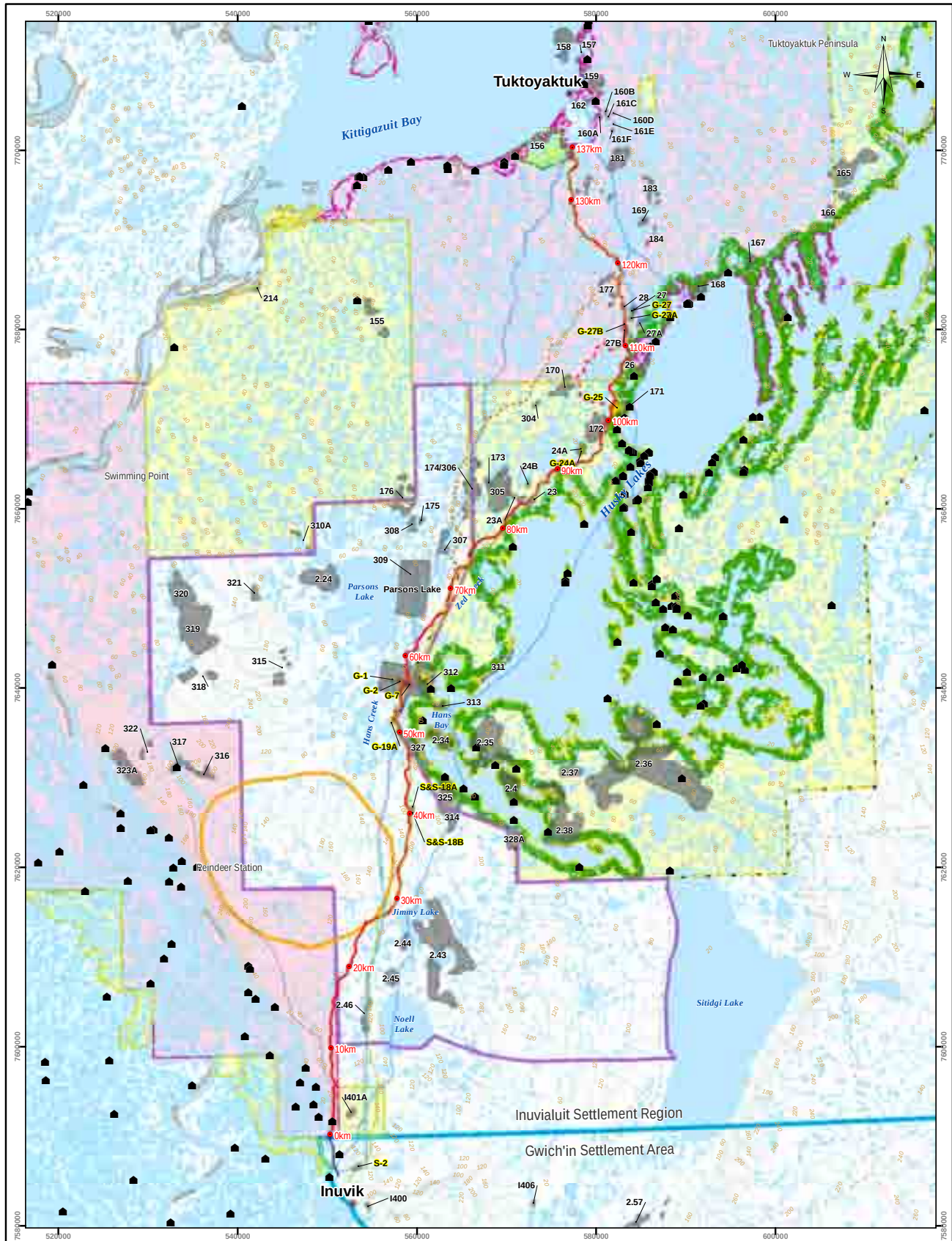
Past and Existing Projects

- Ikhil Gas Development and Pipeline Project
- Tuktoyaktuk to Source 177 Access Road
- Winter Access Trails
- Former NCPC Power Pole
- Seismic Lines
- Oil and Gas Well Sites

Potential Future Projects/ Activities

- Parsons Lake Gas Field, Associated Infrastructure and Gathering Pipeline
- Mackenzie Gas Project Pipeline
- Tuktoyaktuk Harbour Project
- Husky Lakes Development

Brief descriptions of each of these past, existing and potential future projects and activities, and to what degree they may contribute to a possible cumulative effect in relation to the proposed construction and operation of the Inuvik to Tuktoyaktuk Highway are provided in the following sections. Figure 12.1-1 depicts existing land use in the general vicinity of the proposed Highway.



LEGEND

- ▲ Residential Leases
- 2009 Route
- - - Other Alignments Considered
- - - Upland Route
- Proposed Alignment (PWC77)
- Navy Road
- Snowmobile Trails
- ⚡ Highway Borrow Sources
- ⚡ Borrow Sources
- ⚡ Approximate Winter Reindeer Range
- ⚡ Approximate Allotment B
- ⚡ Inuvialuit 7(1)(a) Lands
- ⚡ Inuvialuit 7(1)(b) Lands
- ⚡ Pingo Park
- ⚡ Gwich'in / Inuvialuit Boundary
- Former Powerline
- Ikhiil Gas Pipeline
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

NOTES

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

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Existing Land Uses

PROJECTION UTM Zone 8		DATUM NAD83		 	
Scale: 1:400,000 				 	
FILE NO. V23201098_PDR-Map022-CEA-ExistLandUse.mxd					
PROJECT NO. V23201098	DWN KWM	CHK RH	REV 1		
OFFICE EBA-VANC	DATE February 11, 2010				

Figure 12.1-1

Figure 12.1-1

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12.3.1 Past and Existing Projects

12.3.1.1 Ikhil Gas Development and Pipeline Project

The Ikhil Gas Development and Pipeline Project consists of two producing gas wells, associated feeder lines, a small gas processing plant and a 50 km (30 miles) long, 168.3 mm (6 inch) diameter buried gas pipeline. The gas production site is located approximately 50 km north of Inuvik in the Caribou Hills, and extends south from there to a pressure regulation and metering facility near the Northwest Territories Power Corporation power plant in Inuvik (Figure 12.1-1).

The pipeline component of the project was presented and reviewed by the EISC during the summer of 1997. Their review concluded that the project would not result in significant environmental impacts, and as a result the project was not referred to the EIRB for a more rigorous assessment (North of 60 Engineering 2004).

An environmental screening of the project was also performed by the NEB as mandated under CEAA. Their review also found the project environmental impact to be small and manageable through the application of appropriate mitigation measures.

The project was developed during the period 1997 to 1999 and is expected to be in service for the foreseeable future.

The pipeline is buried in permafrost and parallels the East Channel of the Mackenzie River for its entire 50 km. Where the pipeline crosses the Douglas Creek Valley, it is supported by piles above ground to avoid disturbance to the slopes on either side of the creek. Since the gas is cooled to below freezing temperatures at the Ikhil production facility, limited melting of the permafrost will occur as the gas passes through the pipeline. Pipeline and right-of-way (ROW) performance has been monitored on an ongoing basis by Inuvik Gas operations personnel (North of 60 Engineering 2004).

Restoration and re-vegetation efforts have been very successful, with hardly any disturbance visible over the ditch centre-line (Photo 12.3-1). There are currently no geotechnical or groundwater related issues associated with the operation of the pipeline. The pipeline has performed as designed. Based on visual inspections there has been no significant frost heave or thaw settlement along the line.

The buried gas pipeline approaches the proposed Inuvik to Tuktoyaktuk Highway alignment at KM 5 and then runs parallel to the proposed Highway alignment heading south towards the end of Navy Road in Inuvik. The pipeline is located within an established 30 m wide utility ROW. To ensure that the pipeline will not be disturbed or affected in any way, the proposed Inuvik to Tuktoyaktuk Highway alignment will be located at an appropriate and approved distance from the existing gas pipeline ROW.

The development of the highway may facilitate access to the portion of the buried gas pipeline that will be located adjacent to the highway. However, with the application of the planned mitigation measures, there will be no interactions or opportunity for a potentially significant cumulative environmental effect to occur.



Photo 12.3-1
Right-of-way at the end of Navy Road

12.3.1.2 Tuktoyaktuk to Source 177 Access Road

The Tuktoyaktuk to Source 177 Access Road is a 19 km long road that is currently under construction. The proposed Highway alignment follows the same general route as originally selected for the northernmost 19 km of the proposed all-weather Highway between Inuvik and Tuktoyaktuk. The alignment is located entirely on Inuvialuit Private Lands.

In January 2009, the EISC concluded that the development, if authorized subject to the environmental terms and conditions recommended by the Screening Committee, would have no significant negative impact on the environment in the Inuvialuit Settlement Region (EISC 2009).

Following receipt of ILA permits, construction of the first 12 km of the access road commenced in February and was completed in April 2009. All aggregate materials used for construction of the road were obtained from Source 177. The road design was developed by FSC Architects and Engineers in accordance with GNWT Department of Transportation design requirements.

The road is being constructed by an experienced regional road construction contractor. The basic road construction sequence included the clearing of snow from the right-of-way, the placement of geotextile fabric directly onto the undisturbed frozen surface, the placement (by end-dumping) of aggregate material in lifts onto the liner and the compacting of the road grade. The second winter of construction will proceed in early 2010. Photos 5.2-3, 5.8-1, 5.8-2, and 5.8-3 in Section 5.0 of this Project Description Report illustrate the construction methods employed and the appearance of portions of the completed road in spring/summer 2009.

Most of the streams crossed by the Tuktoyaktuk to Source 177 Access Road are ephemeral but for potentially fish-bearing streams, the stream crossings are being constructed in conformance with DFO Operational Procedures designed to protect fish habitat. Areas with surface runoff were addressed with the installation of standard diameter (800 mm to 2,000 mm) roadway culverts. Follow-up monitoring during the spring/summer of 2009 determined that some areas of ponding occurred and plans have been developed to mitigate these minor issues.

As part of the construction of the Inuvik to Tuktoyaktuk Highway, there will be a need to upgrade the current Tuktoyaktuk to Source 177 portion of the overall alignment to meet the highway design criteria. During both the October 2009 and January 2010 consultation sessions, several questions were raised regarding what would need to be done to complete this section of the highway in the future. It was indicated that the current horizontal alignment of the Tuktoyaktuk to Source 177 Access Road would continue to be used for the new Highway. However, there will be a need to build up the road embankment to achieve the highway design criteria.

The existing Tuktoyaktuk to Source 177 Access Road will represent the northernmost portion of the overall Inuvik to Tuktoyaktuk Highway. However, with the application of the planned mitigation measures there will be no opportunity for a potentially significant cumulative environmental effect to occur.

It is anticipated that the completed highway will make it easier for people to access the land for their various traditional, recreational and cultural pursuits. To ensure that the environment of the area remains protected, it will be important for the users of the highway to abide by access controls and limitations that may need to be developed for the Highway by the resource management agencies and co-management bodies in consultation with the HTC and other interested stakeholders.

12.3.1.3 Winter Access Trails

Since the introduction of snow machines, winter access trails have been developed each winter as needed, to allow residents of Tuktoyaktuk and Inuvik to pursue their traditional recreational, hunting, trapping and other activities on the Tuktoyaktuk Peninsula and in the Mackenzie Delta, including the general area of the proposed Inuvik to Tuktoyaktuk Highway. One of the major winter routes that has become established every winter are the traditional routes from Tuktoyaktuk and Inuvik to the Husky Lakes area (Figure 12.1-1).

The consultations sessions held in October 2009 and January 2010 confirmed that many families have and continue to use the traditional winter routes to the Husky Lakes. The consultations also identified a second, more overland route, which generally followed the alignment of the former Northern Canada Power Commission (NCPC) transmission line ROW that extended from Inuvik to Tuktoyaktuk (Figure 12.1-1).

The winter access trails are considered to be of a low impact nature, disappearing with the annual spring snowmelt, and leaving behind minimal evidence that they were ever there. With the development of the highway, it is anticipated that most north-south traffic will use the highway, with snow machines and all terrain vehicles (ATVs) being towed by trailer to points along the highway where they would continue to be used to access the adjacent land, as was done previously.

The presence of the highway will make it easier for people to access the land for their various traditional, recreational and cultural pursuits. To ensure that the environment of the area remains protected, it will be important for the users of the highway to abide by access controls and limitations that may need to be developed for the highway by the resource management agencies and co-management bodies in consultation with the HTC and other interested stakeholders.

12.3.1.4 Former NCPC Power Line

In 1972, a 144 km wood pole transmission line (69 KV) was constructed by the Northern Canada Power Commission from Inuvik to Tuktoyaktuk, the only line of its type in the world north of the Arctic Circle (NTPC 2009). The route of this former power line is illustrated in Figure 12.1-1.

Due to high maintenance costs, this line was abandoned and salvaged in the late 1980s and replaced with diesel power generation facilities installed at Tuktoyaktuk (A. Martin, NTPC Pers. Com. 2009). Currently the Hamlet of Tuktoyaktuk is serviced by a complement of three diesel generators with a total installed capacity of 2,205 KW. As previously indicated, the former power line ROW was used as a winter trail between Tuktoyaktuk and Inuvik. The power line was used to mark the route and also served to help harvesters on the land to determine their location (G. Colton, NTPC Pers. Com. 2009). Today little physical evidence remains of the former NCPC power line.

12.3.1.5 Seismic Lines

Since the 1960s the most extensive non-traditional land use that has occurred in the Mackenzie Delta, including the area in the vicinity of the proposed Inuvik to Tuktoyaktuk Highway, has been seismic exploration. As an example, in the 41,105 ha Parsons Lake Study Area defined for the Mackenzie Gas Project, approximately 1.5% of that Study Area had been subjected to seismic lines and associated activities (IOL et al. 2004).

In some areas of the Mackenzie Delta, particularly in forested areas near Inuvik, visible evidence of the historic, linear seismic lines remains today. However, on the open tundra of the Tuktoyaktuk Peninsula, very few of the historic seismic lines can be detected at this

time. Although from the air the vegetation along the seismic lines sometimes appears to have a different colour, on the ground, little physical evidence remains of these historic seismic programs. As a result, there will be little opportunity for a potentially cumulative environmental effect to occur between the limited residual effects of historic seismic lines and the construction and operation of the proposed Highway.

12.3.1.6 Oil and Gas Well Sites

A number of exploratory oil and gas wells were completed by Imperial Oil near the proposed Highway right-of-way near Tuktoyaktuk on the Tuktoyaktuk Peninsula. For example, 13 wells were drilled in the mid-1980s during Imperial Oil's Tuktoyaktuk Tertiary program. In addition, Gulf drilled a number of exploratory and development wells in the Parsons Lake area in the early 1970's.

12.3.2 Potential Future Projects/ Activities

12.3.2.1 Mackenzie Gas Project

Developing a natural gas pipeline from the Mackenzie Delta through the Northwest Territories to southern markets has been contemplated for many years. Various pipeline projects have been proposed during the last 30 years that consider economics, regulatory requirements, socio-economic and environmental conditions, and engineering and geotechnical issues in the decision-making process (IOL et al. 2004).

The proponents of the proposed Mackenzie Gas Project include Imperial Oil Resources Ventures Limited Partnership (IOL), ConocoPhillips Canada (North) Limited (ConocoPhillips), ExxonMobil Canada Properties (ExxonMobil), Shell Canada Limited (Shell) and Mackenzie Valley Aboriginal Pipeline Limited (MVAPL) partnership.

The purpose of the proposed project is to develop three onshore natural gas fields (anchor gas fields) in the Mackenzie Delta and to transport natural gas and natural gas liquids (NGLs) by pipeline to market (Figure 12.3-1). The main Mackenzie Delta components of the project include:

- The facilities (field development, flow lines, gas conditioning and production facilities and associated infrastructure to be located at each of three anchor fields at Niglintgak, Taglu and Parsons Lake;
- A gathering system including gathering pipelines to transport the natural gas and NGLs from the three anchor fields to a facility to be located near Inuvik;
- A pigging facility at Storm Hills and a gas processing facility and supporting facilities near Inuvik to recover NGLs from the gas stream;
- A pipeline (the NGL pipeline) to transport NGLs south from the Inuvik area facility to Norman Wells, where it will be tied into the existing Enbridge Inc. pipeline; and

- A pipeline to transport natural gas from the Inuvik area facility to the NOVA Gas Transmission Ltd. (NGTL) interconnect located near the Northwest Territories-Alberta boundary.

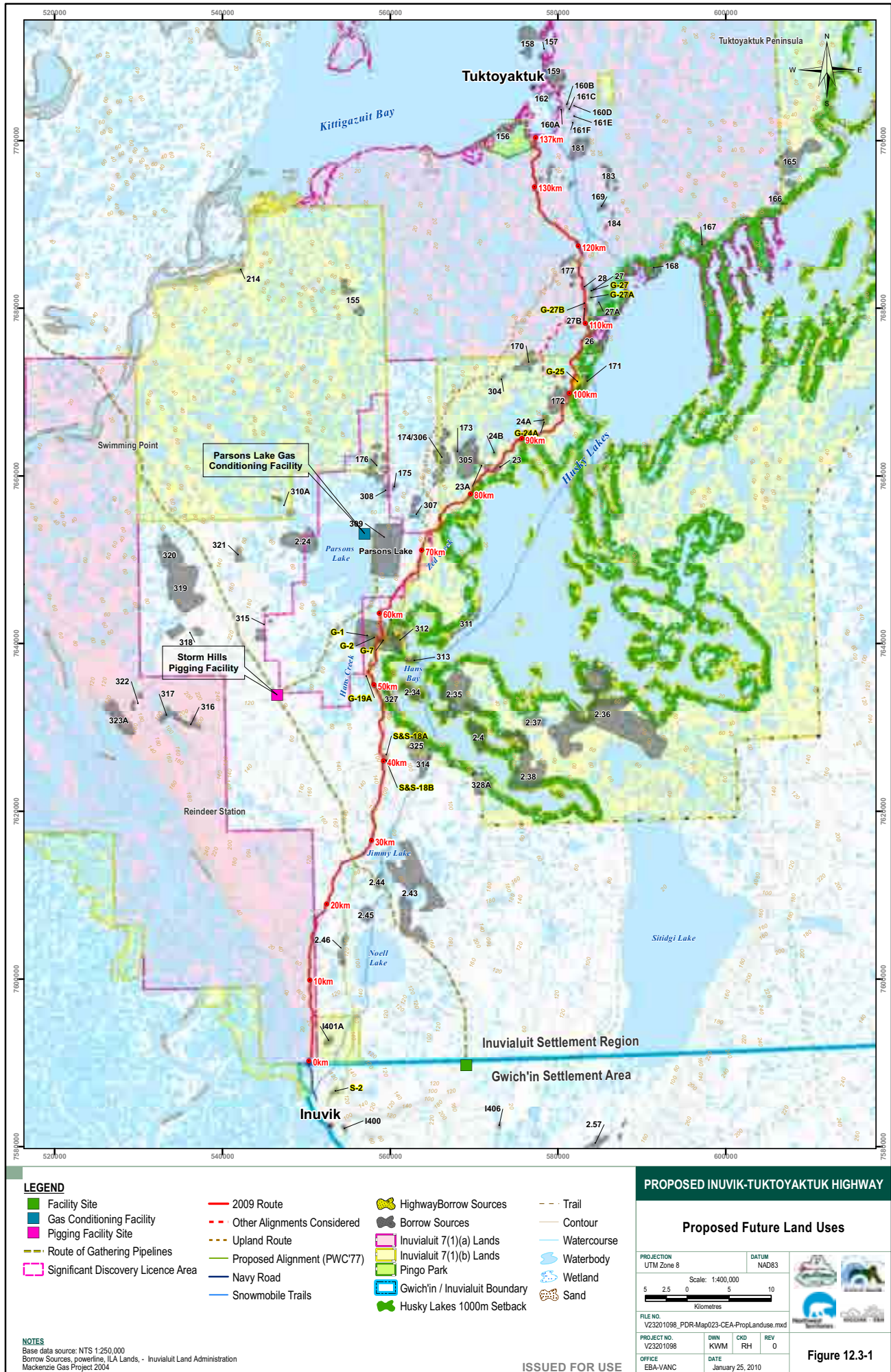
The environmental impact assessment for the Mackenzie Gas Project conducted a comprehensive assessment of the available information, including several years (2001-2004) of additional, new scientific field survey data, the results of community consultations and Traditional Knowledge studies, with detailed descriptions of the importance and value of wildlife and wildlife habitat to the local residents. The potential effects on populations and harvest practices, as determined from the results of harvest studies, were measured against the assessment criteria (IOL et al. 2004).

Based on their assessment, it was determined that the Mackenzie Gas project would likely have some minor effects on wildlife and wildlife habitat at the local level that could last throughout the life of the project, and in some cases beyond. Noise from facilities and flares might also affect wildlife during operations (IOL et al. 2004).

Their assessment determined that some local wildlife movements might be affected near the project, but no effects on the seasonal movements or migration patterns of wildlife would occur, with the possible exception of the movements of barren-ground caribou from the Cape Bathurst herd in fall and winter. No other possible effects on the seasonal distribution of barren-ground caribou were expected to occur (IOL et al. 2004).

The key conclusions of the cumulative effects assessment conducted for the Mackenzie Gas Project (IOL et al. 2004) were as follows:

- The Mackenzie Gas Project would not contribute significant cumulative effects.
- There were no significant overall cumulative effects.
- The project could contribute to one potential cumulative effect of management concern, direct grizzly bear mortality, which could be addressed with diligent monitoring and management by responsible parties.
- Based on the project footprint, the project would disturb a negligible proportion of the regional study area.
- The project might encourage other development, particularly gas exploration and production in the Northwest Territories; however, information to adequately assess potential cumulative effects contributions from such possible developments were not yet available.
- The pattern of any future hydrocarbon development on the land, such as additional production fields, and any effects from such activities would likely be similar to effects predicted for current and reasonably foreseeable land use. Those developments would be subject to their own environmental impact assessment, including cumulative effects.



PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Proposed Future Land Uses

PROJECTION UTM Zone 8	DATUM NAD83	
Scale: 1:400,000 5 2.5 0 5 10 Kilometres	FILE NO. V23201098_PDR-Map023-CEA-PropLanduse.mxd	
PROJECT NO. V23201098	DWN KWM	REV 0
OFFICE EBA-VANC	DATE January 25, 2010	

Figure 12.3-1

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These conclusions indicated that, despite the size and duration of operations, the contribution to cumulative effects by the Mackenzie Gas Project on the regions and communities of the Northwest Territories were not expected to be significant. The conclusions also meant that there was no reason to believe, based on available information and the assessment method, that in the future there would be an issue of management concern associated with cumulative effects on a particular valued component from this project. These conclusions were based on the assumption that appropriate management and monitoring programs, as outlined in the EIS prepared for the Mackenzie Gas Project would be carried out (IOL et al. 2004).

At this time it must be emphasized that the proposed Mackenzie Gas Project is still awaiting the outcome of the Joint Panel Review and future regulatory permitting and approvals decisions by a number of regulatory agencies. In addition, there remains considerable uncertainty as to if and when the Mackenzie Gas Project may in fact proceed. Currently the earliest projections for the possible start of construction of the project suggest the year 2015. However, a number of other critical factors, including economic, market and strategic priority considerations, could potentially result in further delays to the implementation of the Mackenzie Gas Project.

At this time it is more likely that the proposed Inuvik to Tuktoyaktuk Highway will be constructed and be in full operation well before construction of the Mackenzie Gas Project proceeds. On this basis, it is assumed that the one location where the future Mackenzie Gas Project pipeline (Storm Hills Lateral) may interact with the highway would be in the vicinity of KM 26 of the highway. At this location it is understood that the pipeline, when constructed, will be buried and would have to be installed beneath what would then be the existing highway, most likely using horizontal drilling technology. Using this technique, the highway would remain undisturbed and vehicles could continue to use the highway in an unimpeded manner.

The development of the highway may facilitate access to the portion of the buried Mackenzie gas pipeline that would pass under the highway, but with the application of the planned mitigation measures for the Mackenzie Gas Project, there would be no interactions or opportunity for a potentially significant cumulative environmental effect to occur.

12.3.2.2 Parsons Lake Gas Field Associated Infrastructure and Gathering Pipeline

The Parsons Lake gas field, currently operated by ConocoPhillips, is located about 55 km southwest of Tuktoyaktuk and 70 km north of Inuvik (Figure 12.3-1). The Parsons Lake gas field was discovered in 1972 and defined by two-dimensional (2-D) seismic and other study programs between 1959 and 2001. A major three dimensional (3-D) seismic program was conducted over the Parsons Lake gas field in winter 2001-2002. Between 1971 and 1986, 19 wells were drilled. The Parsons Lake significant discovery licences were granted in 1987. Based on the most recent interpretations of the exploration data obtained, the proponents estimate that the Parsons Lake field could contain about 2.3 Tcf of recoverable raw natural gas and NGLs (ConocoPhillips 2004a and 2004b).

The main production facilities at the Parsons Lake field will be located on two main gravel pads, the most northerly and larger of the two near the northeast shore of Parsons Lake. The north pad, which will accommodate the gas conditioning facility, camp, fuel storage, and other associated infrastructure, is proposed to be built first. The connection to the Mackenzie Gas gathering system will also be located at the north pad. The second, smaller well pad will be constructed about five or six years later and will be located about 14 km from the north pad at a location south of Parsons Lake. An elevated two-phase flow line will transport natural gas from the south pad to the north pad's gas conditioning facility (ConocoPhillips 2004a and 2004b).

The Parsons Lake gathering pipeline (Parsons Lake lateral) will originate from the gas conditioning facility located on the north pad and will head south around Parsons Lake. From there, the buried lateral will continue southwest between West Hans Lake and East Hans Lake to the Storm Hills Junction (Figure 12.3-1). The Parsons Lake lateral will be approximately 27 km long and centered in a 30 m wide ROW. At its nearest point, the lateral will be located approximately 1.8 km to the west of the Inuvik to Tuktoyaktuk Highway project.

Similar to the status of the rest of the Mackenzie Gas Project, the Parsons Lake gas field component of the overall project is continuing to wait for the outcome of the Joint Panel Review and future regulatory permitting and approvals decisions by a number of regulatory agencies. As indicated earlier, there also remains considerable uncertainty as to if and when the Mackenzie Gas Project may proceed. Currently the earliest projections for the possible start of construction of the overall project suggest the year 2015. However, a number of other critical factors, including economic, market and strategic priority considerations, could potentially result in further delays to the implementation of the entire Mackenzie Gas Project, including the Parsons Lake gas field component of the overall project.

At this time it is more likely that the proposed Inuvik to Tuktoyaktuk Highway will be constructed and be in full operation well before construction of the Parsons Lake gas field component of the overall Mackenzie Gas Project proceeds.

Assuming that this will be the case, it would seem likely that the highway would be used for the two-way transportation of workers and consumables from Tuktoyaktuk and Inuvik to the Parsons Lake gas field project. Possible use of the highway for the transportation of large modules to Parsons Lake from the Tuktoyaktuk harbour area would likely also be considered.

In addition, it could be anticipated that the provision of year-round overland highway access would likely reduce the need for extended-season storage of various critical consumables, including fuel, drilling and production supplies, etc. at the Parsons Lake facility. The existence of the highway may also influence future industry decisions regarding the need for and nature of an airstrip to support the Parsons Lake gas field project.

Such possible uses of the highway in support of the Parsons Lake gas field project would increase the overall use of the highway by oil industry vehicles and equipment for periods of time. The timing of use and traffic controls that would need to be implemented to permit the safe transit of specific equipment (e.g., large modules) and supplies would need to be developed and implemented. However, since the Inuvik to Tuktoyaktuk Highway will be a low volume traffic highway, such possible activities are expected to be manageable and are not likely to create a significant issue for the other users of the highway.

In addition, the year-round access provided by the highway may trigger future refinements to the Parsons Lake gas field project that may present environmental benefits. These could include potentially reduced on-site fuel and consumables storage needs and associated reductions in project footprint size and aggregate borrow requirements for infrastructure pad construction.

As a result, it is anticipated that the future existence of the Inuvik to Tuktoyaktuk Highway prior to the implementation of the Parsons Lake gas field project may provide operational and environmental advantages for the development of the Parsons Lake gas field project, but is not expected to contribute to a potentially negative cumulative environmental effect.

12.3.2.3 Tuktoyaktuk Harbour Project

During the October 2009 community consultations, a question was raised about the possible development of Tuktoyaktuk Harbour and how that might impact the development and operation of the proposed Inuvik to Tuktoyaktuk Highway. The harbour at Tuktoyaktuk is the only existing natural and active port along the Canadian Beaufort Sea coastline. Historically it has served as the primary base for offshore oil and gas exploration in the 1970s and 1980s when the oil and gas exploration companies were active in the area.

With the recent renewed interest in Beaufort Sea exploration and the possible development of the Mackenzie Gas Project, Tuktoyaktuk Harbour may again play an important role as an offshore logistics and service centre for the oil and gas industry.

In late 2005, as part of the ongoing Joint Review Panel (JRP) process, the proponents submitted updated information for the Parsons Lake gas field development. A potential option, not previously proposed, was for sea-lift transport of large modules on barges to Tuktoyaktuk Harbour following existing shipping lanes (IOL 2006).

The potential option to bring modules for the Parsons Lake gas field through the Beaufort Sea to Tuktoyaktuk is currently under study by ConocoPhillips. The option involves shipping process modules weighing up to 1,000 t on Series 240 or 400 barges from an offshore assembly location to Tuktoyaktuk, provided that the barges could be brought into Tuktoyaktuk Harbour without the need for dredging. If this was not possible, the modules would be transferred at Kuparuk or Prudhoe Bay, Alaska onto Series 1500 barges, which will accommodate loads of the weight and size of the proposed modules. Series 1500 barges are regularly used by Northern Transportation Company Limited (NTCL) for re-supplying Tuktoyaktuk (IOL 2006).

To date no formal proposal for the development of Tuktoyaktuk Harbour has been put forward. Nevertheless, assuming that Tuktoyaktuk Harbour is used in the future to accommodate further offshore exploration activities and/or the development of the Mackenzie Gas Project, and in particular the Parsons Lake gas field, it would seem likely that the highway would be used to provide overland logistics and transportation access to the Parsons Lake gas project.

The specific nature of possible uses of the Tuktoyaktuk Harbour and Highway in support of the Parsons Lake gas project cannot be defined with certainty at this time. However, it would seem likely that if the highway was in operation, it would be used for the two-way transportation of workers and consumables from Tuktoyaktuk and Inuvik to the Parsons Lake gas project. Possible use of the highway for the transportation of the large modules from Tuktoyaktuk Harbour to Parsons Lake would likely also be considered.

Such possible uses of the Tuktoyaktuk Harbour and the Highway in support of the Parsons Lake gas field project would increase the overall use of the highway by oil industry vehicles and equipment for periods of time. The timing of use and traffic controls that would need to be implemented to permit the safe transit of specific equipment (e.g. large modules) and supplies would need to be developed and implemented. However, since the Inuvik to Tuktoyaktuk Highway will be a low volume traffic highway, such possible activities are expected to be manageable and are not likely to create a significant issue for the other users of the highway.

As a result, the possible future development of the Tuktoyaktuk Harbour is not expected to contribute to a potentially negative cumulative environmental effect.

12.3.2.4 Husky Lakes Development

The Husky Lakes Special Management Area (Site No. 705D) is located adjacent to a portion of the proposed alignment of the Inuvik to Tuktoyaktuk Highway. In accordance with anticipated revisions to the Husky Lakes Criteria and associated Management Plan and specific directions received from the ILA, the alignment of the proposed Highway has been re-routed to the extent possible to maintain a minimum setback of at least 1 km from the Husky Lakes Special Management Area.

As confirmed during the October 2009 and January 2010 community consultations and previous consultations for the Tuktoyaktuk to Source 177 Access Road project, the project proponents understand fully that the Husky Lakes area is considered by the residents of Tuktoyaktuk and Inuvik to be very important for year-round hunting, trapping, fishing, and recreation and for seasonal berry picking.

As stated in the EIRB's Husky Lakes Criteria (EIRB 2002), the Husky Lakes area is considered by many as one of the best places to hunt and fish in the Inuvialuit Settlement Region. It is an area with abundant plant and animal life, frequented by campers, local hunters and trappers, and visiting sports hunters and fishers. Many go there to relax and enjoy the experience the Husky Lakes area provides.

The Husky Lakes also provide spawning habitat for herring and lake trout. The TCCP (Community of Tuktoyaktuk et al. 2000) reported that fish harvesting has been typically concentrated in the upper parts of Husky Lakes around Saunatuk, Zieman Cabin and Stanley Cabin. Community of Tuktoyaktuk et al. (2000) also suggests that harvesting use has been more limited to the west of Husky Lakes (including the vicinity of the Inuvik to Tuktoyaktuk Highway alignment).

According to ILA records, there are currently about 118 registered leases located throughout the Husky Lakes area with the heaviest concentrations of cabins present in the narrows northwest of Five Hundred Lakes and to a lesser extent around Whale Point and Portage Point at the southern limit of Husky Lakes (see Figure 7.5-1).

The Husky Lakes Integrated Management Planning Study, completed in 2001, suggested that the area was already under pressure and that the local people were concerned about the deterioration of the “specialness” of Husky Lakes due to increased garbage and crowding of Husky Lakes related to the increasing number of cabins and residential leases (Hoyt 2001). At that time there was already a concern that land use activities may affect the traditional ways of life. As reported in Hoyt (2001), the region was considered to be vital to the community as a place where families could spend time together and pass on the skills and culture of the Inuvialuit.

During the October 2009 community consultation sessions, some people expressed concerns about the proposed Highway being too close to the Husky Lakes area. The main concern was that a highway near the Husky Lakes could result in more people coming into the area and this could subsequently lead to the development of additional cabins, docks, over harvesting, the generation of more garbage, etc. Other people were of the view that the highway should still be built because it would make it easier for them to get to the Husky Lakes and concerns such as those raised should be managed to ensure that such potential problems would not occur. It was also noted by some people that the relative proximity of the highway would make it easier for people to transport garbage back to their home communities for more appropriate disposal in established landfill facilities.

During the January 2010 community consultations, community members expressed general satisfaction that the Project Team had employed all reasonable mitigation measures to address the concerns of the community members. In particular, the community members were generally pleased with the Project’s efforts to keep the proposed Highway alignment beyond the 1 km setback recommended by the ILA and the latest version of the Husky Lakes Management Plan.

Representatives of the ILA confirmed that the Hunters and Trappers Committees, the Elders, the Community Corporations, resource management agencies, co-management bodies, the ILA and the proponents of the Inuvik to Tuktoyaktuk Highway should work together to develop the necessary management tools to minimize the potential for such concerns to be realized.

13.0 SPILL CONTINGENCY PLAN

For the construction of the Inuvik to Tuktoyaktuk Highway, the successful prime contractors will be responsible for the preparation and implementation of the appropriate project-specific spill contingency and emergency response plan covering their areas of operation.

The key strategy will be to prevent accidents from occurring through education and enforcement. With the application and implementation of the preventative and mitigation measures as outlined, no significant fuel, chemical or other product spills are expected to occur.

A typical example of a suitable spill response plan is provided in Appendix C. The development of site-specific plans will be undertaken in the future after the prime construction contractors have been selected.

14.0 OTHER ENVIRONMENTAL ASSESSMENTS

From the 1970s to present, all-weather transportation infrastructure has been contemplated and studied approximately once every ten years. Prior to this Project Description Report and the Project Description Report for Screening the Tuktoyaktuk to Source 177 Access Road (Kiggiak-EBA 2008), the most recent environmental and socio-economic assessment to evaluate an all-weather alignment between Inuvik and Tuktoyaktuk was the *Proposed Inuvik to Tuktoyaktuk Road: Environmental/Socioeconomic Baseline Report* (Rescan 1999). In addition to the transportation-oriented environmental assessments, petroleum exploration in the Mackenzie Delta and Beaufort Sea region has generated substantial volumes of information on the environmental aspects of potential industrial developments and related activities.

Relevant to the assessment of the effects of a Highway's linear corridor, petroleum industry environmental assessment efforts, particularly the *Environmental Impact Statement for the Mackenzie Gas Project* (IOL et al. 2004), has amassed substantial additional biophysical baseline data, as well as socio-economic, cultural, and consultation inputs from the residents of Inuvik and Tuktoyaktuk. Prominent in this assessment are the Parsons Lake project, the ConocoPhillips natural gas anchor field and the gathering system that would connect it to the pipeline that will transport gas down the Mackenzie Valley to southern markets. Petroleum industry environmental assessments are considered relevant to this transportation project, and have been cited as appropriate.

Several environmental assessments have been prepared for review by the EISC for land-based oil and gas seismic and drilling exploration in the Delta area from the late 1990s to the present day. These include MGM Energy Corp.'s seismic and drilling programs, Chevron et al. drilling programs, and Petro Canada's seismic and drilling programs on the Tuktoyaktuk Peninsula. In addition, in 1997, the Ikhil Pipeline Project was reviewed by the EISC and an environmental screening of this project was also performed by the NEB as mandated under CEAA. In the offshore, Devon Canada Corporation, GX Technology

Corporation, Imperial Oil Resources Ventures Ltd., and British Petroleum plc have completed assessments and on-going data collection for marine geophysical exploration projects, most thorough of which was the Devon Beaufort Sea Exploration Drilling Program - Comprehensive Study Report (Devon 2004).

Additionally, government departments have stepped up the pace of collecting suitable background data for characterizing and monitoring the natural environment in Canada's north. These data sources comprise a significant amount of information and lessons learned from previous industrial and non-industrial development and related activities in northern environs.

15.0 CLOSURE

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 major policy objective of the Government of the Northwest Territories.

From the regional perspective, the Highway will result in a dramatic decrease in the cost of living in Tuktoyaktuk and other benefits for Inuvik. It will improve residents' access to healthcare professionals and educational opportunities. The Highway will support year-round social and recreational 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 to protecting Canadian sovereignty in the Arctic and providing diverse economic development opportunities for the future.

The Inuvik to Tuktoyaktuk Highway PDR demonstrates the viability and importance of the Highway. It describes how the anticipated effects of the Highway are manageable. This finding is derived from the scientific and engineering assessments conducted for this PDR and from the knowledge shared and views expressed by the communities of Inuvik and Tuktoyaktuk. Consultations revealed a general satisfaction with the approach and proposals contained within the PDR.

Based on consultation with the environmental screening and regulatory authorities, community organizations, and residents, 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 longterm operation and maintenance.

We trust this Project Description Report provides the information required for the Environmental Impact Screening Committee and Federal agencies to successfully complete their screening review of the proposed Inuvik to Tuktoyaktuk Highway project.

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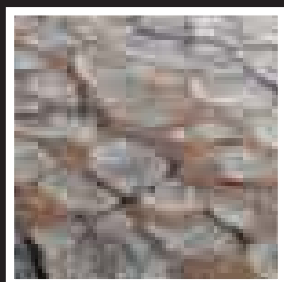
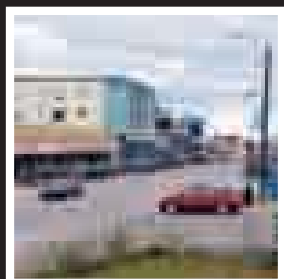
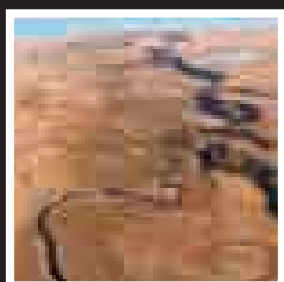
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Hamlet of Tuktoyaktuk, Town of Inuvik and the
Government of the Northwest Territories

PROJECT DESCRIPTION REPORT FOR CONSTRUCTION OF THE INUVIK TO TUKTOYAKTUK HIGHWAY, NORTHWEST TERRITORIES

APPENDICES

ISSUED FOR USE
February 2010

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**Hamlet of Tuktoyaktuk, Town of Inuvik and the
Government of the Northwest Territories**

ISSUED FOR USE

**PROJECT DESCRIPTION REPORT
FOR CONSTRUCTION OF
THE INUVIK TO TUKTOYAKTUK HIGHWAY,
NORTHWEST TERRITORIES**

APPENDICES

V23201098

February 2010

APPENDICES

Appendix A Community Consultations and Meeting Summaries

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- A-2 Meeting Notices and Television Advertising
- A-3 October 2009 Backgrounder
- A-4 Meeting Attendance Logs
- A-5 Notification of Field Study and Request to Support Archaeological Survey
- A-6 Presentation

Appendix B Map Book, Issued for Use, January 2010

Appendix C Typical Spill Contingency and Emergency Response Plan

Appendix D Previous EISC Decisions and Regulatory Inputs

- D-1 Decision of the EISC, signed January 11, 2009
- D-2 EISC letter to Department of Transportation (Government of the Northwest Territories), dated January 20, 2009
- D-3 Northwest Territories Environment and Natural Resources letter to EISC dated January 12, 2009
- D-4 Fisheries and Oceans Canada letter to EISC and Inuvialuit Land Administration, dated January 9, 2009
- D-5 Indian and Northern Affairs Canada letter to EISC, dated January 12, 2009
- D-6 Fisheries Joint Management Committee letter to EISC, dated January 8, 2009
- D-7 Inuvialuit Land Administration Facsimile, dated February 4, 2009 re: Land Use Permit No. 1LA08TF021
- D-8 Conditions Annexed to and Forming Part of Land Use Permit No. ILA08TF021

APPENDIX A

APPENDIX A COMMUNITY CONSULTATIONS AND MEETING SUMMARIES

Appendix A summarizes consultation proceedings from October 2009 January 2010 Inuvik to Tuktoyaktuk Highway consultations. The October 2009 Consultation notes were circulated to communities, organizations, agencies, and regulators on January 8, 2010.

For clarity, regardless of the terminology used during a meeting, for the purposes of these meeting summaries, the term 'Highway' is used to refer to the proposed Inuvik to Tuktoyaktuk Highway and the term 'Road' is used to refer to the Tuktoyaktuk to Granular Source 177 Access Road.

Appendix A-1. Inuvik to Tuktoyaktuk Highway Project - Community Meetings, Presentations, and Consultations October 2009 - January 2010

Topic	Community	Date	Location
October 2009 Consultations: Inuvik to Tuktoyaktuk Highway Project Proponents, Project Status, Schedule, Questions, Community Input and Recommendations	Inuvik Town Council – Town Council Meeting, Mayor Derek Lindsay, Mayor-Elect Denny Rodgers, and Council Members	October 26, 2009	Town of Inuvik Council Chambers, Inuvik, NT
	Tuktoyaktuk Community Meeting (Tuktoyaktuk) – Hamlet of Tuktoyaktuk, Tuktoyaktuk Hunters and Trappers Committee, Tuktoyaktuk Community Corporation, Tuktoyaktuk Elders' Committee, residents (i g a c g)	October 27, 2009	Kitti Hall, Tuktoyaktuk, NT
	Inuvik Community Corporation & Inuvik Elders' Committee (i g a c g)	October 28, 2009	Midnight Sun Recreation Complex, Inuvik, NT
	Inuvik Community Meeting (Inuvik) (i g a c g)	October 28, 2009	Midnight Sun Recreation Complex, Inuvik, NT
	Inuvik Hunters and Trappers Committee – Note: i c u l i g	October 29, 2009	Inuvik Hunters and Trappers Committee Office, Inuvik, NT
January 2010 Consultations: Inuvik to Tuktoyaktuk Highway Project – Updates since October 2009, Routes, Schedule, Next Steps	Inuvik Community Corporation, Tuktoyaktuk Community Corporation, Inuvik Hunters and Trappers Committee & Tuktoyaktuk Hunters and Trappers Committee meeting with the Inuvik to Tuktoyaktuk Highway Project Steering Committee Inuvik Community Meeting	January 13, 2010	Ingamo Hall Friendship Centre, Inuvik, NT
	Tuktoyaktuk Community Meeting	January 14, 2010	Midnight Sun Recreation Complex, Inuvik, NT
	Tuktoyaktuk Community Meeting	January 14, 2010	Kitti Hall, Tuktoyaktuk, NT

Appendix A-2. October 2009 Tuktoyaktuk and Inuvik Community Consultation Summary

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response
Inuvialuit Final Agreement and Protection of Special Areas	Husky Lakes have special status under the Inuvialuit Final Agreement, Section 8(1). A plan is needed to manage development in the area. There is concern about opening access.	Tuktoyaktuk	Note: Actions or project modifications made are shown in []. The Inuvialuit Land Administration brought this to our attention in September, and indicated some of the special considerations for this area, including a 1 kilometre setback for development. [IFA Section 8 consulted with reference to the proposed project.]
	The completion of the Husky Lakes Management Plan, Environmental Standards, and the Community Conservation Plan updates are anticipated by the end of the year.	Tuktoyaktuk	The submission of the PDR is scheduled for January 2010. We will seek draft copies of the noted plans. [EIRB 2002 and 2005 Drafts obtained and consulted with reference to the proposed project.]
	Show Highway route's distance from 1 kilometre setback along Husky Lakes.	Tuktoyaktuk	The 1 kilometre setback can be shown on maps for January consultation and regulatory submissions. [Husky Lakes 1 km setback obtained from ILA and added to maps.]
	Obtain EIRB guidelines. Consult the IFA Section 8 about Husky Lakes.	Inuvik Community Corporation	Recommendation noted.
Project-Specific Regulatory Review and Decision-making Process	Bring the EISC to the Tuktoyaktuk meeting in January to hear directly from the people.	Tuktoyaktuk	Noted. [Kiggiak-EBA informed the EISC of this request during Oct 29 meeting with F.McFarland and B.Chalmers.]
	Illustrate decision-making process and time line.	Tuktoyaktuk	Once the PDR is submitted to the EISC, the EISC will refer the PDR to regulatory agencies for 30 days. Then the EISC will review the comments and make its decision. The EISC usually applies terms and conditions to their decision, which must be considered as other authorizations are obtained from INAC, DFO, etc. We are working to confirm the regulatory review requirements.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
			[Note: After the Tuktoyaktuk Community meeting, regulatory consultation identified: (1) the EISC has adopted a 45 day review period and (2) the land use and quarry permits on Crown land and the water licence will require a federal review under the Canadian Environmental Assessment Act (CEAA) in addition to the EISC Screening.]
	What will happen if this project is referred to the EIRB?	Inuvik	Referral to the EIRB could be expected to add at least 6 months to the approval process.
Possible Subsequent Developments	The ILA will administer subsequent developments, such as access, proposed gas station, etc.	Tuktoyaktuk	[John Fraser, Emily Borsy, and Barry Jacobsen attended the community meeting and provided background on the role of the ILA, as required.]
Route and Route Alternatives	Several residents and Elders prefer the Upland route because it is farther from Husky Lakes. There have been many meetings here for decades. Different routes were identified. It is a concern if the options are not considered adequately.	Tuktoyaktuk	We will state in the PDR that some residents would like the Highway to be farther from Husky Lakes. [In response to interest in the Upland Route, the project team undertook more detailed study for comparison. The Partners, Steering Committee, and the communities will be provided with the comparison information.]
	Who will make the decision about the route? Will the Upland route be considered?	Tuktoyaktuk	Along with the community's views, engineering considerations, such as the amount of fill, and the cost will be factored in to the decision about the route that is put forward for development.
	Will the PDR show three routes?	Tuktoyaktuk	To be screened by the EISC, the Partners will need to propose one preferred route for construction. The pros and cons of the route will be given, as will the pros and cons of other options. The PDR's comparison will provide a basis for route selection provided.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Traditional Land Use and Cultural Considerations	Show the three to four routes that have been identified since 1977. Show the pros and cons.	Inuvik Community Corporation	The previous studies have been taken into consideration in identifying the PWC 1977 as most suitable for construction, with some modifications.
	The Highway will help residents get to their cabins and camps. With the Highway comes the responsibility to properly protect hunting, trapping, and fishing.	Tuktoyaktuk	We agree. GNWT Environment and Natural Resources said the same thing when we discussed the project with them.
	The ICC is accountable to the people on the land and is responsible for helping them maintain their lifestyle. The ICC members will vote on this project.	Inuvik Community Corporation	Noted.
Project Proponent	Who will make the decision to construct the Highway? How long will they take to decide?	Tuktoyaktuk	The Partners (GNWT DOT, Hamlet of Tuktoyaktuk, and Town of Inuvik) will decide when they want to submit their Project Description. It is currently scheduled for January 2010 submission. The EISC and other authorities and review agencies will decide if the Highway plan, as presented, can be approved.
Project Economics	The Town of Inuvik and Hamlet of Tuktoyaktuk are proposing a project on Inuvialuit private lands. It is up to the people to decide if the project should be allowed.	Inuvik Community Corporation	Noted.
	What inside information can be provided about the federal funding and timing?	Tuktoyaktuk	We do not have further information on funding for construction.
	How much will the Highway cost? Costs for this highway not yet been determined. What is the difference in cost between the proposed route and the Upland route?	Tuktoyaktuk	Based on other recent northern highway construction experience road construction costs have been in the range of \$600,000 to \$1 million per kilometre.
	If this project is approved, will it be built?	Inuvik	Unknown, but federal funding availability will require that it is approved, and the window of opportunity may pass (does not always look as promising as it does now).

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Granular Resource / Borrows	Will fees and royalty rights be collected?	Inuvik Community Corporation	The fee and royalty arrangement has not been decided.
	What is the total estimated cost for the project?	Inuvik Town Council	Cost estimation is under development and will be better understood by the end of the year.
	Which gravel sources will be used? What is the quality and quantity of gravel from each source?	Tuktoyaktuk	Calculations will be done over the winter. Some fieldwork will be needed to verify the information.
	Have the gravel sources been identified and secured? Will the ILA issue quarry rights at a discounted royalty rate?	Tuktoyaktuk	There are numerous gravel sources identified along the route. Authorizations will be required. Royalties need to be discussed further.
Project Schedule	Will borrows be on Inuvialuit or Crown Lands?	Inuvik	There are several potential borrow sources along the route. The team has not selected quarries yet.
	When will construction start?	Tuktoyaktuk	The Partners have asked Kiggiak-EBA to submit the application to the EISC in January. This is being done to enable equipment to be stored at borrow sources in March or April 2010 so that work in the borrows can commence in the summer or fall of 2010.
	The Highway project is moving too quickly.	Inuvik Community Corporation	Noted.
	What is the timeline for activities between now and submission? When will the necessary information be collected? Has enough time been allowed?	Inuvik Community Corporation	There is a lot of background information available because this project has been studied many times in the past. Focused field studies will be necessary, but the project can be submitted for screening based on the information that is currently available.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Community Social, Economic, and Cultural Considerations	Are the effects of drugs and alcohol on the community being considered?	Tuktoyaktuk	There are positive and negative aspects to a project like this, and they all need to be considered. The EISC is expected to consider environmental and social effects. The issue will be brought to the attention of the decision-makers in the PDR.
	Include a socio-economic and cultural component in the application. Obtain harvest information from the Inuvialuit Game Council.	Inuvik Community Corporation	The PDR will draw socio-economic information from previous studies and we will hope to update it with the information the meeting participants and organizations provide in the coming months.
	Will the Hamlet be responsible to upgrade and maintain the Tuktoyaktuk to Source 177 component? Will funding be provided? How will the contract for maintenance be awarded?	Tuktoyaktuk	The Tuk to 177 access road is a municipal road. It has not been decided how the funding or contracts for the maintenance of 177 will be handled after the Highway is constructed. Nothing is decided yet, and community input will be included in the decision.
Associated Infrastructure Maintenance and Responsibilities	Will Navy Road be improved? It is rough and narrow. Will the Tuktoyaktuk to Source 177 Road be upgraded?	Inuvik	An upgrade to a portion of Navy Road and the 177 Access Road are planned.
	How will the contracts be let? Will they be federal or territorial?	Inuvik	This has not been determined.
	How safe are single-lane bridges? Would a wider crossing be safer?	Tuktoyaktuk	Double lane bridges are not being considered. Risk factors that are reviewed include visibility and traffic volumes. The locations along the Highway where bridges would be installed have excellent or unlimited sight distances. The traffic volumes are low. Signage will be in place.
Public Safety	Are the Highway and bridge specifications adequate to support large module trucking for Parsons Lake?	Inuvik	The Highway will be constructed to the DOT-GNWT requirements. Overweight loads will operate under permit, will require more axles, lower speeds, seasonal timing, and other special haulage considerations, which are standard for NWT

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Reference to the Tuktoyaktuk to Granular Source 177 Access Road			highways and private resource roads. They are suitable for this Highway design.
	Have the terms and conditions for the Tuktoyaktuk to Source 177 Road been followed?	Tuktoyaktuk	ILA staff responded that adherence to the terms has been good. The ILA has held the permit holder accountable. Self monitoring, reporting, detailed activity reports, environmental monitors, and inspections have been done. The ILA noted that things do not go perfectly, but any problems have been caught quickly and corrected. The permit holder has been responsive.
	How much gravel has been used at Source 177?	Tuktoyaktuk	Approximately 249,000 cubic metres of the several million available there.
Consultation Approach	Did the Tuktoyaktuk to Source 177 Road go through the EISC or just the ILA? Unless referred by the HTC, it should have been reviewed only by the ILA.	Inuvik	It was screened by EISC and reviewed by the ILA. 177 was referred for comment to the standard referral agencies and community groups. The ILA issued permits.
	Who is being consulted?	Tuktoyaktuk	Residents of Tuktoyaktuk and Inuvik, regulatory agencies and other organizations.
	Please provide residents of Tuktoyaktuk with the questions asked at the Inuvik meeting	Tuktoyaktuk	The meeting proceedings will be circulated. [This summary will be circulated in fulfillment of the commitment made to share information.]
	At the Tuktoyaktuk meeting, how many young adults were there, and how many elders?	Inuvik	Roughly 45 people participated in the meeting, several others came and went. The 45 included elders, adults, young adults (<30 years old), and children.
	A project website would be helpful for people in town to stay up-to-date on the project progress.	Inuvik	Noted.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
	Decisions have been made without adequate communication with groups including the Inuvik Community Corporation (ICC) Board and the members. Proper processes should be followed.	Inuvik Community Corporation	Noted.
	The aspects of the project to reconsider or improve in the future include: presumptions regarding acceptance of the 'proposed' route; September 2009 field study (personnel, authorizations, process exemptions); October 2009 consultation advertising, timing, meeting location, format, and presentation; accelerated project timeline.	Inuvik Community Corporation	Preferences and suggested improvements noted.
	The ICC is not saying it is for or against the project. The members have not been asked, and the decision is up to them.	Inuvik Community Corporation	Noted.
	Has the route been decided without consultation?	Inuvik Community Corporation	The proposed route is being put forward by the Partners as one that could realistically receive funding to be built. The route has not been decided. The Upland route received considerable attention in the Tuktoyaktuk community meeting.
	Preferred consultation approach: first meeting with notebooks only, second meeting with presentation and maps.	Inuvik Community Corporation	Noted.
	Consult with the HTCs, Elders, Community Corps, ILA, Aurora Research Institute (necessary application, review, referral, and approval process).	Inuvik Community Corporation	Noted.
	Need more detail so the ICC can decide to endorse the project, or not.	Inuvik Community Corporation	We can provide additional information. The goal during this consultation is to identify interests and concerns so that we can respond to them. Kiggiak-EBA can add the ICC to the PDR distribution list.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Areas for Further Investigation	Use experienced local land users for field studies. They have been educated by the land and have important information about the areas and activities that must be considered.	Inuvik Community Corporation	Noted.
Land Tenure	The community would like clarification on land tenure arrangement – lease, right-of-way, etc.	Tuktoyaktuk	This has not been decided.
	What is the land tenure arrangement? Lease, right-of-way, land swap?	Inuvik	This has not been decided.
Protection of Permafrost, Wildlife, Birds, and Fisheries Resources and Habitat	How will wildlife and waterfowl be protected?	Inuvik	Management plans created by the proponent, community organizations, and regulatory authorities will be required.
	The co-management boards will need to decide how to protect wildlife and fish. The users will need to be responsible stewards.	Inuvik	Agreed.
For Discussion in January 2010	Will there be one big contractor for construction or will smaller companies have a chance?	Tuktoyaktuk	The Partners could respond to that question in January 2010.
	Identify associated training opportunities.	Tuktoyaktuk	It will be a three to four year project and a large workforce will be required. EGT has just graduated 12 heavy equipment operators. Currently, environmental monitor training is underway. There should be a range of opportunities.
	People would feel more comfortable to share information in smaller meetings. There should be a chance to do that.	Tuktoyaktuk	Preference noted.
	Make the next meeting on Monday or Wednesday.	Tuktoyaktuk	Noted.
	Land tenure arrangement.	Tuktoyaktuk / Inuvik	The land tenure arrangement has not been decided.

Appendix A-3. January 2010 Tuktoyaktuk and Inuvik Community Consultation Summary

Of special note, at the start of the meeting in Tuktoyaktuk, elder Persis Gruben, 92 years of age, made a statement to the community. Her statement was in her language, Inuvialuktun, with translation provided by Fred Wolki. A community member recorded the main points of Persis Gruben's statement and they have been transcribed for the project PDR as follows.

Persis comments that she has not been in a meeting about Husky Lakes road before. She says that we tried to build the road before. It is windy travelling by plane. When you travel, things happen. Travel on the ocean and coast water has caused accidents. It may help when we can travel by land. She always thinks it is a good idea to have the road. People benefit by the road. Cheaper things will be better. Things are high-priced now. Maybe oil will be cheaper. To her understanding, a lot of things happen. A lot of times Inuvialuit ask the GNWT about things, and never get them. When oil companies and government ask for things, they push until they get it. The road will help us out – make it easier for people to get things they need.

This message described the proposed Highway development from the elder's view. It expressed what she has seen in her lifetime and what she feels is important for the community in the future.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Inuvialuit Final Agreement and Protection of Special Areas	What stage is the Husky Lakes Management Plan at? What if parts of the plan do not agree with the Highway route?	Inuvik	(ILA response) The Husky Lakes Management Plan is in the final stages of discussions and approvals. (Proponent response) Ultimately, the intent is to construct a highway that is acceptable and beneficial to the Inuvialuit. It would be ideal to know if there are any issues prior to submitting the PDR to screening. This will prevent revisions later on. We have been in communication with the ILA to try to keep up with potential Management Plan terms that may affect the proposed Highway.
	(Participant comment) For Husky Lakes, it won't matter if the Highway is five miles away or two miles away, we will go there. We have the resources to protect it.	Tuktoyaktuk	

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Project-Specific Regulatory Review and Decision-making Process	What would the Federal government's priority of the routes be? Will it be the Federal government that has the final say?	Inuvik	There is no clear answer to this. The decision about the section of the proposed Highway on Inuvialuit private lands would be the decision of the ILA. The EISC will also screen the project. ILA will take into consideration other agencies comments and recommendations. The Federal government would then have a say on whether the funding is available.
	What if the timeline is delayed, at what point will the Federal government take back the funding?	Inuvik	We do not know how long this funding opportunity will be open. There is a reasonable chance to get funding now. The likely reasons for a longer timeline would be with the environmental screening process. If there are significant concerns of either environmental impacts or public concerns, the project would be escalated to higher levels of assessment. This would mean that more time would need to be spent assessing possible effects and addressing public concerns.
	Can the Highway be divided into sections for the application process, since it seems that the more northern end of the Highway is the most contentious and may take longer to decide upon?	Inuvik	No. The regulators have been clear with us on this point. They have advised us that this would be a 'road to nowhere' concept. They will not screen it in parts or phases.
		Inuvik	(Proponent statement) The decision about the significance of the impacts created by this construction project and the eventual road has to be made by those who know what is out there on the routes, and by those who know whether those impacts can be lived with. Even if the impacts are considered significant, however, doesn't mean that

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
			the funding will not be available, because mitigations can be put in place to control those impacts. A road is a pretty predictable and controllable project, as far as environmental impacts are concerned, but we need to know what the show-stoppers for this project might be from the communities' and traditional users' points of view in order to try and address them or to rule out any specific alternative routes. You must understand that some impacts, though, will occur, such as access from the south right into the Husky Lakes area.
	People might bring up environmental concerns later or even at the last minute. This may cause delays in the timeline for the project. There is a chance now to get the funding, but there is also a need to address all of the public concerns.	Inuvik	Regulatory agencies are not going to sign off on the project if there are major concerns. The question to ask yourself now is, "Are there any show stoppers?" If the environmental concerns could affect whether the project goes ahead or not, we are asking for those points now. Manageable environmental concerns should also be brought up. Manageable effects are things that can be incorporated into management plans and we would see developing those plans as part of the next steps after the screening process.
	What about last minute concerns from the communities after this meeting?	Inuvik	This is highly likely the last round of consultations before screening. However, the EISC may request more consultations and presentations after the PDR is submitted. If the community wants more meetings, we will make note of that interest.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
	How long before we find out if approved?	Tuktoyaktuk	The review process will begin in 2010. Decisions will start to come from that process in spring or early summer.
	We want the road. The community of Tuktoyaktuk will have their say on the route and it will be settled. We could vote on it.	Tuktoyaktuk	The federal government will go with the route that the communities have chosen. They will want to know what the communities want.
	Oil companies have an interest in the road. Can they be approached for funding?	Tuktoyaktuk	This will be a public highway. The initial construction funding being pursued will be government-sourced.
	Husky Lake Access will be opened up. People will want to build cabins and boat launches there. What's to stop that from happening?	Inuvik	(ILA response) The ILA will uphold the HLMP and control access to the extent that it's possible. Any sort of development will have to be approved by the ILA.
Route and Route Alternatives		Inuvik	(Proponent explanation of construction approach) The difference between construction in the northern NWT and southern NWT is that in the south you can shave off hills and push materials to make a flat road. In the north, you cannot cut hills to fill valleys. It is no longer appropriate engineering practice. This means you must bring materials from borrow pits to level the existing terrain. There are a lot of hills on the Upland Route making it like a roller coaster. The valleys along the Upland Route could have problems with snow build up, which may require the Highway to be closed. The Upland Route would be less safe to drive, harder to maintain and more expensive to construct.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
	Has the final route been selected? It sounds like it has been. What priorities go into route selection? Who decides? Do the communities' views bear any weight in the decision?	Inuvik	The routes shown on the map are at about the same stage of analysis, so that's what we're here to get your feedback about. Kiggiak-EBA is at these community consultations to present all three options that the project Steering Committee is considering. We want your comments and feedback on them. The project engineers and scientists have recommended the 2009 route to the Steering Committee above the others for technical and economic reasons. That said, all of the routes are still up for discussion. Ultimately, it is up to the community residents, the Community Corporations, Hunters and Trappers Committees, and the general public to decide what will work for them. The GNWT Department of Transportation's consideration is based on engineering and construction factors, such as construction codes, the constructability of the road along a given route, future maintenance operations, and road stability. The communities' views provide critical input into this process at every step. The project partners (GNWT Department of Transportation, Hamlet of Tuktoyaktuk, and Town of Inuvik) the purpose of these meetings is to identify any considerations that could tip the balance for or against the 2009 alignment (or one of the others). The Steering Committee will instruct Kiggiak-EBA

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
			on which route to use. The Committee is reserving that decision until they hear the outcome of these consultations.
	When the PDR is submitted to the EISC, one route will be selected, what will happen with the alternative routes at this point?	Inuvik	For the PDR submission to the EISC, one route will be selected. The alternative routes will also be mentioned within the PDR. It is important that we describe in that document how the alternatives were evaluated, and how the choice was made.
	A resident favours the Upland Route. How does he ensure that he gets heard? There are lots of people in Tuktoyaktuk that want the Upland Route.	Tuktoyaktuk resident at Inuvik meeting	[ILA and Kiggiak-EBA representatives acknowledged this view and it will be presented in the consultation summary.]
	We are in support of the Highway, but how are we going to get the funding? Who are we going to ask, the Minister, parliament, our MP? Who will write the letter?	Tuktoyaktuk	The Partners (GNWT, Town of Inuvik, and Hamlet of Tuk) are investigating all options for federal funding. To our understanding, the Town of Inuvik and Hamlet of Tuk will put forward formal requests for funding.
	(Participant comment) We have confidence that with the 2009 Route, we can look after the environment, safety concerns, and the cost. Happy with the more cost effective and safe road.	Tuktoyaktuk	Noted.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
	(Participant comment) A bit of history: Persis is over 90, women have a lot of power, and we admire her thinking of family. Twenty years ago, we discussed the Highway and it got surveyed. Later, the Hamlet Council changed, and our dream was gone. The first time, we went up the river with dogs and it took us days. Then, we went with bombardiers and it took us 10 hours. When we got trucks, it took eight hours. The GNWT said we should build a road – an ice road. Now, we need to get our road to Inuvik. Problems – things happen. Persis said we could learn. Put rules and regulations to protect Husky Lakes. I hope we don't lose this chance.	Tuktoyaktuk	
Traditional Land Use and Knowledge	(Participant suggestion) Engineering should, in certain areas like lower places, have the elders on a plane to see them. They recognize muskegs and can show them before the road is built. There is a lot of planning on Highways and you need some local elders that have knowledge of muskeg. We know some bad areas.	Tuktoyaktuk	
Project Proponent	Would the project be managed by GNWT?	Inuvik	An agreement will be established outlining roles and responsibilities between the project partners (Town of Inuvik, Hamlet of Tuktoyaktuk and GNWT Dept. of Transportation). If is managed the same way as the Tuk to Source 177 Access Road, it would likely be the GNWT Dept. of Transportation.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Project Economics	When will you find out about the funding?	Inuvik	In a couple of weeks, the project partners will be meeting with INAC Minister Chuck Strahl and delivering a proposal for funding. The partners are making efforts to identify other possible sources of money that could be applied for to help this project happen.
	The environmental process should take as long as it needs and the funding shouldn't then disappear.	Inuvik	We hope that the funding will be there when the regulatory review is complete.
	How much stockpiling will be needed?	Inuvik	It is too early in the design to know. Assessments of the pits will determine which pits are suitable. Stockpiling for maintenance would come later. The gravel sources, such as Source 177, will need to ensure that gravel is available for municipal use and community use.
Project Schedule	Is there a concern that delays caused by responding to Community and Committee issues will close the window on the funding opportunity?	Inuvik	To some extent, yes. The timing window is perceived to be small because the funding being sought is being made available by the federal government for a very specific purpose. It is stimulus funding, so if it is felt that the Canadian economy no longer requires this assistance, the funding may disappear. It is important to note, though, that due diligence, with respect to concerns about the route, must still be upheld, both with information gathering and identifying environmental impacts. If the review process determines there are significant concerns or risks, then that process may take longer. However, once funding is secured, then federal government would not withdraw the funding.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Community Social, Economic, and Cultural Considerations	Wouldn't the Upland Route generate more local employment because it is a bigger project? It should be the preferred route.	Inuvik	The Upland Route crosses hilly terrain requiring large fills and many curves for any alignment built across it. Flatter, straighter roads are considered safer because of improved sight distances and more gradual corners. There is no question, the Upland Route would require more movement of materials. The Steering Committee has to consider what the tradeoff point might be where the Federal government would say, "Why do we have to spend that much money, when other options are cheaper?" The evaluation of options shows that the Upland Route would be more expensive. The Upland Route would require more fill. The capital cost estimates mentioned in the presentation do not incorporate the long-term maintenance costs for the routes. There would be more erosion and the sides of the Highway if the Upland Route is constructed. It would go farther out and create a larger footprint on the land.
	What will happen to the ice road construction industry? Also, the ice road is a big draw for tourism.	Inuvik	(Participant comment) I would rather work on an all-weather road any day, than an ice road. (Participant response) Northwind Industries would rather have this Highway than the ice road. There would be more jobs available. It is expected that anyone currently working on ice road construction would be able to make the transition to all-weather road work pretty smoothly.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
			There will always still be some ice road somewhere, since it is a big draw for tourism.
	Has heard the Inuvik population, in general is opposed to the Highway.	Tuktoyaktuk	Noted. The consultations have heard from people in Inuvik and Tuk who want to protect Husky Lakes. Some have said they think the Highway will change or possibly threaten Husky Lakes. In October, a few people said they prefer other routes that have been considered over the past 30 years, including some far west of the ones we see on these maps. Many people in Inuvik and Tuk have told us they are in favour of building a Highway.
	There is a concern from Inuvik about whether it will be beneficial to their community versus our community.	Tuktoyaktuk	Noted.
	(Participant comment) Elders would like to have access to visit their families. The ice road is not open long and is rough.	Tuktoyaktuk	Noted.
	(Participant comment) I give my support because of the economics. Not many people are working. That's the main reason.	Tuktoyaktuk	Noted.
	(Participant comment) The pros outweigh the cons. There are so many benefits for the community. Food is one of them.	Tuktoyaktuk	Noted.
	(Participant comment) Some people do small arts and crafts. Tourism will provide a lot of resources to them.	Tuktoyaktuk	Noted.

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Public Safety	Along the flatter, straighter 2009 route, there may be more disregard for speed limits. Wildlife would more likely access the Highway. The Upland Route would, however, require more continuous maintenance subsequently providing more jobs within the communities.	Inuvik	Some people speed no matter what kind of road they're on, but there's a better chance they will survive an accident on a flatter, straighter road, at a lower elevation. The flatter, straighter 2009 route would be safer to drive than the Upland Route because it will have a lower profile. The Dempster Highway, for example, has had a lot more fatalities in comparison to the ice road that has hardly had any serious accidents.
Reference to the Tuktoyaktuk to Granular Source 177 Access Road	You say the costing figures are for the total amount. Does that include costs from Source 177 to Tuk?	Tuktoyaktuk	The funding for upgrading Tuk to 177 Access Road to Highway standards is included in the capital costs for the Highway. The funding will come from the federal government / GNWT.
	The community is in support. The question is the route. You came in October 2009, yourself, Hamlet of Tuk, and Town of Inuvik. About the finalization of the road meeting up with Tuk to Source 177, you did not answer my question. Is the upgrade of the 177 road going to be the Hamlet's responsibility?	Tuktoyaktuk	
	Is the upgrade of Source 177 to highway standards going to be the Hamlet's funding responsibility?	Tuktoyaktuk	
Consultation Approach	Will there be any more visits, more consultations?	Inuvik	Requests to return to consult again have been received, so depending on the need for more and the funds available, we are certainly willing to consider an additional consultation.
	What plans are there to ensure that all of the community members have expressed their opinions?	Inuvik	The consultation process is intended to provide that opportunity to as many people and agencies as possible by circulating information ahead of time, then discussing it during meetings and question and

Interest, Concern, or Issue	Question Comment or Interest (as stated by the Community)	By	Response Note: Actions or project modifications made are shown in [].
Protection of Permafrost, Wildlife, Birds, and Fisheries Resources and Habitat			answer sessions. This will continue through the regulatory review process, during which comments can be submitted individually, or collectively through committees. The EISC's online registry makes the PDR publically available for viewing and comments.
	The Gwich'in are concerned about what is being called "consultation" for this project. The JRP took such a long time to submit the report for the MGP. There should be caution used on the term consultation. We do not want to see this project delayed because it sounds like it will be a good project. More details of our comments/concerns will be provided in a letter.	Inuvik	Please submit comments in the form that you feel is most appropriate.
	How thick is the geotextile that will be used to insulate the tundra?	Inuvik	Approximately 3/8 of an inch.
	Is geotextile going to be placed under the haul roads to the gravel pits?	Inuvik	Likely temporary winter access ice roads will be used during the winter for haul roads to the gravel pits. There will be very few permanent access roads.

Appendix A-4. Inuvik to Tuktoyaktuk Highway Project - Organization and Agency Meetings, Presentations, and Consultations October 2009 - January 2010

Topic	Organization or Agency	Date	Location
October 2009 Consultations: Inuvik to Tuktoyaktuk Highway Project Proponents, Project Status, Schedule, Questions, Organization and Agency Input and Recommendations	Fisheries and Oceans Canada (DFO) – Amanda Joynt (Fish Habitat Biologist), Kevin Bill (Fisheries Management Biologist) & Fisheries Joint Management Committee (FJMC) – Louie Porta (Resource Biologist)	October 26, 2009	Fisheries and Oceans Canada, Western Arctic Area Office, Inuvik, NT
	Government of Northwest Territories, Environment and Natural Resources (ENR) – Paul Voudrach (Environmental Protection Officer), Marsha Branigan (Manager, Wildlife Management)	October 27, 2009	Environment and Natural Resources Shell Lake Office, Inuvik, NT
	Indian and Northern Affairs Canada (INAC) – Conrad Baetz (District Manager), Glenn Sorenson (Resource Management Officer III), Robert Gowan (Manager, Land Programs)	October 27, 2009	Indian and Northern Affairs Canada Office, Inuvik, NT
	Inuvialuit Land Administration (ILA) – John Fraser (Chief Land Administrator), Emily Borsy (Land Use Policy Coordinator), Barry Jacobson (Land Management Officer), Janet Elias	October 28, 2009	Inuvialuit Land Administration Office, Tuktoyaktuk, NT
	Northwest Territories Water Board (NWTWB) – Mike Harlow (Executive Director)	October 29, 2009	Northwest Territories Water Board Office, Inuvik, NT
	Environmental Impact Screening Committee (EISC) – Fred McFarland (Chair) / c c , Barb Chalmers (Environmental Assessment Coordinator)	October 29, 2009	Joint Secretariat Office, Inuvik, NT
	Inuvialuit Land Administration (ILA) – Christina Carter (Environmental Specialist)	October 29, 2009	Inuvialuit Regional Corporation Office, Inuvik, NT
	Joint Meeting of the Environmental Impact Screening Committee (EISC) and the Environmental Impact Review Board (EIRB) Note: a i i c c	November 5, 2009	Inuvik, NT
	Wildlife Management Advisory Council (NWTC) Note: l c c a i u a i g	December 7, 2009	Inuvik, NT
	Environment Canada – Joel Ingram (CWS)	October 16, 2009 pers. comm.	Inuvik, NT
Telephone Contact - Project Proponents, Project Status,			

Topic	Organization or Agency	Date	Location
Schedule, Questions, Community and Agency Input and Recommendations	Environment Canada – Myra Robertson (Environmental Assessment Coordinator)	October 2009	Yellowknife, NT
	Indian and Northern Affairs Water Resources Branch – Robert Jenkins	December 16, 2009	Yellowknife, NT
January 2010 Consultations: Inuvik to Tuktoyaktuk Highway Project – Updates since October 2009, Routes, Schedule, Next Steps	Regulatory- Project Steering Committee Meeting hosted by Indian and Northern Affairs Canada: Conrad Baetz, INAC; Christina Carter, ILA; Jozef Carnogursky, INAC; Norman Snowshoe, GNWT ENR; Jan Davies, INAC; Walter Orr, FSC; Masood Hassan, Kiggiak-EBA; Rick Hoos, Kiggiak-EBA; Rhonda Batchelor, GNWT DOT; Sandra Lukas-Amulung, Kiggiak-EBA; Russell Newmark, Hamlet of Tuk / EGT; Glenn Sorensen, INAC; and Mike Harlow, NWT Water Board. Amanda Joynt, DFO; Sarah Olivier, DFO; Joseph MacLeod, DFO / c c // i	January 13, 2010	Indian and Northern Affairs Canada Office, Inuvik, NT

Appendix A-5. October 2009 Agency or Organization Consultation Summary

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response
Inuvialuit Final Agreement and Protection of Special Areas	How are the consultations going?	EISC	Although the 1 kilometre setback is being observed, the main Husky Lakes concern seems to be more about access and pressure on the natural resources than it is about proximity +/- a few hundred metres.
	Contact Eli Arkin at EIRB to obtain information on Husky Lakes protection under the Inuvialuit Final Agreement.	DFO, FJMC	Draft Husky Lakes Environmental Standards and Draft Community Conservation Plan (Kiggiak-EBA received from E. Arkin on November 3, 2009).
	Review the Inuvialuit Final Agreement Sections 13 and 14.	WMAC (pers. comm. B. Hanbidge Nov 16/09)	Sections 13 and 14 of the IFA can be reviewed. The Partners will seek clarification on the application of the IFA to this project. They will further welcome interpretation from the

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Project-Specific Regulatory Review and Decision-making Process			co-management organizations, communities and organizations.
	Is this a feasibility study?	EISC	This is beyond feasibility. It is the confirmation of conceptual design and logistics to construct the Highway.
	PDR submission is required in mid-January 2010 to have the project screened in March 2010.	EISC	Noted.
	What if the Inuvialuit process and CEAA process have different outcomes?	ILA	The EISC is the starting point. [Inquiry with federal agencies (NWTWB, INAC, DFO) suggests that the federal process would commence only after the EISC issues its decision.]
	Outline regulatory path for Inuvialuit and CEAA processes.	ILA	The regulatory path is becoming clearer through consultation. It will evolve over the coming weeks.
	This is a large scale linear project.	INAC	-
	CEAA screening process will apply as a result of land use permit to be issued for Crown Lands. INAC will likely be the Federal Environmental Assessment Coordinator (FEAC), with NWT Water Board and DFO as Responsible Authorities (RAs) to the CEAA screening. The CEAA screening process will take a minimum of 42 days.	INAC	The project documentation will be designed to meet EISC, CEAA Screening, ILA, and any other requirements that apply. [Discussions with INAC are on-going and continue to support the PDR to be used for EISC and federal CEAA processes.]
	The EISC Project Description Report (PDR) could serve the purposes of the CEAA screening. Clarity, contingencies, and completeness in the PDR are very important for efficient screening.	INAC	Noted. If further information about content or process is needed, we will inquire.
	For overland movement of equipment to borrow sources, a Land Use Permit (LUP) will be issued by INAC under the <i>i i a l a g u l a i</i> . The ILA will likely require a LUP on Inuvialuit Lands. Borrow authorizations will	INAC	Noted.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
	require a land use permit, a pre-disturbance survey and a pit management plan.		
	A 'phased' construction approach is not suitable for the CEAA process. The screening will review the whole project.	INAC	Noted.
	Apply for one water licence for the Highway project.	INAC	Recommendation noted.
	DFO anticipates that the Highway will require regulatory screening under the Canadian Environmental Assessment Act (CEAA) due to the requirement for a water licence. DFO will participate as a Responsible Authority (RA) to the CEAA screening, as well as a referral agency to the EISC screening. One document (PDR) could be prepared to serve both purposes.	DFO	The same basic documentation is required for EISC screening as would be required for a CEAA screening. The documentation for this proposed project will be structured to meet the needs of the applicable review processes.
	A water licence under the <i>initial</i> a c is triggered by a) use of 300 cubic metres of water per day, b) water crossings for streams >5 metres wide; c) camps of 50 or more persons; and/or d) water diversions.	NWTWB	A licence is anticipated for water withdrawals, water crossings, and camps, if considered collectively. Water diversion is not currently being considered.
	Based on the description, NWTWB believes this project will undergo CEAA screening.	NWTWB	Noted.
	The project will require a Type A water licence. A Type A licence may require a hearing if interveners request it.	NWTWB	We will prepare for this possibility. The project team will conduct consultation and compile PDR information to attempt to address questions about the project.
	Submit the PDR to the EISC and NWTWB review at the same time. NWTWB staff will review it for completeness. After the EISC renders its decision report, the proponent may wish to submit amendments to the NWTWB prior to the CEAA screening.	NWTWB	Noted.
		NWTWB	Noted.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Lands Administration and Possible Subsequent Developments	In addition to the water licence, the Federal (INAC) land use permit will require CEAA screening.	NWTWB	Noted. The PDR will be designed to meet the information requirements of these processes.
	ILA has the mandate to regulate any subsequent developments, e.g., access.	ILA	Noted.
	The ILA will issue an access permit, land use permit, and quarry/borrow licences. ILA will work closely with the EISC to formulate the project terms and conditions.	ILA	Noted. The Partners will maintain open communication with the ILA to assist with the process however possible.
	ILA to supply the Partners with mapping files for the former powerline, the Devon winter road (if available), voluntarily registered camps, 1 kilometre setback around Husky Lakes, and more.	ILA	[Complete. This additional information has been added to the project maps.]
Route and Route Alternatives	INAC is responsible for the management of granular resources/borrow sources and issuance of land use permits on Crown Lands.	INAC	Noted.
	-	EISC	The project partnership advised on the main proposed route and alternate alignments to be considered leading to PDR development. Tuktoyaktuk and Inuvik residents' concerns about the potential effect of increased access to Husky Lakes prompted requests for more detailed comparison of the Upland route and the proposed route and report back to the communities.
	Can the most rugged areas of the Upland route be identified?	ILA	Request noted.
	Conduct quantity and cost estimate for comparison of proposed route and the Upland route.	ILA	Further Upland route investigations are warranted based on October 2009 consultation feedback. [Further investigation took place during November and December 2009, using available data.]

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
	There is a long history to this highway proposal. Many routes have been considered in the past.	GNWT ENR	This proposal aims to take those ones into consideration and put forward a Highway that can be constructed.
	Previous studies have examined options for a highway between Inuvik and Tuktoyaktuk.	Joint EISC/EIRB Meeting	The Partners have considered the pros and cons of the 'proposed' route, the Upland route, and other previously examined options.
	Regarding the preferred route, who favours it? Why?	Joint EISC/EIRB Meeting	Public Works and GNWT Dept. of Transportation helped determined where this iteration of the project should start. It started with the PWC 1977 route and examined some alternatives. Changes from PWC'77 include maintaining 1 kilometre distance from Husky Lakes; using the Navy Road approach to Inuvik; and assessing the Upland Route.
	If the preferred route is rejected, would an alternate route be put forward?	Joint EISC/EIRB Meeting	If it is not deemed acceptable by people in decision-making roles, then the project would not take place. For example, the Federal government would not fund it. The funders will likely assess the population base that the Highway will serve, the traffic on it, and the cost of alternatives.
	Will the Upland route have a greater environmental impact?	Joint EISC/EIRB Meeting	Yes. The Upland Route footprint will include filling in deep valleys or winding around terrain features. The potential for heritage resources is higher on the Upland Route. Bear denning areas are more likely there too. A lower impact aspect of the Upland Route compared to the proposed route is fewer stream crossings.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Traditional Land Use and Cultural Considerations	Provide a clear comparison between the 2009 route and the Upland route.	Joint EISC/EIRB Meeting	Based on the community consultations, the Upland Route and the proposed route are being treated equally in the analysis process. Some people felt that the proposed route was too close to Husky Lakes. No route will be acceptable to everyone, but the Partners want to put forward a route that addresses most issues as well as possible. The comparison will be developed further in the PDR when more information is available.
	Roads have the potential to generate other activities (more cabins, greater access, increased harvesting).	EISC	John Fraser, ILA, responded, indicating that part of the ILA's mandate is to regulate these subsequent activities.
	Most people respect the ban on caribou hunting. Trapping continues between Tuktoyaktuk and Parsons Lake.	GNWT ENR	-
	The Highway is a positive move to help people pursue traditional and recreational activities and cultural activities year-round.	GNWT ENR	-
	There are significant sites and fishing areas along the route.	GNWT ENR	-
	Who will have the Highway responsibility in the long term?	EISC	GNWT
Project Proponent	Whose name will be on the permits? The permittee must consider potential strict liability implications.	INAC	This has not been determined.
Project Economics	When will the cost be known?	EISC	The costs of the project are being calculated in parallel with the preparation of the PDR. A preliminary estimate should be ready by the time the PDR is complete.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Granular Resource / Borrows	Is the money to build the Highway certain?	INAC	The sooner the project is approved, the more likely it will be to receive funding for construction.
	What will the cost be?	Joint EISC/EIRB Meeting	One task the team will complete before January is the budgetary cost estimate.
	Will there be any borrows within 1 kilometre of Husky Lakes?	EISC	No. The borrows that appear to be in or immediately adjacent to Husky Lakes will be revised for the next version of the map.
	On the Inuvik end, will the project use gravel from Source 251 and Source 235?	INAC	Candidate gravel sources have not been selected yet.
	INAC must balance the granular resource demands of this project with others. Submit the planned volumes per source prior to submission to the EISC.	INAC	Noted.
	Some granular resources are in or near lakes. Will they be used to build the Highway?	DFO, FJMC	Borrow material will not be taken from the shore or the bottom of lakes.
	Remove the gravel sources on the south shore of Husky Lakes from consideration.	GNWT ENR	All gravel sources are shown on this map. Gravel will not be taken from sources at the shores of Husky Lakes. These sources should either be distinguished from potential sources on future maps or removed.
	What is the quality of borrow material? Clarify the borrow source locations and quality.	Joint EISC/EIRB Meeting	It is not the greatest material, but it is good enough, feasible. The material used for the Dempster 25 years ago was better, but this will work.
Project Schedule	Will this application be submitted before the Community Conservation Plan update is finalized? Anticipate that Husky Lakes will become Category E, which restricts development.	DFO, FJMC	This PDR is scheduled for submission to the EISC in January 2010.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Community Social, Economic, and Cultural Considerations	Will the PDR assess the possible social and economic downside, as well as the benefits?	Joint EISC/EIRB Meeting	In the community meetings, people have expressed concern about alcohol and drugs. This is not the specific role of screening, but we will identify the issues that have been brought forward.
Public Safety	Will this eliminate the need for the seasonal ice road?	EISC	Yes.
	Describe responsibility for enforcement of regulations on the Highway.	ILA	The RCMP would be responsible for some types of enforcement. For others, long term operations plans will need to be prepared and responsibilities allocated.
Reference to the Tuktoyaktuk to Granular Source 177 Access Road	-	EISC	The winter road alignment for Tuktoyaktuk to Source 177 Road was changed to be alongside the all-weather access road route.
	Was the gravel for the Tuktoyaktuk to Source 177 Access Road suitable?	NWTWB	It is not the best quality, but with maintenance it is suitable for the purpose.
	Tuktoyaktuk to Source 177 Road: requested addition of culverts; majority of road looked good on inspections.	ILA	-
	Tuktoyaktuk to Source 177 Access Road: ponding noted, additional culverts or revisions required; construction and operations phase environmental management plans are required for this Highway.	DFO	Items noted.
	ENR staff have observed ponding and "slumping" along the Tuktoyaktuk to 177 Access Road. M. Branigan provided photos of a possible "slumped" area adjacent to the Road embankment.	GNWT ENR	[Photographs received and reviewed.]

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Consultation Approach	Could Kiggiak-EBA deliver the October 2009 consultation tour presentation via teleconference to EISC/EIRB in early November?	EISC	Yes. [Completed on November 5/09.]
	ENR wishes to review and provide input to the PDR prior to submission to EISC. They indicated that it would be preferable for GNWT departments to agree on PDR content before submission.	GNWT ENR	Noted.
	Could Kiggiak-EBA deliver the October 2009 consultation tour presentation via teleconference to WMAC during their quarterly meeting in early December?	WMAC, B. Hanbidge pers. comm. Nov 16/09	Yes. [Completed on December 7/09]
Areas for Further Investigation	The Tuktoyaktuk to Source 177 Road project helps with planning the Highway regulatory process and necessary coordination.	ILA	[The terms and conditions from the Tuk to 177 Access Road are being reviewed for incorporation into the project design and the PDR environmental protection measures, as applicable.]
	INAC recommends the proponent submit information for all 40+ crossings.	INAC	Noted. Additional fieldwork will need to be done in spring/summer 2010.
	Contact INAC Water Resources Division in Yellowknife to clarify their anticipated requirements.	INAC	Noted. [Contacted and discussed project and NWT Water Board review process, December 16, 2009]
	Show proximity to Husky Lakes and distance from 1 kilometre setback.	DFO, FJMC	Request noted. [ILA 1 km buffer added to maps.]
	Will water crossings be assessed at high water conditions (spring)?	NWTWB	Assessment under high water conditions is recommended.
	HTCs can help identify appropriate water sources for the project.	GNWT ENR	Good idea.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
	Add proposed MGP lines and the Ikhlil pipeline to the map.	GNWT ENR	Future maps can incorporate these additions. [Select PDR maps will present these features.]
Land Tenure	What is the land tenure arrangement?	EISC	To be determined.
Protection of Wildlife, Birds, and Fisheries Resources and Habitat	Need to work with the Fisheries Joint Management Committee, Wildlife Management Advisory Committee and perhaps the Inuvialuit Game Council to address the larger, longer-term issues.	EISC	Please provide us with the appropriate contacts. [FJMC – Louie Porta; WMAC – Bruce Hanbidge and Jennifer Lam]
	Management plans will be required and their development should include FJMC, the Wildlife Management Advisory Committee (WMAC, NWT), and others.	ILA	Noted.
	INAC to further consider Lloyd Binder's reindeer wintering reserve near Jimmy Lakes.	INAC	-
	Support use of single span bridge structures for fish-bearing streams.	DFO	-
	DFO and FJMC expect that increased accessibility to Husky Lakes and pressures on the fisheries could increase. Will the scope of the assessment include increased access to Husky Lakes?	DFO, FJMC	Yes.
	DFO supplied report <i>i S ci i i u i a cia a i i u i u a Si i gi a S</i> (Limnotek 2007).	DFO	-
	Were any active bear dens identified during the field survey?	GNWT ENR	Yes, 1 active, 2 inactive bear dens identified and shown to ENR. Note: no active bear dens were identified during 2009 ENR Tuktoyaktuk to Source 177 Road surveys.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Other	Is global warming being considered in this PDR?	EISC	Yes, the discussion will include the reduced reliability of the existing public ice road and the protection of permafrost.
	Will the impact footprint of the project be extended to include gravel sources? Will a regional or linear spatial scope be used for impact assessment? Mitigation?	Joint EISC/EIRB Meeting	The gravel sources will be included. A linear assessment area will be used for terrain and vegetation. A regional scope will be used for wildlife (caribou, grizzly bears, waterfowl, etc.), issues of access, and harvesting. Mitigation discussions are underway. Management tools such as hunting restrictions can be used. GNWT ENR and local land users will need to work together to develop management plans.
	How will the oil and gas industry be considered in the cumulative effects section?	Joint EISC/EIRB Meeting	The PDR will include cumulative effects related to oil and gas, but this project does not look to affect oil and gas development.
	The EISC noted that the Tuk to 177 operations plan and a fisheries mitigation plan, with community input, are needed. A wildlife plan for construction was received.	EISC	Noted.
	Advise that a Fisheries Mitigation Plan for Husky Lakes may eventually need to be developed. FJMC wants to examine different pressures and sees a multi-year time frame to develop the plan.	DFO, FJMC	Such a plan could be prepared while the Highway is under review and construction.
Environmental Mitigation and Management Planning	In addition to the DFO Operational Statements in the presentation, Hunters and Trappers Committee directions will be important inputs into DOT's plan. ENR cannot dictate a Highway operations management plan.	GNWT ENR	Noted.
	The Highway will require a wildlife protection plan.	GNWT ENR	Noted.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
	The long-term environmental management plan for the operation of the Highway is important. It will require community and regulatory agency input in order to be effective.	Joint EISC/EIRB Meeting	Noted.
Construction Specifications	Where will culverts be used? Bridges? Culverts in the area can become perched.	INAC	Culverts and bridges will be used. Each crossing will be assessed for suitability.
	How high will the Highway be?	NWTWB	1.4 to 1.8 metres minimum.
	What will the differences be between the proposed Highway and the Tuktoyaktuk to Source 177 Road?	Joint EISC/EIRB Meeting	The biggest differences are width and posted speed. The Tuktoyaktuk to Source 177 Road is 7-7.5 metres wide and is designed for 50 km/h posted speed limit. The Highway will be 8-9 metres wide. It will have flatter curves and will be designed for 80 km/h.

Appendix A-6. January 2010 Agency or Organization Consultation Summary

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Inuvialuit Final Agreement and Protection of Special Areas	The ILA has advised that there is to be no industrial activity within 1,000 metres of Husky Lakes. Is this setback being observed?	GNWT ENR	(ILA response) The Husky Lakes Management Plan is in development. The 1,000 metre setback has been approved. There is further discussion on the rest of the plan. (Proponent response) The 2009 route has an encroachment of less than 2 kilometres within the setback. The 2009 route with a minor realignment (shown on map) avoids this encroachment. It adds five kilometers to the overall distance of the Highway.
Project-Specific Regulatory Review and Decision-making Process	The EISC and CEAA screenings will run in parallel. But there is a stop point for the CEAA process. At that point, CEAA will wait for the EISC decision and incorporate it into their process. Could a season of work be completed prior to screening? That way, if crossings change there would not be a need to re-screen the project.	INAC DFO	Noted. The stream crossings were a top priority during the brief September 2009 field study. We gathered enough data from the environmental and engineering perspective that we do not anticipate the crossings moving. However, more information is needed to satisfy construction requirements, and that is scheduled to be collected in summer 2010.
Project Economics	Where does the funding for this project come from? Do the cost estimates include royalties and land access?	DFO ILA	INAC and CanNor through a contribution agreement with the Hamlet of Tuktoyaktuk. The cost estimates presented are capital costs for construction only. They include the upgrade to the Tuk to Source 177 Access Road.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Granular Resource / Borrows	How confident can we be that the gravel quantities and quality is available? This factors in to construction and maintenance.	NWT Water Board	Our compilation and review of all available historical information shows that the material is available and the quality is sufficient for the construction and maintenance of the Highway. A summer geotechnical investigation will provide further data, mostly to help us determine which sources are preferable over others.
Project Schedule	Has the schedule considered EISC, EIRB, CEAA screening?	DFO	The Project Description report has been prepared to meet the screening requirements of the EISC and CEAA. Screening is the first step. Information will be provided to meet the needs of the applicable processes.
	The schedule is optimistic.	NWT Water Board	We believe it is optimistic. However, even with the additional information provided by the various regulatory agencies, we believe the project will be on track for November/December 2010 early construction activities.
	The government must evaluate the Project Description in order to decide what our assessment 'triggers' are. Then the federal agencies will coordinate their activities with each other. If a comprehensive study is required, it could be expected to affect the project schedule.	DFO	The intention is to put this project forward to secure federal funding while it is available. The team is working to provide the information we have to support the project and to satisfy applicable screening and regulatory processes under the constraints of seasonality and funding. The EISC screening and the parallel federal submission are seen as the first steps.
	If any equipment is staged in borrow sources in April 2010, land use permits will be required.	INAC	Noted.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Community Social, Economic, and Cultural Considerations	The October 2009 consultation document indicates that the EISC will be provided with information to consider socio-economic aspects of the project. This is not their mandate.	DFO	The socio-economic information will be included because it was specifically requested by community organizations to be part of this submission. EISC and CEAA screening may deal with that information as they deem suitable.
Public Safety	Will the road be 80 km/h for big tucks?	GNWT ENR	The speed we note here is in regard to the design speed limits. For practical purposes, it refers to sight lines, curves, etc. The posted speed is a matter for public policy.
	Would the viability of the project be reduced if only a 40 km/h speed were allowed?	NWT Water Board	There will be markings to reduce speed on corners, and perhaps for other reasons. Bridges will be marked down to 20-30 km/h.
	Who will decide to close the Highway due to reduced visibility?	GNWT ENR	The Highway will be part of the GNWT Department of Transportation system. They will decide when to close it. It will operate seamlessly with the Dempster, so that could be considered as an example.
	It will not be feasible for people to slow down to 50 km/h on the Tuk to 177 stretch of road. Will it be upgraded if the Highway goes ahead?	DFO	Tuk to 177 upgrade is in the budget for the proposed Highway. At present, it is a hybrid between an 80 km/h in terms of its curves, but it requires fill to be modified from a 50 km/h rating now, to an 80 km/h standard when the Highway is completed. The alignment is right for the final Highway plan.
Areas for Further Investigation	Will spring and fall fisheries assessments be completed? DFO is recommending a multi-assessment approach.	DFO	Funding has not been approved. Fisheries assessments are planned, and the project team will have to make best use of available funds.

Interest, Concern, or Issue	Question, Comment, or Interest (as stated by the Regulatory Agency)	By	Response Note: Actions or project modifications made are shown in [].
Protection of Wildlife, Birds, and Fisheries Resources and Habitat	Authorizations under the Navigable Waters Protection Act have not been discussed. Federal coordination could be delayed if they do not receive project information.	DFO	They will likely be needed. However, the specific design information that Transport Canada will look for is not available.
	Fisheries authorizations will be required if fish habitat is affected.	DFO	Noted.
	Where will geotextile be used?	INAC	It will be used for the full length of the Highway, just like the Tuk to 177 Road. It keeps the gravel together, and does not allow it to 'punch out' in soft or ice-rich areas. The fabric bears the load across a wide area and continues to hold the weight evenly.
	If your additional wildlife studies identify dens, or habitat features, will the line change again?	GNWT ENR	The line (route) is basically as shown. However, if sensitivities are identified and a revision is required, modifications will be made.
Environmental Mitigation and Management Planning	DFO wants to see sediment and erosion control plans for Highway construction and maintenance.	DFO	Noted.
	INAC will need pit management plans. The proponent is responsible for providing the specifics for borrow sources that will be used.	INAC	Noted.



MEETING NOTICES AND TELEVISION ADVERTISING



Inuvik to Tuktoyaktuk Highway Community Consultation Meeting

Date: Tuesday, October 27, 2009
Location: Kitti Hall
Time: 6:00 pm

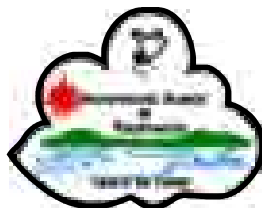
**Dinner
will be provided**

We are pleased to invite the residents and organizations in Tuktoyaktuk to attend this important meeting to discuss the proposed construction of the all-weather road from Inuvik to Tuktoyaktuk. The information received from this meeting will provide valuable input to the preparation of the necessary government (regulatory) submissions leading to approval of the road project.

We would like to share information on:

- . road planning, routing, and construction;**
- . environmental, social, and cultural considerations;**
- and**
- . any questions, comments or concerns that you may have.**

If you require further information, please contact Sandra Lukas-Amulung, Kiggiak-EBA at (403) 723-6895.



Inuvik to Tuktoyaktuk Highway Community Consultation Meeting

Date: Wednesday, October 28, 2009
Location: Midnight Sun Recreation Complex
(Upstairs)
Time: 7:00 pm

We are pleased to invite residents and organizations in Inuvik to attend this important meeting to discuss the proposed construction of the all-weather road from Inuvik to Tuktoyaktuk.

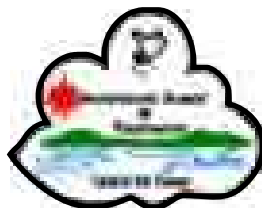
The information gathered will be used to prepare a screening application and other regulatory submissions to construct the road.

The project team will present:

- proposed road planning, routing, and construction**
- environmental, social, and cultural considerations**

We wish to record and respond to any questions, comments, and concerns that you may have.

If you require further information, please contact Sandra Lukas-Amulung, Kiggiak-EBA at (403) 723-6895.



Come out and see the plans for the Inuvik-Tuktoyaktuk Highway

Community Consultation Meetings

October 27th - 6:00pm - Kitti Hall, Tuktoyaktuk

October 28th - 7:00pm, MS Rec Complex, Inuvik

Everyone is welcome to attend!

Inuvik to Tuktoyaktuk Highway January 2010 Community Meetings

The Government of Northwest Territories Department of Transportation, the Hamlet of Tuktoyaktuk, and the Town of Inuvik ask residents to watch for an announcement about community meetings that will take place during the week of January 11-15, 2010.

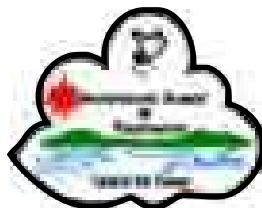
In these meetings, we will discuss the interests and issues raised in October 2009 consultations. We will provide an update on the project plan (including schedule and cost), and we will advise on how community and regulatory input is being considered in ongoing project activities. The meetings are proposed as an opportunity for the communities to provide comments and input prior to the start of the regulatory review.

**Date: Week of January 11-15, 2010
 (Dates to be announced in early January)**

Locations: Inuvik & Tuktoyaktuk

Time: Evening

**If you require further information, please contact
Sandra Lukas-Amulung, Kiggiak-EBA at (403) 723-6895.**



Inuvik to Tuktoyaktuk Highway January 2010 Community Meetings

The Government of Northwest Territories Department of Transportation, the Hamlet of Tuktoyaktuk, and the Town of Inuvik invite residents, organizations, and regulatory agencies to participate in community meetings on January 14, 2010.

The meetings will cover the following topics:

- What we heard during the October 2009 consultations and how we addressed these items.**
- What the project looks like now (a presentation about highway location, schedule, and cost).**
- Next steps.**

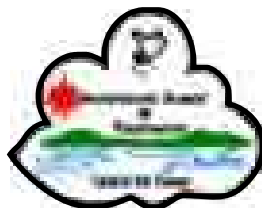
Project representatives will be available to respond to questions and receive comments before, during, and after the presentation.

Date: Two meetings on Thursday, January 14, 2010

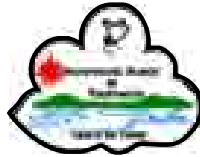
**Place/Time: Inuvik Meeting
Midnight Sun Recreation Complex,
Curling Lounge (Upstairs), 7:00 p.m.**

**Tuktoyaktuk Meeting
Kitti Hall, 8:00 p.m.**

**If you require further information, please contact
Sandra Lukas-Amulung, Kiggiak-EBA at (403) 723-6895.**



OCTOBER 2009 BACKGROUND



Inuvik-Tuktoyaktuk Highway Project Consultations

October 2009 Project Overview

The construction of a highway between Inuvik and Tuktoyaktuk is a long-term priority for the Government of the Northwest Territories (GNWT) and the communities of Inuvik and Tuktoyaktuk to provide basic services and a number of significant socio-economic opportunities to the region¹. Federal government planning for this infrastructure dates back to the 1960s.

In August 2009, federal funding was confirmed for the completion of a Project Description Report (PDR) for the Inuvik-Tuktoyaktuk Highway (the Highway). In September 2009, DOT, the Hamlet of Tuktoyaktuk, and the Town of Inuvik struck a Memorandum of Understanding (MOU) to form a Steering Committee to guide preparation of the PDR and other regulatory submissions for the Highway. Specifically, the parties to the MOU intend to prepare and submit a PDR for the Highway in early 2010.

Kiggiak-EBA Consulting Ltd. and its associate FSC Architects & Engineers, has been hired to prepare the PDR. Preparation of the PDR will include the following tasks:

- Reviewing and compiling existing information and identify any critical information gaps;
- Conducting community, regulatory, and other stakeholder consultations;
- Collecting field observations of the proposed route, and alternatives (see Figure 1), including granular sources, stream crossings, terrain, and sensitive areas; and
- Producing a PDR that meets the requirements of the regulatory agencies with jurisdiction.

The focus of current project activities is consultation and information gathering. Consultations in Tuktoyaktuk and Inuvik are scheduled for the October 27 and 28, 2009, respectively. The information gathered during these consultations will enable the project team to prepare the environmental screening application and the other submissions that regulators require to approve the Highway project. During the October consultation meetings, the project team will discuss the preliminary proposal for road planning, routing (various alignments including Public Works Canada 1977, the Upland Route, the Navy Road Alignment), and construction (see Figures 2 and 3). We will provide an overview of the field studies done in

¹ Sentence revised from its original version for inclusion in the Project Description Report. The December 14, 2009 version reads, "Government of the Northwest Territories (GNWT) and the communities of Inuvik and Tuktoyaktuk" only.

KIGGIAK - EBA CONSULTING LTD.

September including identification of stream crossings, potential material sources, potential sensitivities (terrain, topography, and other features), and areas that might require further investigation.

The project team hopes to use these meetings as an opportunity to supplement and update the existing environmental, social, and cultural information with input from residents, organizations, and local authorities. Of particular importance, we recognize the cultural, environmental, and historical significance of the Husky Lakes area. Early discussions with the Inuvialuit Land Administration emphasized the importance of maintaining a 1,000 metre setback from Husky Lakes. That setback is being observed in our project planning activities.

Please note that at this stage of the process, the plans for the Highway are in progress, and there is a lot that still needs to be done. Therefore, these meetings and your input are an important part of the Highway development process. A second round of consultations to discuss progress is currently planned for January 2010. These consultations will help to clarify any remaining uncertainties, confirm the details of the project and update proposed construction plans with the communities and regulatory authorities.

Do you have questions about next week's consultations?

If so, please contact Sandra Lukas-Amulung at 403-369-6048.

Lastly, if you cannot attend the meeting, but would like to submit written comments, please email them to slukasamulung@eba.ca or fax to the attention of Sandra at 403-203-3301.



Figure 1. Proposed Inuvik-Tuktoyaktuk Highway Alignment and Borrow Sources

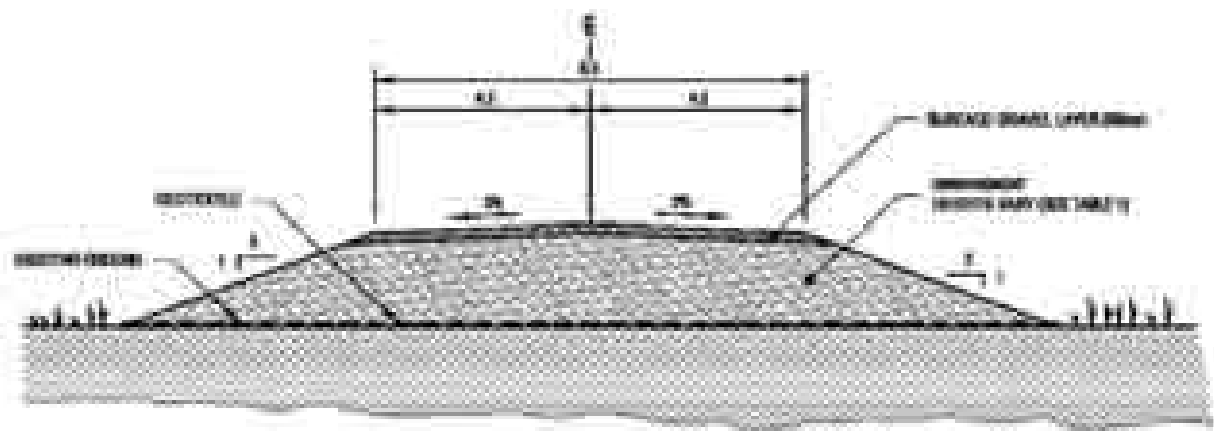


Figure 2. Typical Road Cross Section



Figure 3. 2009 Road Construction Activities on Tuktoyaktuk to Granular Source 177

MEETING ATTENDANCE LOGS

Proposed Inuvik-Tuktoyaktuk Highway
Screening Consultations – October 2009
Meeting Attendance Log

Date: October 23, 2009
Time: 1:00pm
Meeting: Tuktoyaktuk Community Meeting

Name	Organization / Company
Debbie Rieckli	Hamlet of Tuk
Georgina Jacobson-Macdonald	Hamlet of Tuk (Canadian)
Lucy Green	Resident
Thomas Kuvikman Jr	Student
Thomas Kuvikman Sr	Resident
CHARLES POKIPAK	T.H.T.C.
Freddy Boy K.	
Verni Gruber	Resident
Chuck Burton	TCC
Doug Samuels	EUT
Leanne Enright	
Erin Tremblay	Catholic Mission
Betty Jacobson	T.H.T.C.
RIZ Kuvikman	Aurora College
Bernie Kuvikman	T.H.T.C. Member
Angela Shabazz	
Thomas Gruber	Hamlet councillor

Page 1 of 3



Proposed Inuvik-Tuktoyaktuk Highway
Screening Consultations – October 2009
Meeting Attendance Log

Date: Monday Oct 27 2009

Time: 6pm

Meeting: Tuktoyaktuk Community Meeting

Name	Organization / Company
Leannette Koochuk	College
Bruce Narsana	Local
Edna T. Dilloo	TCC
Jordan P. Adam	Hamlet of Tuk
Danny Ereen	Hamlet of Tuk
Carl Kariana	Hamlet of Tuk
~~Alanna Campbell~~	Hamlet of Tuk
~~Edna T. Dilloo~~	Student of Mangalak
Hunter G. Brown	~~Hamlet of Tuk~~
J.M. G. G. G.	HOT.
Lanisha Cockney	
Catherine Koochuk	
Nellie Bessie	Local
Talies Cockney	Local - elder
Roy Cockney	Local - elder
Mahy Wakti	Local elder
Trevor Koochuk	Inuvik Building

Page 2 of 3



Date: October 27, 2009
Time: 6pm
Meeting: Takoyakutuk Community Meeting

[illegible]

**Proposed Inuvik-Tuktoyaktuk Highway
Screening Consultations - October 2009
Meeting Attendance Log**

Date: October 28, 2009

Time: 5:00pm

Meeting: Inuvik Community Corp and Elders Committee

Name	Organization / Company
Duane Smith	ICC
Shelley GRUBEN	ICC
Epiphany Gruben	ICC
	ICC
Leonard HARRY	IEL
Chloe Binkley	IEL
Mark Tuckman	IEL
Sandra L. H. Amulung	Kiggiak EBA
GUARDY JACOB	Dev, Gabor, Tuckman
Rosa Amulung	
TERRY LATITUDE	
MEAGAN DEAMERST	
Rosa English	E-S Gordon (Gabor)
Epiphany Gruben	Shelley (Gabor)
Ken Gruben	Res
Cory Wanner	Cory Wanner, Sonnet
Shane Gordon	Cory Wanner, President of Inuvik

7:00 PM
Community
Meeting

Page 1 of 2



Proposed Inuvik-Tuktoyaktuk Highway Screening Consultations – October 2009 Meeting Attendance Log

Date: Oct 20 - 21

Time: 7:50

Meeting: Unit - Invention Road

[illegible]

Page 2 of 2



Proposed Inuvik-Tuktoyaktuk Highway Consultations
January 2010
Meeting Attendance Log

Date: January 13, 2010

Time: 10:00 Am

Meeting: Regulators' Session

Name	Organization / Company
Christian Carter	ILA
Stef Carapetis	INAC
Michael Andrews	CAIT ENE
Tim Davies	INAC
WALTER OAR	FR
Michael Macleod	EBA
Rita Wong	Kiggiak EBA
NEAD BAETZ	INAC
Rhonda Batchelor	DOT
Sandra Lakes-Manning	Kiggiak-EBA
Michael Westwood	Hadley Hill EBA
Glen Spencer	INAC
Arminia Jynt	DEA (hydroelectricity)
Sarah Olivier	
Jo Macleod	

Page 1 of 1



Proposed Inuvik-Tuktoyaktuk Highway Consultations
January 2010
Meeting Attendance Log

Date: January 14, 2010
 Time: 7:00 PM
 Meeting: Inuvik Community Meeting

Name	Organization / Company
1. <u>Erin L. [unclear]</u>	<u>town of Inuvik</u>
2. <u>Kristen Bouch</u>	<u>CSU - Joint Subsidized</u>
3. <u>John [unclear]</u>	<u>Commission of Inuvik</u>
4. <u>Sean Gray</u>	<u>BSE</u>
5. <u>Fraser Dech</u>	<u>Regional District of Inuvik</u>
6. <u>Kathleen [unclear]</u>	<u>ACE - WPA - NCP</u>
7. <u>Brenda Kereak</u>	<u>T.C.C. - N.T.C. Member</u>
8. <u>Jack [unclear]</u>	<u>Inuvik [unclear]</u>
9. <u>John [unclear]</u>	<u>Thule / Inuvik College</u>
10. <u>Kurt Winkman</u>	<u>NORTHWIND</u>
11. <u>Jim McDonald</u>	<u>[unclear]</u>
12. <u>Richard Gagliardi</u>	<u>ICL</u>
13. <u>Jennifer Cockney</u>	<u>Board of Inuvik / Inuvik [unclear]</u>
14. <u>Yvonne Harrison-Croft</u>	<u>Federated Joint Management Committee</u>
15. <u>ERIC Colman</u>	<u>PUBLIC</u>
16. <u>Dan CRAIK</u>	<u>Transport, Tourism & Investment</u>
17. <u>MIKE MILLEN</u>	<u>[unclear]</u>

Page 1 of 2



Meeting Attendance Log

January 14, 2019

720

INTRA COMMUNITY ACTION

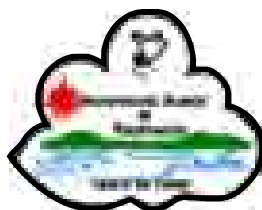
15

**Proposed Inuvik-Tuktoyaktuk Highway Consultations
January 2010
Meeting Attendance Log**

Date: January 14, 2010
Time: 8:00 p.m.
Meeting: Tuktoyaktuk Community Meeting

Name	Name
Fred Wolki	Darrel Nasogaluak
Sharon Green	Churchill Wolki Sr.
Charles Pokiak	Irene Wolki
Emily Borsy	Persis Gruben
Christine MacDonald	Georgina Jacobson-Masuzumi
Dennis Raddi	Barney Masuzumi
Debbie Raddi	Doug Saunders
Chucky Gruben	James Pokiak
Brenda Lucas	John Steen
Jean Gruben	Sandy Wolki
Lennie Emaghok	Ernest Cockney
Sammy Gruben Sr.	Peter Louie
Gloria Gruben	Gus Gruben
Eileen Jacobson	Eddie Lucas
Lucy Cockney	Eileen Gruben
Donald Inuktalik	Veryl Gruben
Roy Cockney Sr.	Barry Jacobson

Page 1 of 2

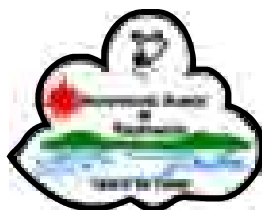


**Proposed Inuvik-Tuktoyaktuk Highway Consultations
January 2010
Meeting Attendance Log**

Date: January 14, 2010
Time: 8:00 p.m.
Meeting: Tuktoyaktuk Community Meeting

Name	Name
John Noksana Jr.	
David Noksana Jr.	
John Noksana Sr.	
Tyronne Raddi	
Randy Gruben	
Peter Nogasak	
Winnie Gruben	
Angus Emaghok	
Georgina Emaghok	
Ryan Yakelaya	
Dorothy Loreen	
Danny Loreen	
Tessa Dillon	
Bradley Felix	
Joe Nasogaluak	

Page 2 of 2



NOTIFICATION OF FIELD STUDY AND REQUEST TO SUPPORT ARCHAEOLOGICAL SURVEY



INUVIK - TUKTOYAKTUK HIGHWAY STUDY

NOTIFICATION OF SEPTEMBER 15-19, 2009 FIELD STUDY & REQUEST TO SUPPORT SEPTEMBER 2009 ARCHAEOLOGICAL SURVEY

Kiggiak-EBA has been retained by the Hamlet of Tuktoyaktuk and the Town of Inuvik to prepare a Project Description Report for the proposed Inuvik – Tuktoyaktuk Highway for submission to the Environmental Impact Screening Committee in the first quarter of 2010.

Purpose of the September 2009 Field Survey

This preliminary field survey will support the preparation of the Project Description Report and other regulatory applications for the Inuvik – Tuktoyaktuk Highway. The Kiggiak-EBA Team needs to complete this basic survey work along the proposed route before winter sets in.

Notification & Request for Support

The Kiggiak-EBA Team is sending this letter to the Inuvik and Tuktoyaktuk Hunters and Trappers Committees (HTCs) and the Inuvialuit Land Administration (ILA) to:

1. Provide notification that two (2) helicopters will be used to conduct preliminary archaeological, environmental, and engineering surveys along the proposed route. The field survey period is scheduled for **next week, September 15-19, 2009**, weather permitting.
2. Request that the HTCs and ILA contact the Prince of Wales Northern Heritage Centre (PWNHC) to express their support for the proposed archaeological and heritage resource study. The archaeological study will include the following activities:
 - Assessment of archaeological potential of a possible all-weather road route between Tuktoyaktuk and Inuvik as well as a number of associated potential borrow sources along the route.
 - Overflight of the route.
 - Some ground level assessments of the borrow sources and water crossings that are planned.
 - Note: If any surface archaeological remains are observed, GPS coordinates will be taken, remains photographed and sufficient information will be recorded to complete a site inventory form. There will be no subsurface testing conducted at archaeological sites or to find archaeological remains.

Please phone the PWNHC **OR** sign and fax a copy of this document to the PWNHC:

Shelley Crouch
GNWT Prince of Wales Northern Heritage Centre
Phone: 867-873-7258
Fax: 867-873-0205

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3. Request that the HTC's and the ILA provide the Kiggiak-EBA Team with their comments on areas where the proposed study could affect harvesting or other traditional use activities.

Approval to access the land will be obtained from the Inuvialuit Lands Administration. This request does not replace the consultation that is yet to be scheduled. Organizations will be contacted within the next couple of weeks to set up consultation meetings about the project (tentatively October). For now, we are seeking your approval to proceed with critical field studies before the snow arrives.

Inuvialuit assistants will be retained to participate in the preliminary reconnaissance survey. More detailed field work is anticipated to be conducted during the spring/summer of 2010 in support of route alignment confirmation and detailed design of the road and associated culverts, bridges, etc.

We trust that this archaeological field program description and notification of field studies will allow the Inuvik and Tuktoyaktuk HTC's and the ILA to support the September 15-19, 2009 field study. If you have any questions, please contact Sandra Lukas-Amulung at 403.723.6895 or Rick Hoos at 604.685.0017 x239.

Respectfully submitted,
EBA Engineering Consultants Ltd.



Richard Hoos, M.Sc., R.P.Bio.
Principal Consultant
Kiggiak-EBA Consulting Ltd
Direct Line: 604.685.0017 x239
rhoos@eba.ca



Sandra Lukas-Amulung, M.A., P.Biol.
Environmental Scientist
Kiggiak-EBA Consulting Ltd
Direct Line: 403.723.6895
slukasamulung@eba.ca

**EXPRESSION OF SUPPORT FOR KIGGIAK-EBA TEAM
SEPTEMBER 2009 ARCHAEOLOGICAL SURVEY**

**PLEASE PHONE 867-873-7258 OR
SIGN & FAX TO SHELLEY CROUCH AT 867-873-0205**

The Inuvik HTC / Tuktoyaktuk HTC / Inuvialuit Land Administration **(please circle one)** supports the Inuvik – Tuktoyaktuk Highway September 2009 Archaeological Study as it has been explained in this letter. We have been given an opportunity to ask questions, and we have been provided with the names and phone numbers of the Kiggiak-EBA Team, who we can contact if we have questions or require more information.

☐ We support the Inuvik – Tuktoyaktuk Highway September 2009 Archaeological Study.

Name (Please Print)

Date

Title

Signature

PRESENTATION

consulting engineers
& scientists



Proposed Inuvik to Tuktoyaktuk Highway Consultations

January 2010



Presentation Overview

- Tuktoyaktuk / Inuvik / DOT Partnership
- Why build the Highway?
- Project Status Update
- Inuvik to Tuktoyaktuk Highway Route Selection
- Highway Design Considerations
- Construction Approach
- Construction Timing and Staging
- Regulatory and Land Management
- Community Input



Partnership

- Hamlet of Tuktoyaktuk / Town of Inuvik / GNWT Department of Transportation Partnership
- Federal funding support
- Technical support provided by the team of Kiggiak-EBA and FSC



Why build the Inuvik to Tuktoyaktuk Highway?

- Completes the highway to the Arctic sea coast and provides year-round overland access to Tuktoyaktuk
- Decreases the cost of living in Tuk by enabling goods to be shipped year-round
- Provides Tuk residents with cheaper, easier and safer access to regional services including:
 - Health care
 - Educational opportunities
 - Recreational opportunities



Why build the Inuvik to Tuktoyaktuk Highway?



- Enhances opportunities for family, social and sporting interactions by providing year-round access between communities
- Promotes the tourism and hospitality industry in Inuvik and Tuk
- Strengthens Inuvik's role as the regional commercial hub
- Provides more opportunities for business expansion
- Reduces costs of onshore oil, gas and mineral exploration and development and encourages new activities
- Supports national security and northern sovereignty objectives



Project Status Update

- First round of community consultations completed in October, 2009
- Based on consultations, alignment alternatives have been evaluated



Project Status Update

The importance of the Husky Lakes area has received particular attention



Project Status Update

- Draft Project Description Report (PDR) provided to Project Steering Committee in December 2009
- Second round of community consultations underway this week
- Results to be incorporated into PDR for submission to EISC shortly



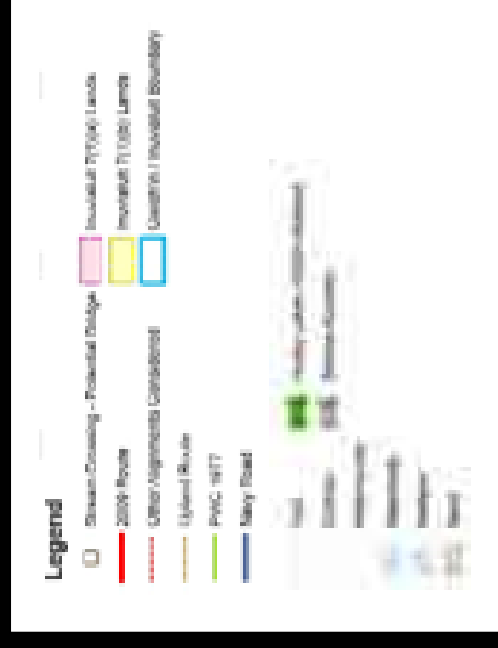
Inuvik to Tuktoyaktuk Highway Route Selection

Based on inputs received from community consultations, the project team evaluated alignment alternatives in greater detail:

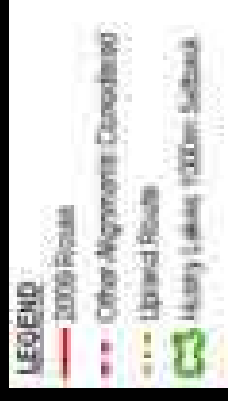
- 2009 Route (similar to PWC 1977)
- Minor Re-alignment of 2009 Route
(to fully satisfy the Husky Lakes Management Plan setback)
- Upland Route



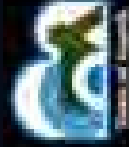
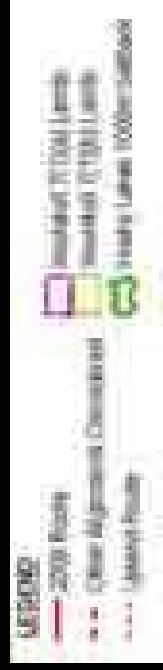
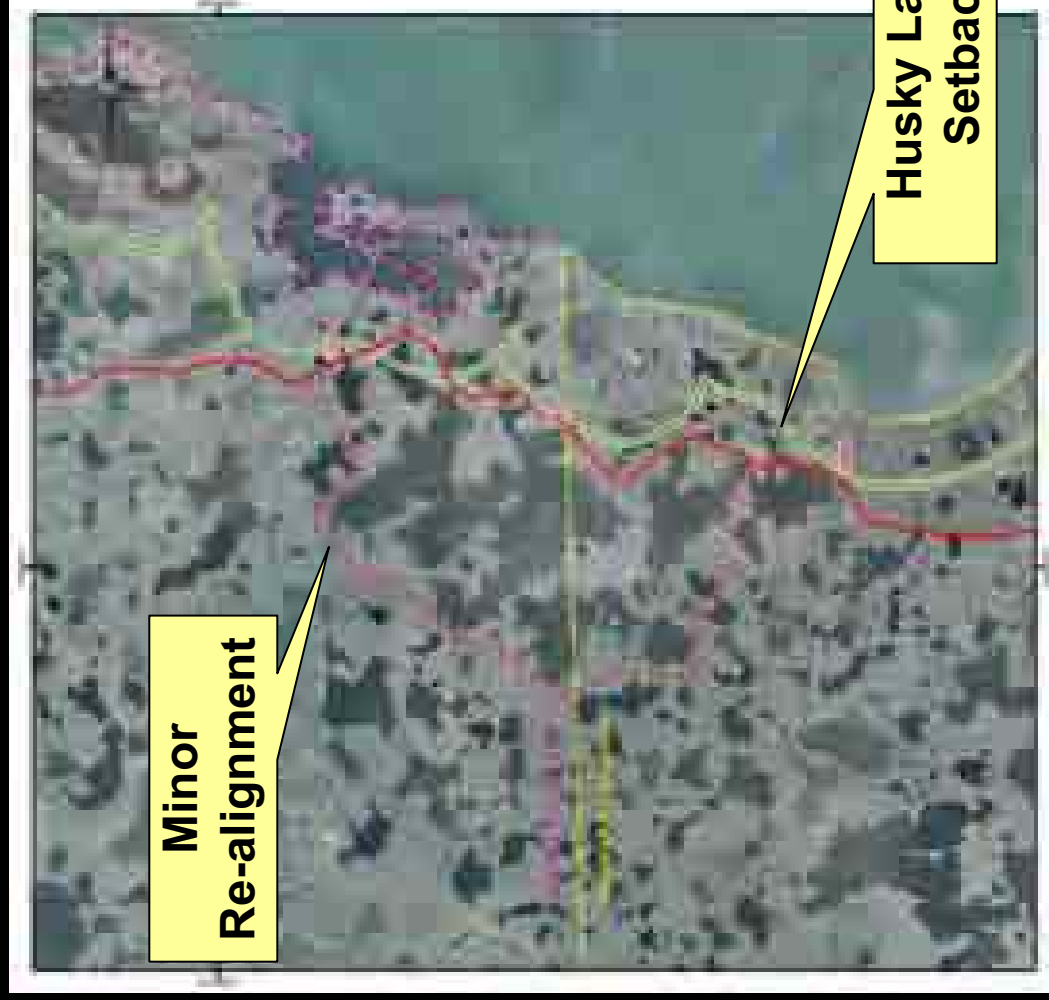
Proposed 2009 Route



Other Alignments Considered - Upland Route and Minor Re-alignment of 2009 Route



Minor Re-alignment – 2009 Route



Comparison of Alignments

Element	2009 Route	2009 Route (with minor re-alignment)	Upland Route
Estimated Highway Length	137 km	142 km	134 km
Estimated Embankment Quantity	4.5 million cu. m	4.8 million cu. m	5.4 million cu. m
Estimated Base Course (Surfacing) Quantity	250,000 cu. m	259,000 cu. m	242,000 cu. m
Estimated Capital Construction Cost	\$221,000,000	\$233,000,000	\$258,000,000



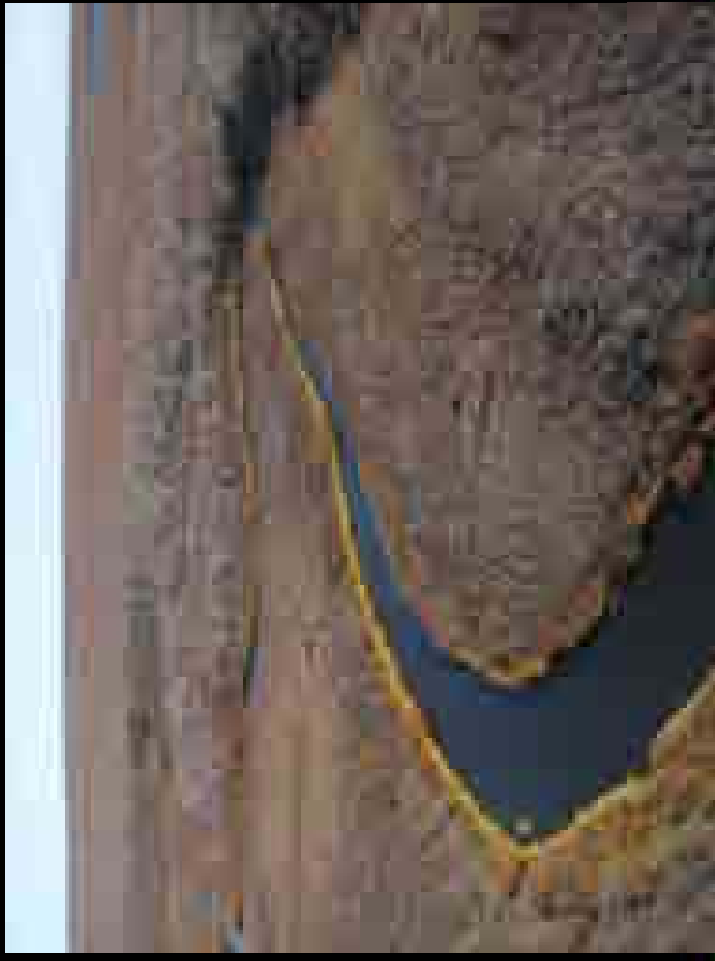
Technical / Economic Basis for Proposed 2009 Route

- Lowest cost alternative
- Requires the least borrow material to construct
- Closer to known borrow sources
- Reduced project footprint (less land disturbance)
- Respects Husky Lakes Setback with a minor exception
- Terrain is less rugged and easier to meet design requirements for public highway
- Safer driving
- Easier and lower cost to maintain



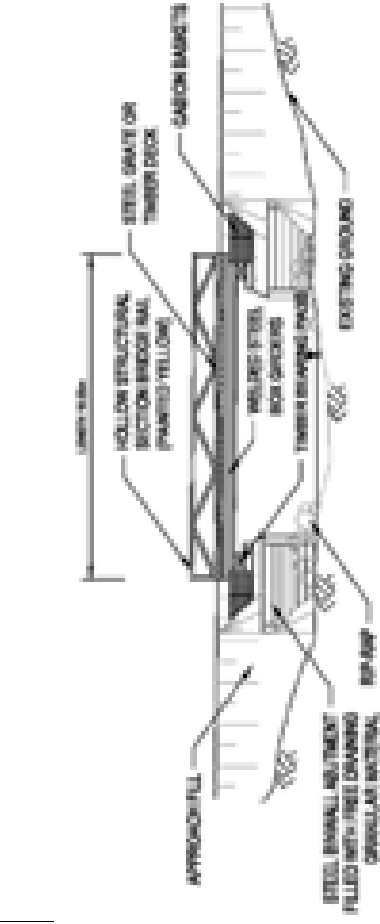
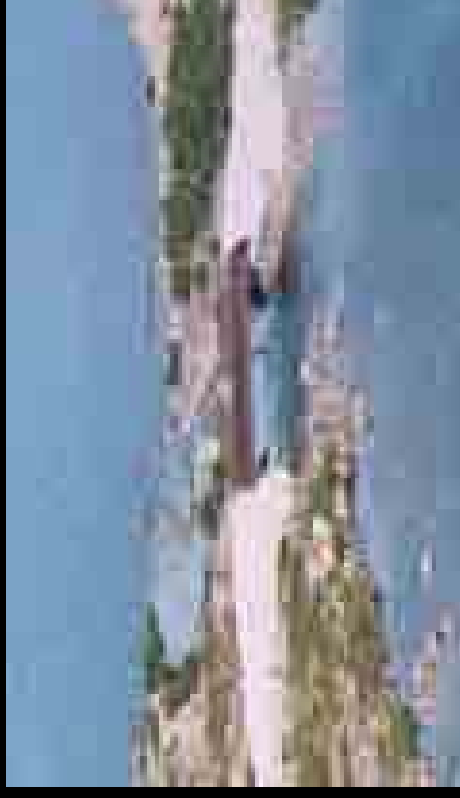
Highway Design Considerations

Small bridges needed for selected stream crossings
→ 8 locations anticipated including Zed and Hans creeks

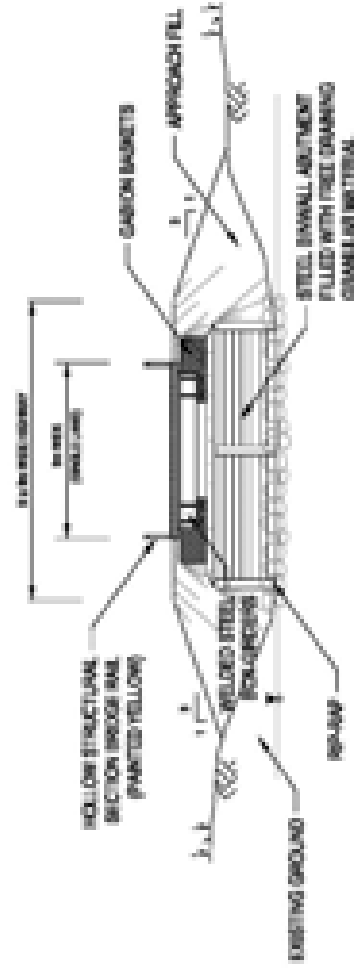


Highway Design Considerations

- Relatively simple - single span - bridge design
- Bridges will be prefabricated, transported to and installed on site
- Fish habitat will be protected



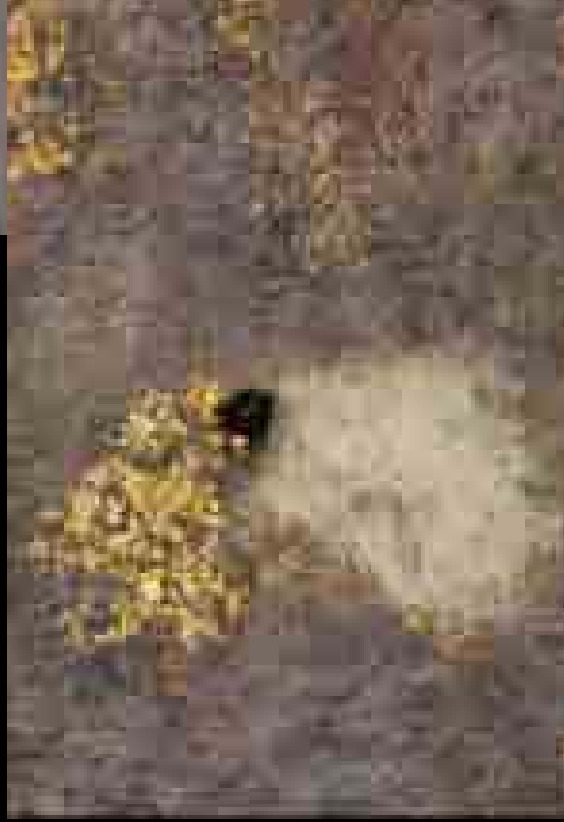
BRIDGE ELEVATION



ABUTMENT ELEVATION

Highway Design Considerations

Avoidance of
rough terrain and
grizzly bear dens



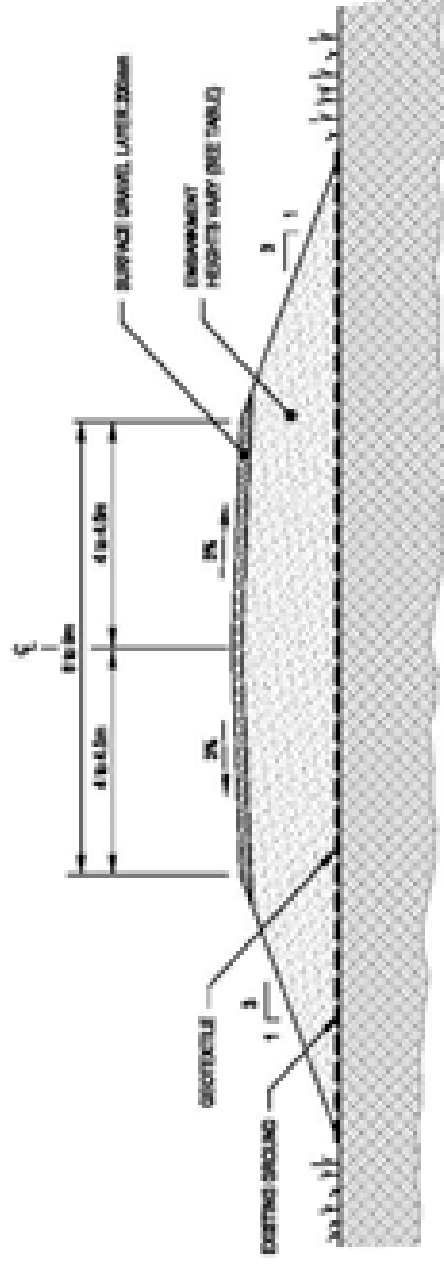
Highway Design Considerations

Avoidance of
sensitive terrain
such as ice-rich
polygons where
possible



Typical Highway Design Cross Section

- Minimum 8 m wide driving surface
- Designed for 80 km/h posted speeds



TYPICAL HIGHWAY CROSS SECTION

TERMINUS TYPE	DESCRIPTION	EMBAKMENT HEIGHTS
1	DRY ICE ROAD TILL AND OUTWASH DEPOSITS	1.4 m
2	WET (CLAYEY TO SILTY) TILL AND OUTWASH DEPOSITS	1.4 to 1.8 m
3	WET SILTY AND CLAYEY (SILT-CLAY)	1.8 to 2.0 m
4	THICK ORGANIC PEATLAYER AND ICE-POH PERMAFROST	2.0 m

Highway Design Considerations

Next Steps...

Engineering

- Borrow source quality and quantity assessments
- Route alignment survey
- Detailed highway design of horizontal and vertical alignment (curves and hills)
- Design of bridges and culverts
- Pit management plans, erosion and sediment control plans

Environmental / Heritage Resources

- Stream crossing assessments
- Wildlife and habitat surveys
- Archaeological assessments

Contractor Responsibilities

- Construction management plans
- Spill / emergency response plans, quality assurance/quality control



Construction Approach

- Tuk to Source 177 Access Road construction provides the model
- The Highway is expected to be built by northern construction contractors
- Construction will proceed from both the north and south ends
- Take advantage of winter season to develop materials sources and construction
- Embankment construction begins by placing geotextile and building forward in lifts of granular material
- Embankment construction continues each season until spring demobilization
- Final shaping, compaction and placement of granular topping takes place in the summer



Proposed Construction Timing and Staging

subject to funding and permitting

August 2010

Pre-positioning equipment at Source 177
Potentially commence construction at Inuvik end

October 2010

Strip and develop initial borrow source(s)

November-December 2010

Continue work at borrow sources, construct winter access and haul roads

January-April 2011

Transport, spread borrow material, construct road embankment and install bridges and culverts

June-September 2011

Compact and grade Year 1 road base

Fall 2011 - Late 2012

Repeat cycle and complete construction



Regulatory and Land Management

- Inuvialuit Tuk 7(1)(a) and 7(1)(b) lands, administered by the Inuvialuit Land Administration (ILA)
- Crown lands administered by INAC
- **Environmental Screening through the EISC and CEAA**
- Land use and Borrow permits to be obtained from ILA and INAC
- Water Licence to be obtained from NWT Water Board
- Conformance with DFO Operational Statements & Authorizations
- Conformance with Tuktoyaktuk and Inuvik Community Conservation Plans



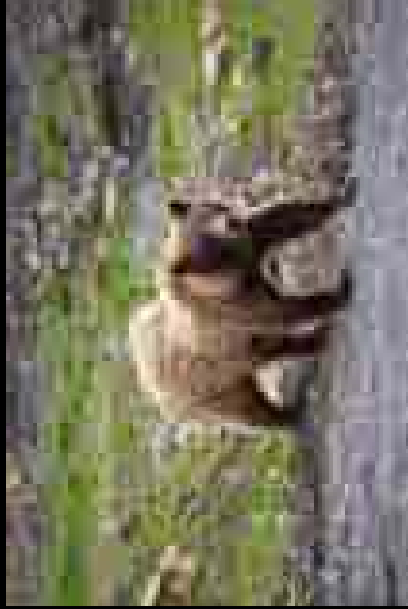
Regulatory Process & Timeline

Consultations – Tuk/Inuvik & Regulatory Agencies	October 2009 and January 2010
Project Description Report Preparation	October 2009 to January 2010
ELSC Submission	January 2010
Presentation to ELSC	March 2010
Permitting, Licencing, and other Authorizations (various regulatory agencies)	April to November 2010

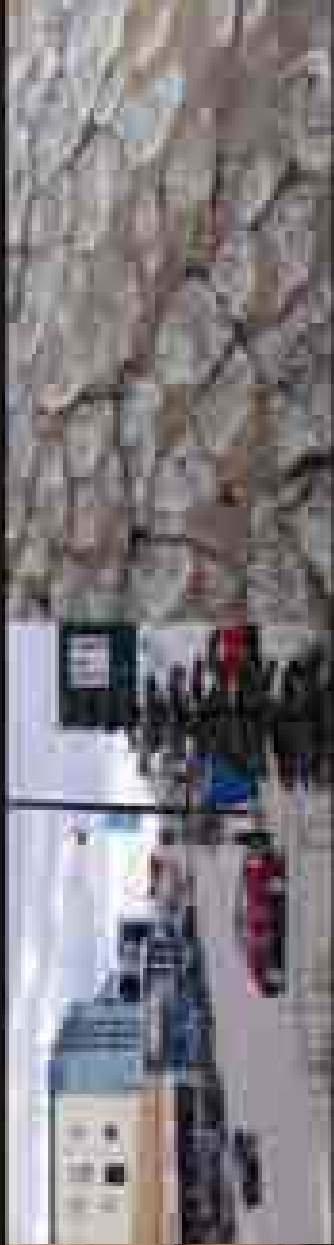


Community Input

We welcome your
questions, thoughts,
comments, and inputs.



THANK YOU



Engineering Transportation Environment
Mining Development Energy

eba.ca



APPENDIX B

APPENDIX B MAP BOOK

consulting engineers
& scientists



Proposed Inuvik to Tuktoyaktuk Highway 1:25,000 Map Book

January 2010
Issued For Use
File# V23201098





LEGEND

- Communities
- 2009 Route
- - - Other Alignments Considered
- - - Upland Route
- PWC 1977
- Navy Road
- Watercourse
- Waterbody
- Wetland
- Map Grid

NOTES

Base data srs: nrs 1 250 000 NCS

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book Index Map

PROJECTION UTM Zone 18	DATE MAY 2010
Scale 1:25,000	
5 10 15 20 25	
Kilometers	

FILE NO.
1/2,000-250 MapBook INDEX-Jan2010.mxd

PROJECT NO. 1/2,000-250	DRAWN KWM	CHECKED Rou	REV 1
DATE EBA/AMC	DATE January 6, 2010		



Index Map

ISSUED FOR USE



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

Grizzly Bear Den

Grizzly Bear Den

Grizzly Bear Den

2004 Route

Other Agreements Considered

Upland Route

PWC 1917

Heavy Road

Gravel Source

Archaeology Areas of Interest

Grizzly Bear Habitat

Twin Otter Strip

Muddy Lake

100m Sectors

1:25,000 Map Book

Scale: 1:25,000

WGS 84 100 200 300 400 500

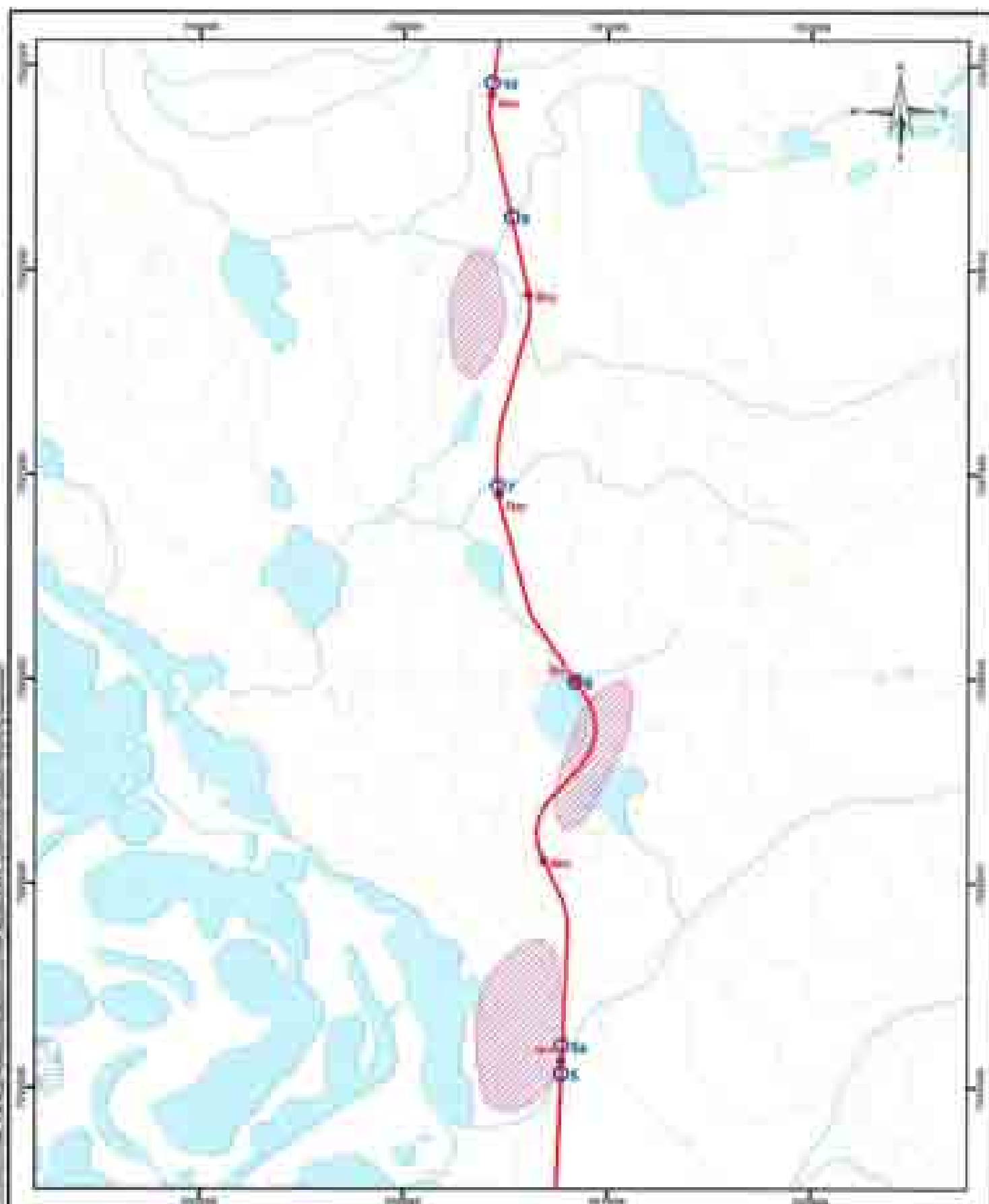
UTM Zone 18

NAD83

Published: 1/25/2010 Map Book Jan 2010 and
 1/25/2010 1/25/2010 Date: January 2010



Map 01



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

-  City of Denver
 Northwest Colorado
 Colorado Department of Transportation
-  DTC Route
 Other Alignment Considered
 Local Route
 Other Road
 Other Road
-  Future
 Water
 Wetland
 Wetland
 Wetland
-  Bottom Source
 Agency Area of Interest
 Right of Way
 Right of Way
 Right of Way
-  Future
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1:25,000 Map Book

Loan # 125,000

100 150 200 250 300 350 400 450 500

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Figure 10



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

- Proposed Road Right-of-Way
- Proposed Road Alignment
- Proposed Road Right-of-Way
- Proposed Road Alignment
- Proposed Road Right-of-Way
- Proposed Road Alignment
- Proposed Road Right-of-Way
- Proposed Road Alignment

- Arrow Source
- Archaeological Areas of Interest
- In-Road Paving
- Orca Bay Belk-Helmuth Zone
- Fair Time Site
- Heavy Lateral
- 100m Section

1:25,000 Map Book

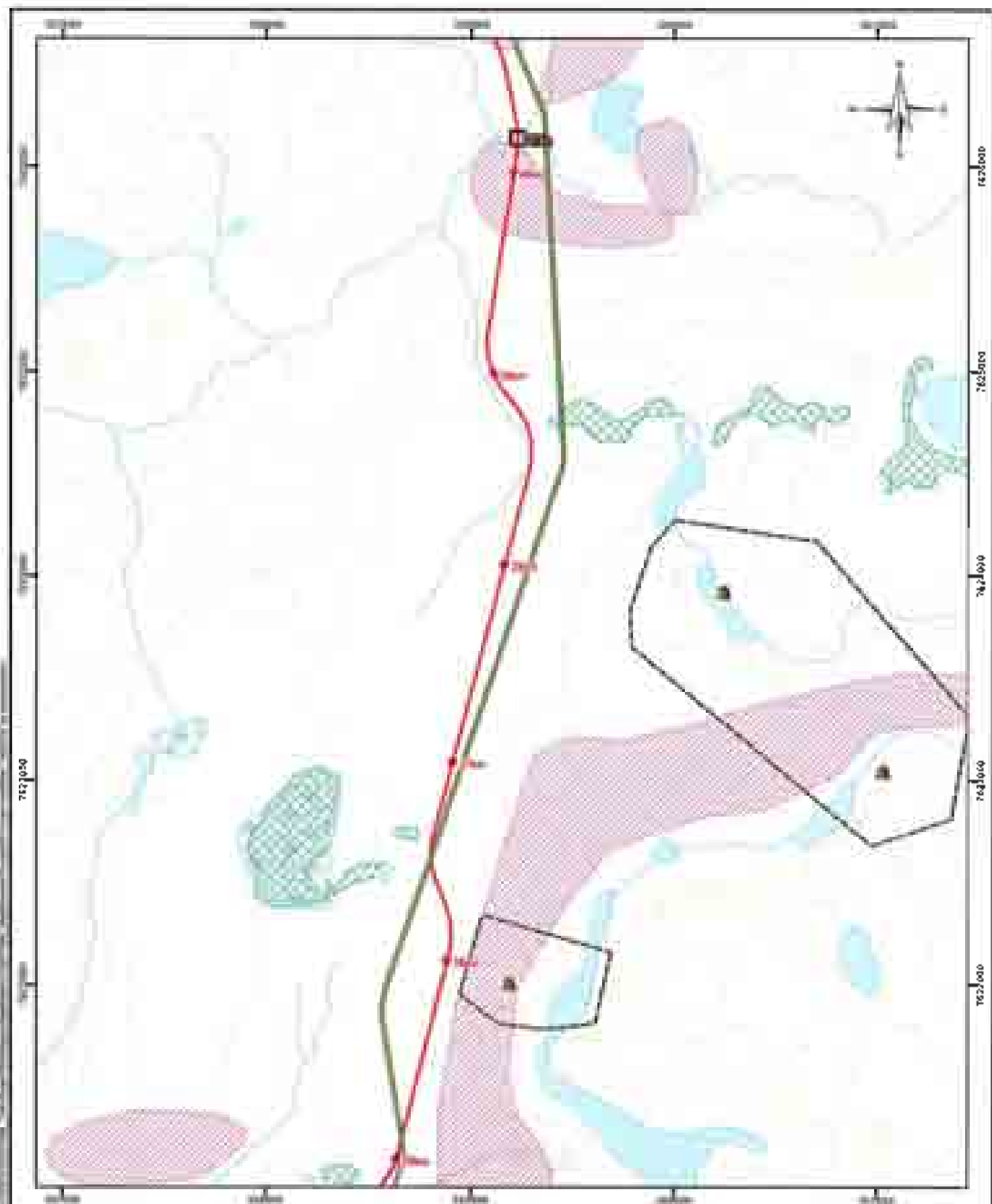
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100m 200m 300m 400m 500m

UTM Zone 8
NAD83



File No: V23201098_WebBookJan2017.rvt
Project No: V23201098 Date: January 1, 2018

Map 08



Legend

- Existing Road
- Proposed Highway
- Wetlands
- Wetlands
- Inuvik-Tuktoyaktuk Highway

- Contour
- Watercourse
- Wetlands
- Sand
- Inuvik-Tuktoyaktuk Highway
- Inuvik-Tuktoyaktuk Highway
- Inuvik-Tuktoyaktuk Highway
- Inuvik-Tuktoyaktuk Highway

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale: 1:25,000
UTM Zone 18N
Datum: NAD83

File No: 123201098 MapBook-123201098
Project No: 123201098 Date: January 6, 2010



Map 08



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

- Proposed Road Right-of-Way
- Proposed Road Alignment
- Proposed Road Right-of-Way
- Proposed Road Alignment
- Proposed Road Right-of-Way
- Proposed Road Alignment

- Boreas Trench
- Archaeological Area of Potential Interest
- Cultural Heritage - Designated Zone
- Fair Game Site
- Honey Lake
- 1000+ Saline

1:25,000 Map Book

Scale 1:25,000
1000 200 400 600 800

LTV Zone 3
NAD83



FILE NO. 102120100 MapBook-Inv02-0-mat
PROJECT NO. 102120100 Part 1 January 5, 2010

Map 09



Legend

	Gravel Road		Proposed Road
	Gravel Road		Proposed Road
	Gravel Road		Proposed Road
	Gravel Road		Proposed Road

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYARTUK HIGHWAY

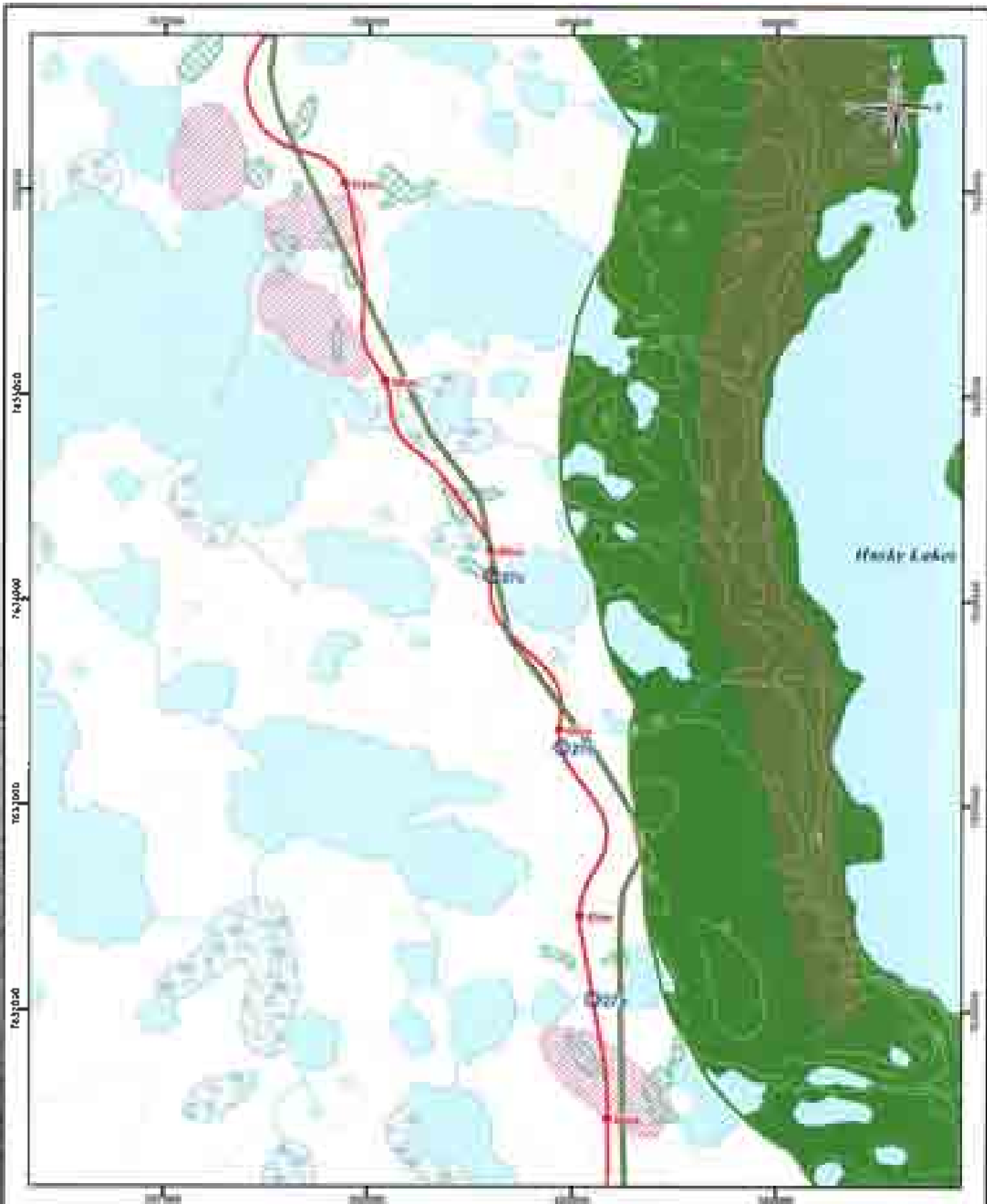
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UTM Zone 8
NAD83

FILE NO: 1:2500098_MapBook_1:25,000
 PROJECT NO: 1:2500098 Date: January 2019

Map 10



Legend

Boundary Area	Proposed Highway	Wetland	Proposed Highway
Proposed Roadway	Existing Highway	Water	Existing Highway
Boundary Area	Existing Highway	Water	Existing Highway
Boundary Area	Existing Highway	Water	Existing Highway

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale 1:25,000

1000 100 20 300 400 500

UTM Zone 8
NAD83



File No. 02/02/002 MapBook NTS Jan2010.mxd
MapBook 02/02/002 Jan 2010 v2.0

Map 10



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

1:25,000 Map Book

Scale 1:25,000

UTM Zone 18N

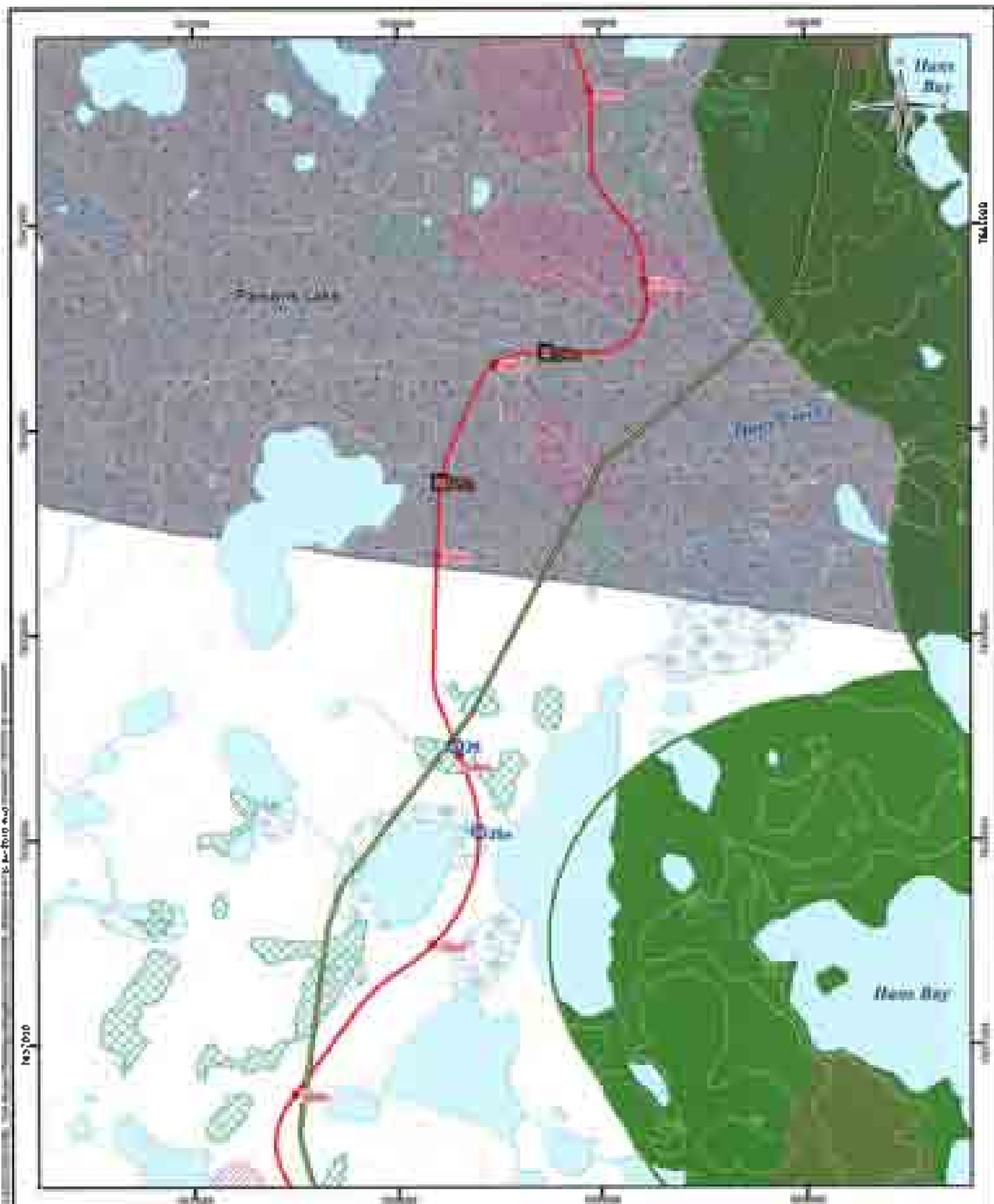
UTM Zone 18N

UTM Zone 18N

UTM Zone 18N



Map 11



Legend

Inuvik	Peary Sound	Peary Bay	Peary Lake
Peary Sound	Peary Bay	Peary Lake	Peary Sound
Peary Bay	Peary Lake	Peary Sound	Peary Bay
Peary Lake	Peary Sound	Peary Bay	Peary Lake

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYARTUK HIGHWAY

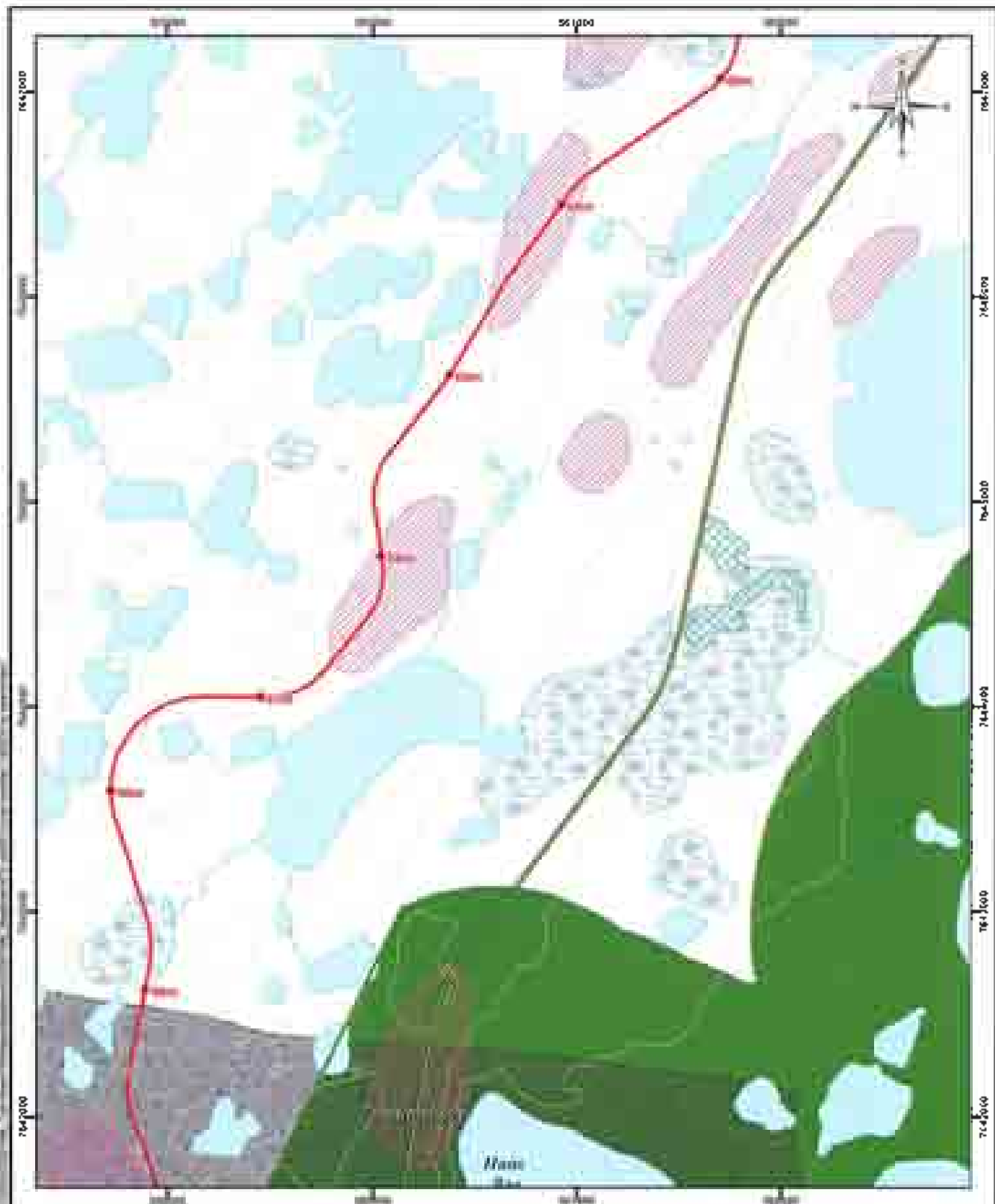
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Scale 1:25,000
 0 100 200 300 400 500
 UTM Zone 5
 NAD83



FILE NO. V23201096 MapBook NTS Jan2010
 PROJECT NO. V23201096 DATE January 2010

Map 11



Legend

	Boundary (Red)		Boundary (Blue)
	Boundary (Green)		Boundary (Yellow)
	Boundary (Purple)		Boundary (Brown)
	Boundary (Pink)		Boundary (Grey)
	Boundary (White)		Boundary (Black)

ISSUED FOR USE

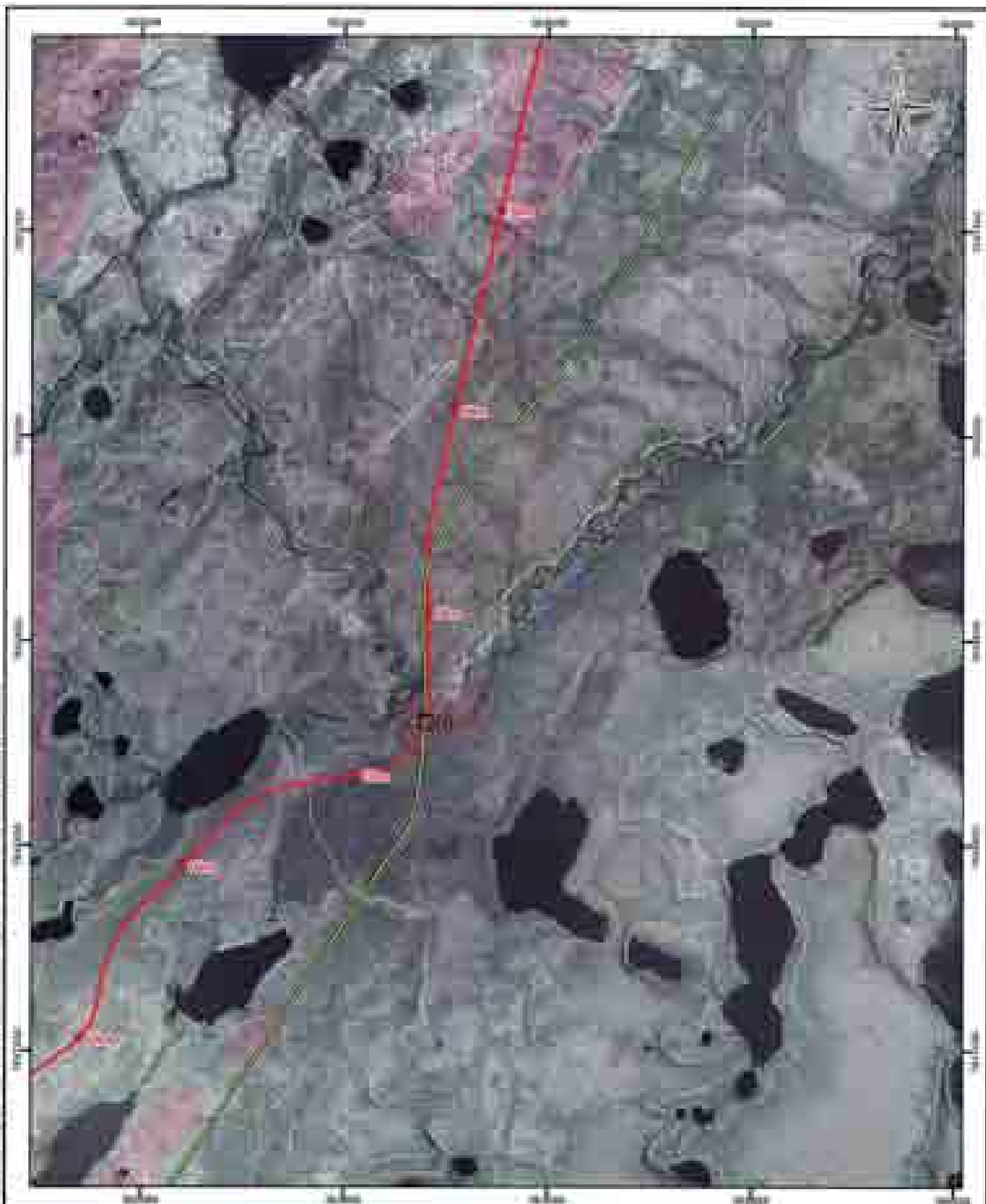
PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale 1:25,000
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 UTM Zone 8
 44081
 PLAN: V23201298 MapBook.NTS.v23210.mxd
 PROJECT: V23201098 DATE: January 4, 2010



Map 12



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

- Highway Alignment
- Highway Right-of-Way
- Highway Right-of-Way
- Highway Right-of-Way
- Highway Right-of-Way
- Highway Right-of-Way
- Highway Right-of-Way
- Highway Right-of-Way
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- Highway Right-of-Way

1:25,000 Map Book

Scale 1:25,000

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UTM Zone 8
NAD83



File No. 122271098 MapBook_012512.mxd

Project No. 122271098 Date January 2018

Map 13



C:\Users\jld\Documents\Map_15.mxd

Legend

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

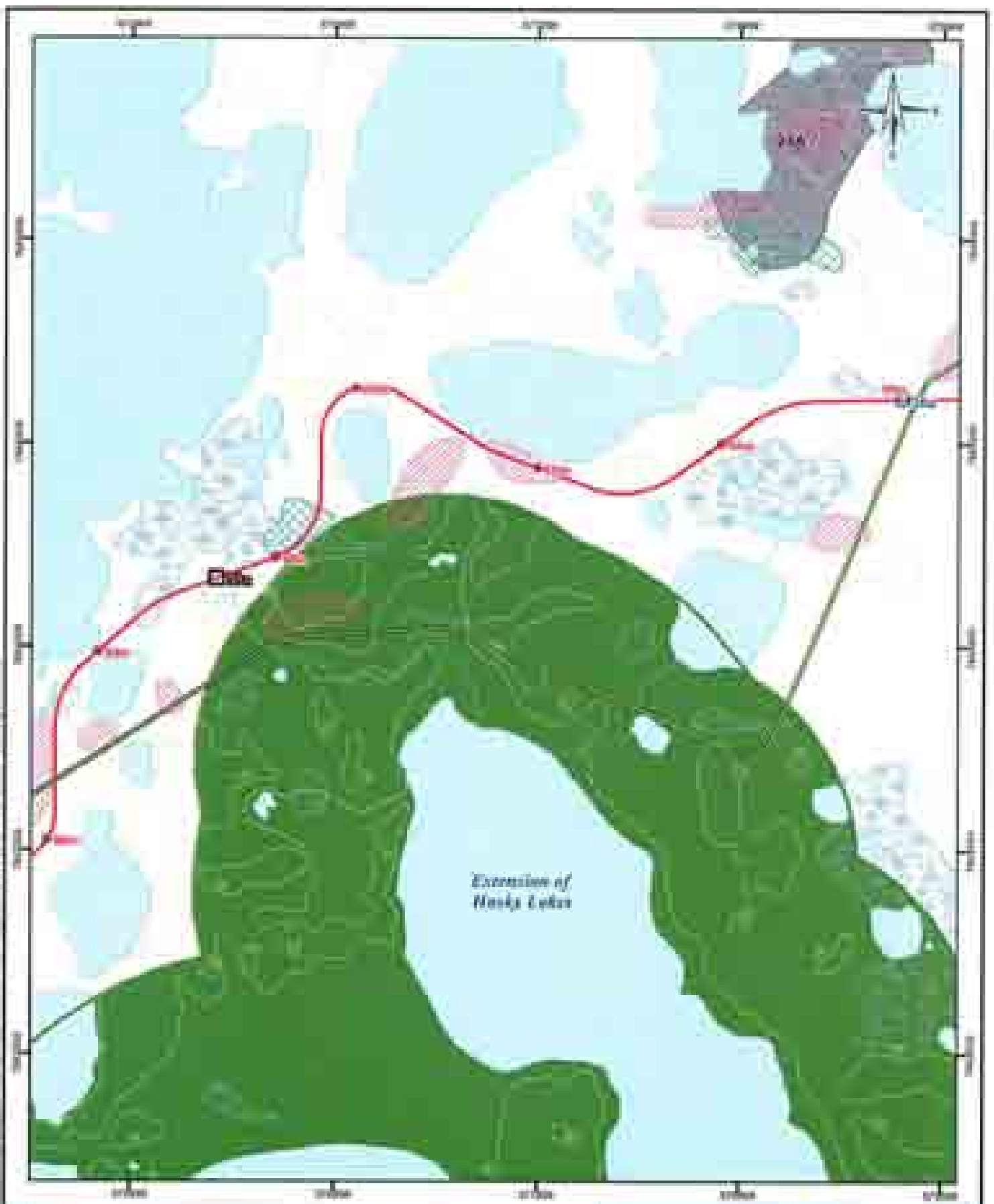
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Scale: 1:25,000
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 METERS

UTM Zone 5
 NAD83

FILE NO: V23201098 MapBook Jan2015.mxd
 PROJECT NO: V23201098 date: January 6, 2015

Map 15



Legend

Brown Shaded Area	Highway	Road	Road
Proposed Highway	Highway Right-of-Way Boundary	Road Right-of-Way Boundary	Road Right-of-Way Boundary
Bridge	Road Right-of-Way Boundary	Road Right-of-Way Boundary	Road Right-of-Way Boundary
	Road Right-of-Way Boundary	Road Right-of-Way Boundary	Road Right-of-Way Boundary

ISSUED FOR USE

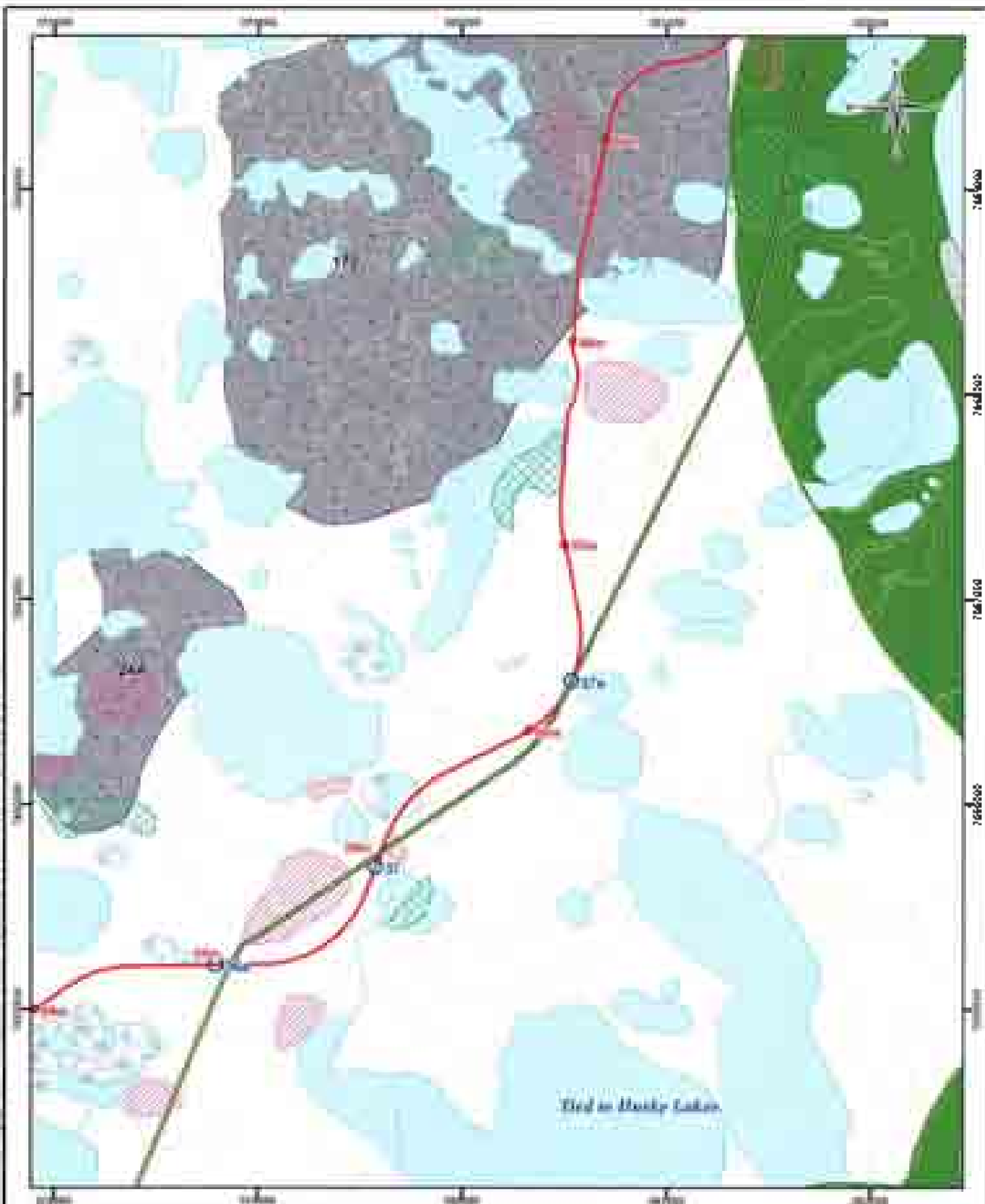
PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale: 1:25,000
UTM Zone 8
NAD83



Map 17



Legend

- Highway Boundary
- Proposed Highway
- Existing Road
- Other Approved Features
- Land Parcel
- 100m Buffer
- 100m Buffer

ISSUED FOR USE

- Boreas Source
- Archaeology Areas of Interest or Rich Regions
- Grizzly Bear Information Zone
- Fuel Oil Stop
- Husky Lakes
- 100m Buffer

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale: 1:25,000
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 METERS
 N
 File No: V23251098, MapBook #13, Jan/01, 2nd
 Product No: V24211596, Date: January 5, 2001

LTM Zone 8
 NAD83



Map 18



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

- Archaeological Area of Interest
- Wetlands
- Proposed Highway
- Proposed Highway
- Proposed Highway
- Proposed Highway
- Proposed Highway
- Proposed Highway

- Survey Station
- Archaeological Area of Interest
- Wetlands
- Proposed Highway
- Proposed Highway
- Proposed Highway
- Proposed Highway
- Proposed Highway

1:25,000 Map Book

Scale 1:25,000
1000 2 100 200 300 400 500

UTM Zone
48QUD

North Arrow

Map 18

Author: Department of Infrastructure
Revision: 10/2018 and January 2019



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale: 1:25,000

UTM Zone 18N, 60° 00' 00" N, 100° 00' 00" W

UTM Zone 18N, 60° 00' 00" N, 100° 00' 00" W

UTM Zone 18N, 60° 00' 00" N, 100° 00' 00" W

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UTM Zone 18N, 60° 00' 00" N, 100° 00' 00" W

UTM Zone 18N, 60° 00' 00" N, 100° 00' 00" W

UTM Zone 18N

UTM Zone 18N

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UTM Zone 18N

UTM Zone 18N

UTM Zone 18N

UTM Zone 18N

UTM Zone 18N

Map 20

Legend

UTM Zone 18N

UTM Zone 18N

UTM Zone 18N

UTM Zone 18N

UTM Zone 18N

UTM Zone 18N

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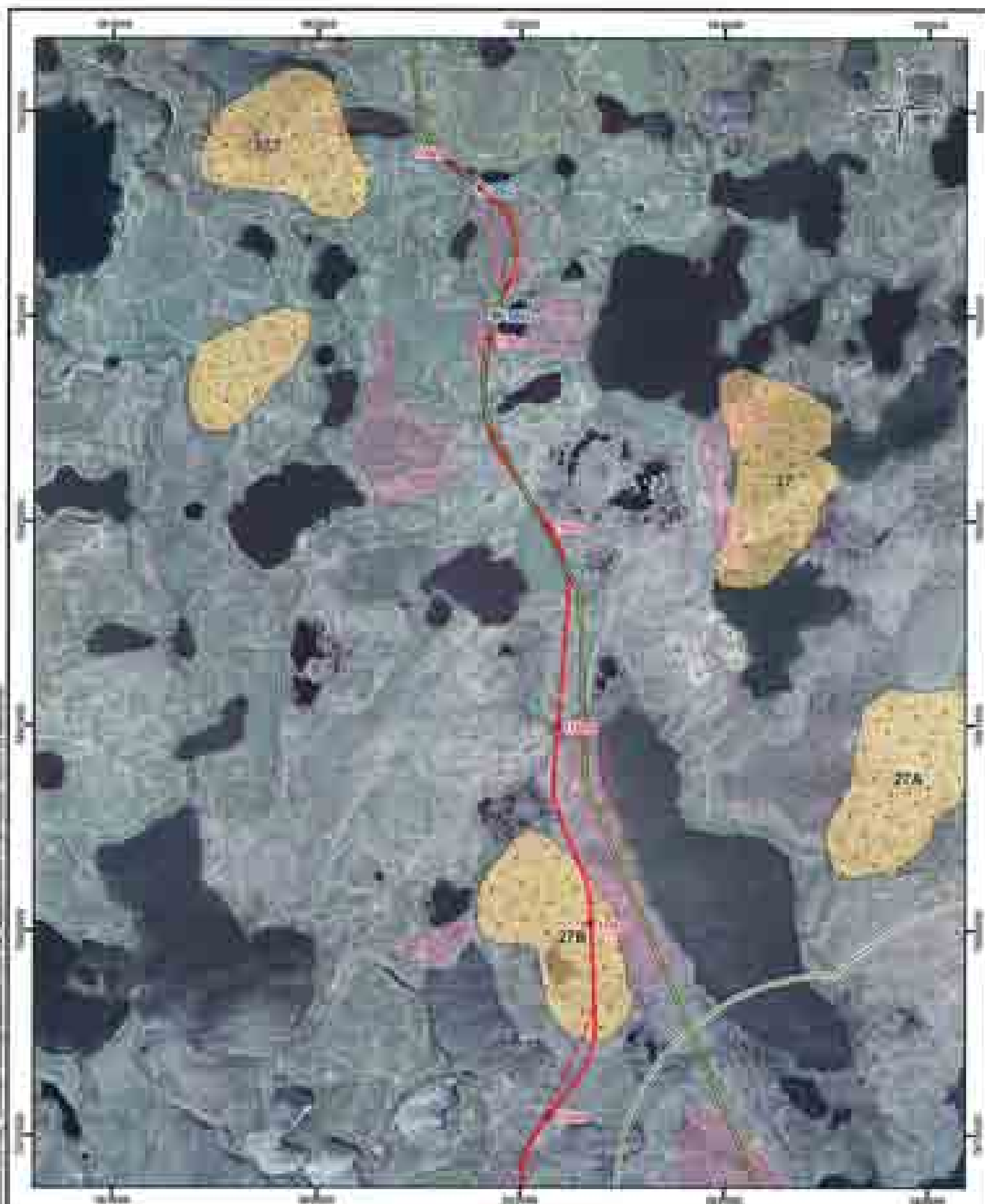
UTM Zone 18N

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UTM Zone 18N



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PROPOSED INUVIK-TUKTOYAKTUX HIGHWAY

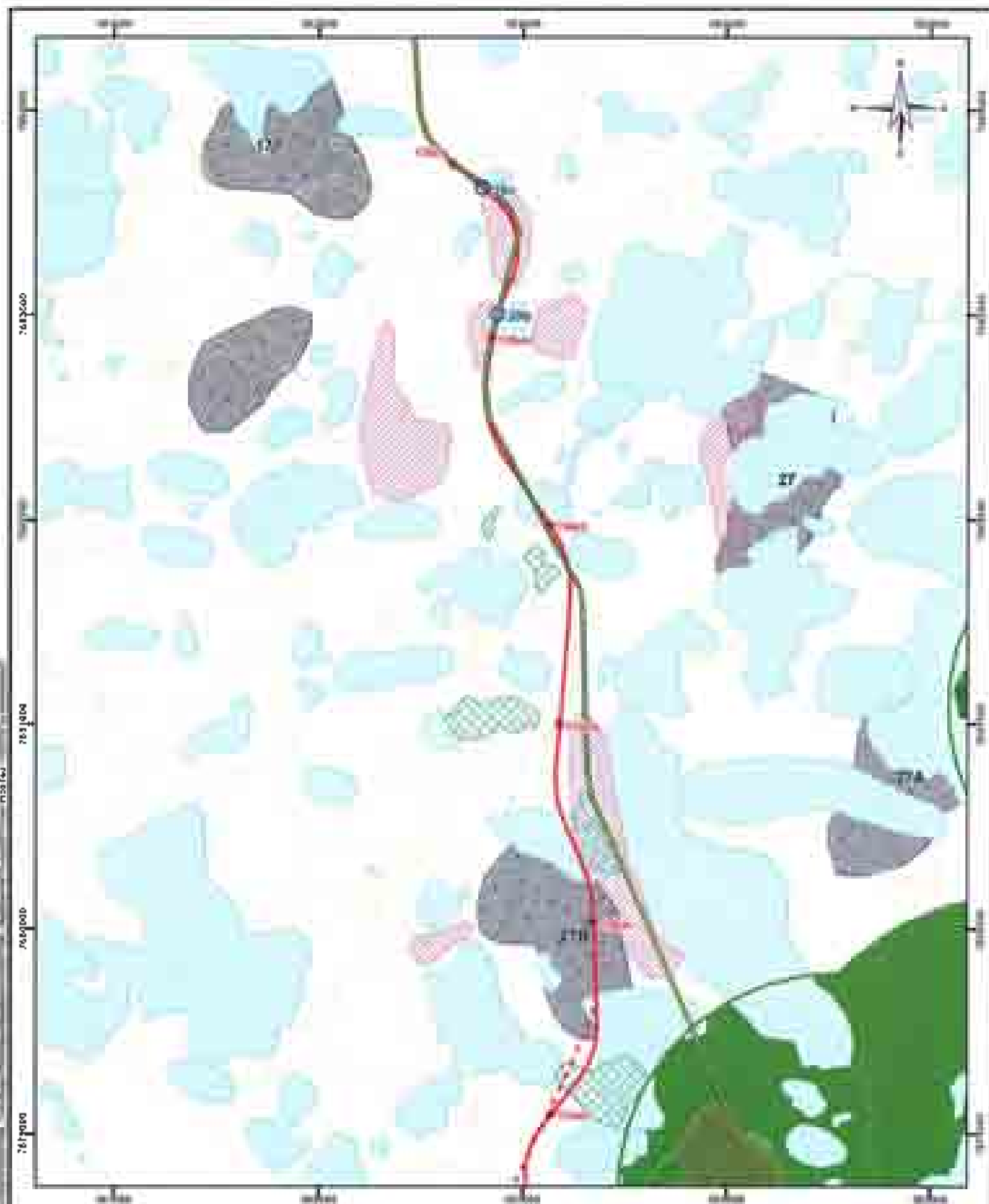
1:25,000 Map Book

1. **Introduction**
 2. **Background**
 3. **Methodology**
 4. **Results**
 5. **Conclusion**
 6. **References**

1999



Map 21



Legend

- Inuvik Airport
- Tuktoyaktuk Airport
- Inuvik City
- Tuktoyaktuk City
- Inuvik City - Proposed Area
- Tuktoyaktuk City - Proposed Area

- Inuvik City - Proposed Area
- Tuktoyaktuk City - Proposed Area
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- Tuktoyaktuk City - Proposed Area

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PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

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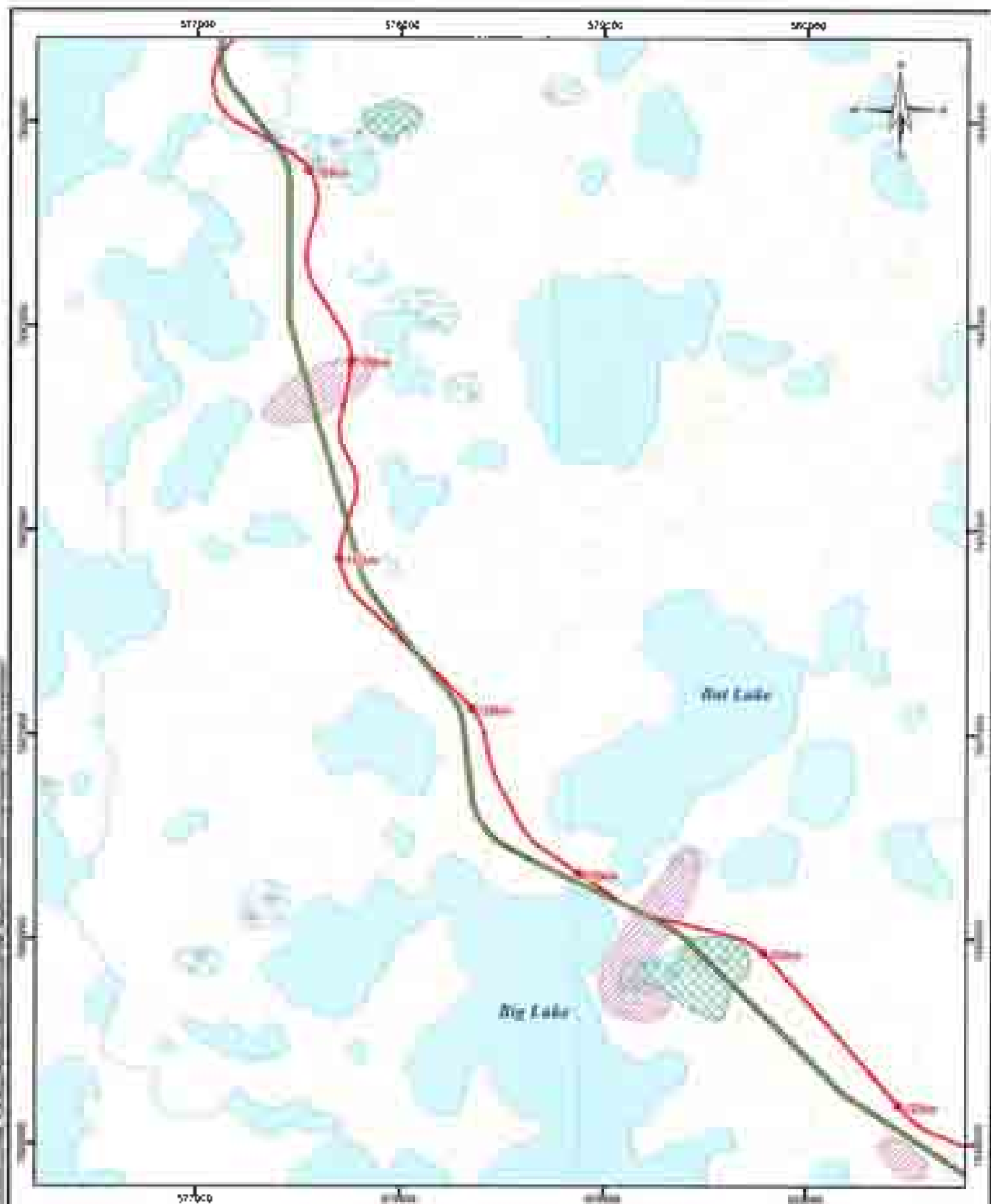
UTM Zone 8

HA081

Map No. 1/232/1098 MapBookNTS Jan 2010 rev

Project No. 1/232/1098 Date Issued: 4/2/10

Map 21



Legend

Gravel Road	Proposed Highway	Water Body	Airfield
Roadway Right-of-Way	Roadway Right-of-Way	Water Body	Airfield
Roadway Right-of-Way	Roadway Right-of-Way	Water Body	Airfield
Roadway Right-of-Way	Roadway Right-of-Way	Water Body	Airfield

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PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

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Scale 1:25,000
 1000 200 300 400 500
 UTM Zone 8
 NAD83
 File No. (2130) 298, MapBook-ITS-2010-01
 Project No. (2130) 098, Date: January 6, 2010



Map 23



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PROPOSED INUVIK-TUKTOYAPATUK HIGHWAY

Legend



Abstract



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100



1000



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Continue

23. Bottom: 30/10/11

At a party, Anna's brother



Non-Arch Polygons



Even Other Stop

1:25,000 Map Book

Score: 72.000

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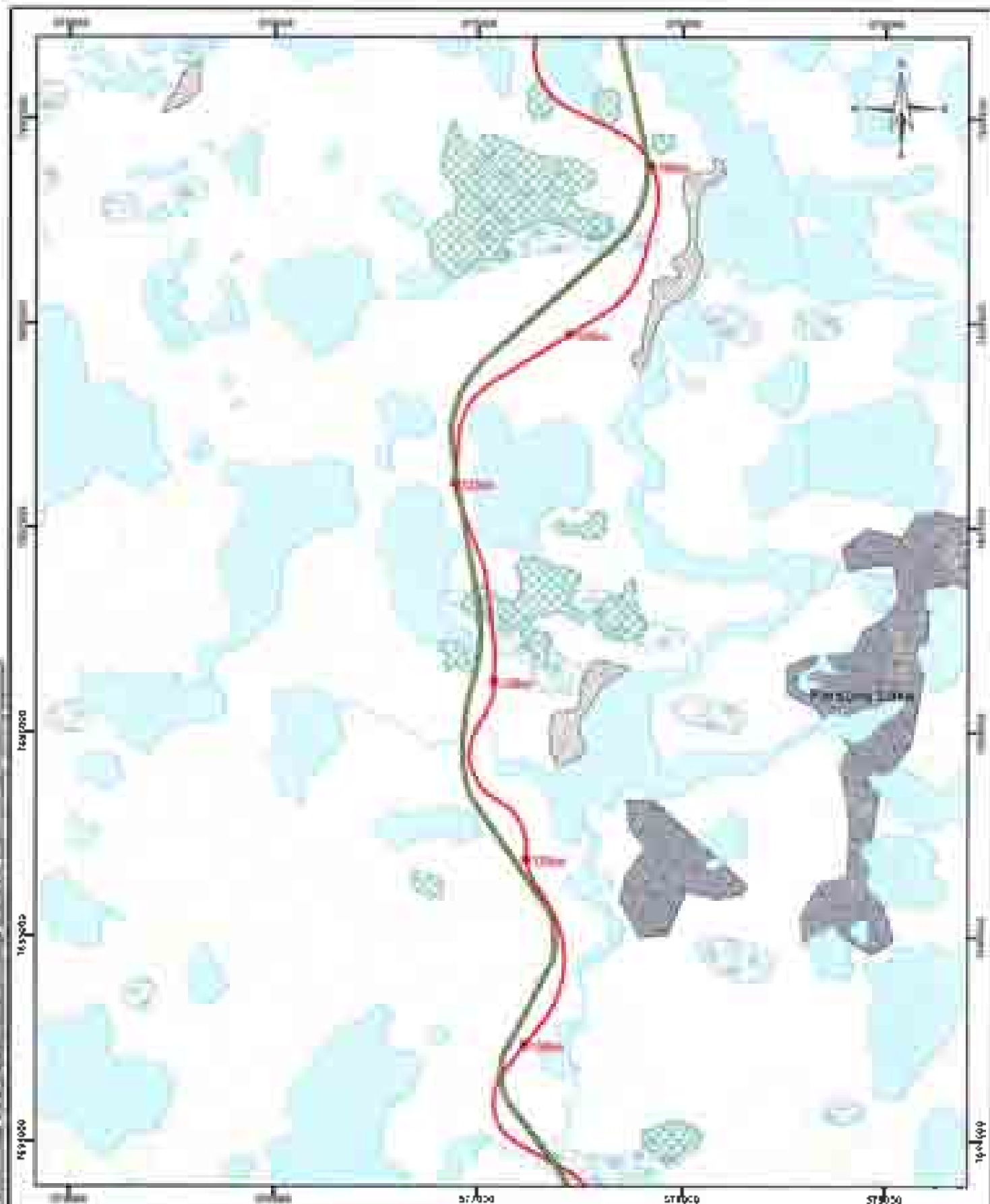
64581



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Page: 1234567890 Date: January 2015

Map 24



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

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UTM Zone 5
NAD83

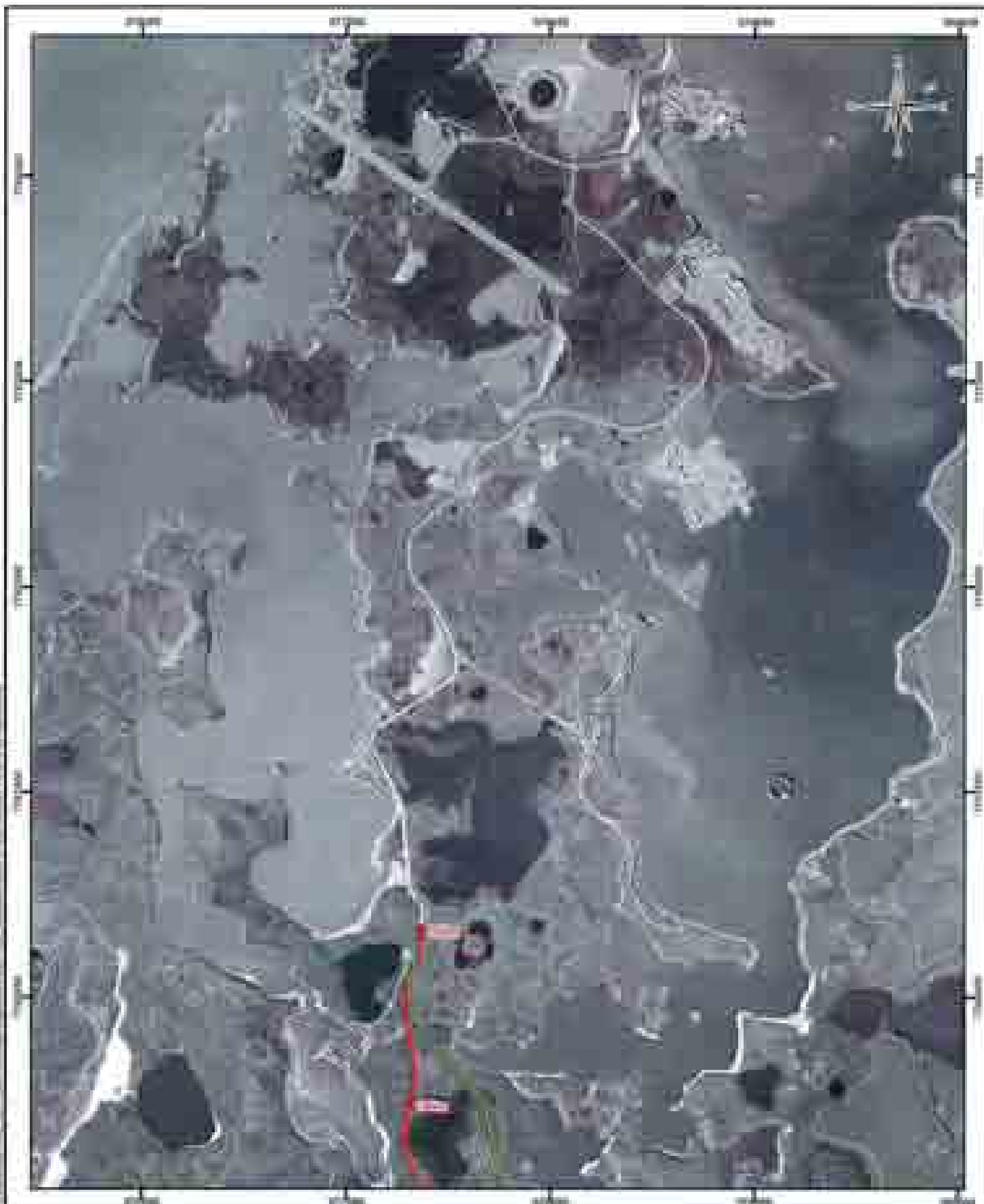


File No. V2320-298 MapBook-ITS-up 2010 rev
Revised No. V2320-298 Date January 6, 2013

Map 24

Legend

Inuvik	Tuktoyaktuk	Beaufort Sea	Proposed Highway
Existing Road	Other Significant Features	Waterways	Proposed Highway
Proposed Highway	Proposed Highway	Proposed Highway	Proposed Highway



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PROPOSED INUVIK-TUKTOYARTUK HIGHWAY

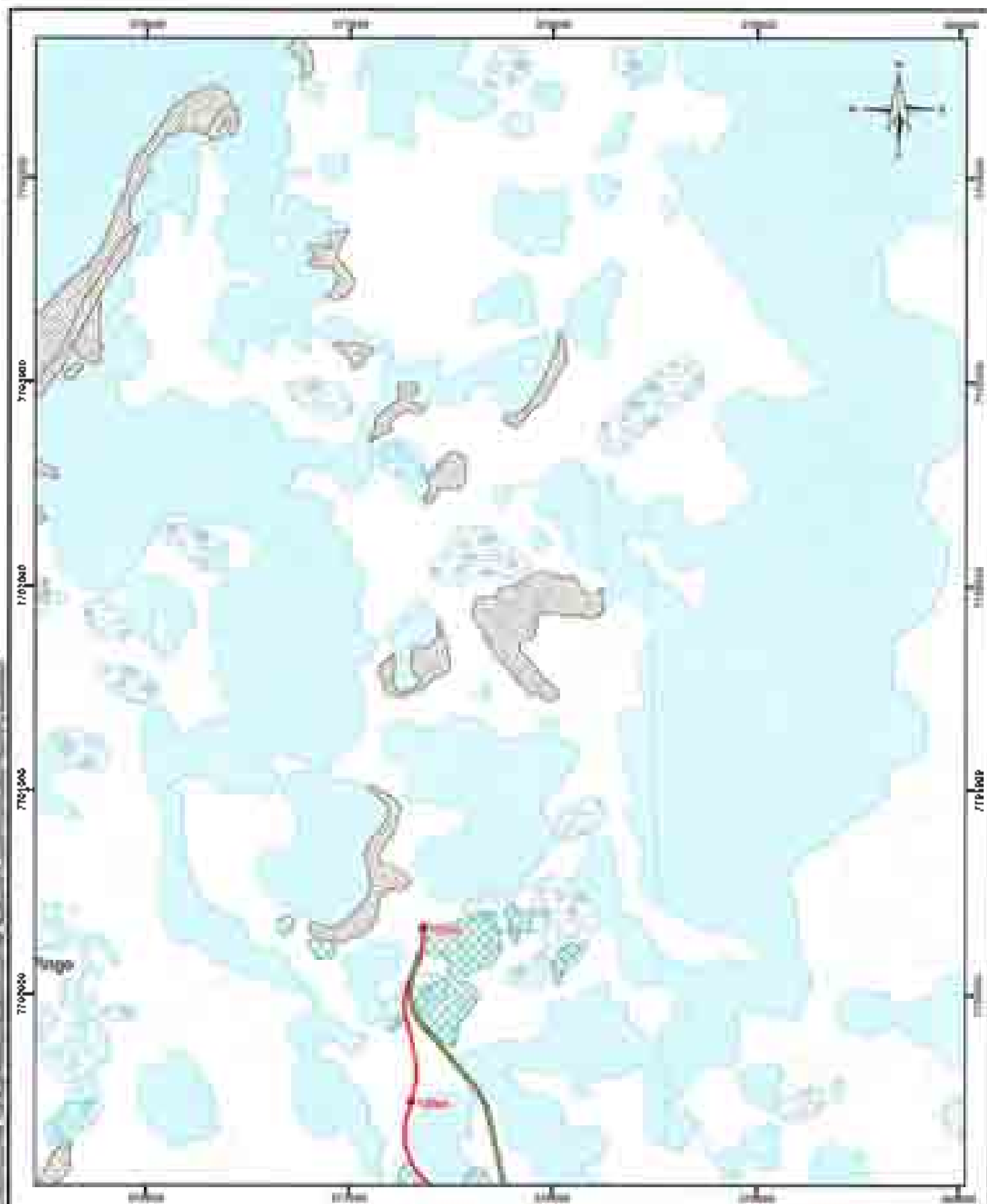
Legend

Grizzly Bear Den	Yellow Route	Black Line	Black Line
Blue Line	Other Alignments Considered	Archaeological Areas of Interest	Archaeological Areas of Interest
Green Line	Yellow Route	Grizzly Bear Mitigation Zone	Grizzly Bear Mitigation Zone
Navy Road	Road 107	Turn Over Site	Turn Over Site
		Heavy Lanes	Heavy Lanes
		100m Buffer	100m Buffer

1:25,000 Map Book

Scale 1:25,000
 0 100 200 300 400 500
 METERS
 UTM Zone 18
 NAD83
 File No: V23201098_MapBook.v23210.mxd
 Project No: V23201098 Date: January 6, 2010

Map 25



Legend

- Brown Line (Not)
- Blue Line (Not)
- Black Line (Not)

- Red Line (Not)
- Green Line (Not)
- Blue Line (Not)

- Black Line (Not)
- Blue Line (Not)
- Green Line (Not)

- Brown Line (Not)
- Blue Line (Not)
- Green Line (Not)

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PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

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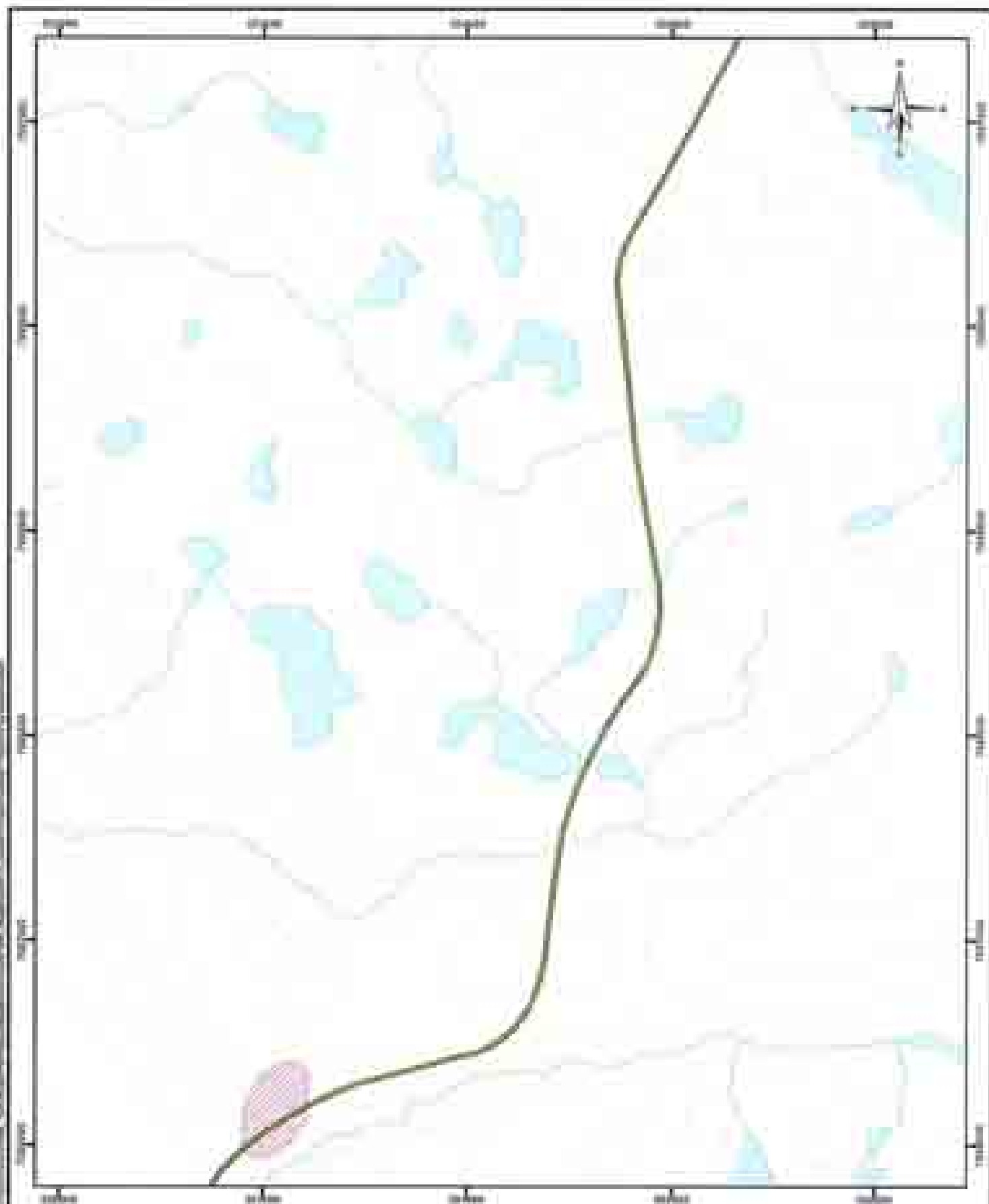
1000 0 100 200 300 400 500

UTM Zone 8
44001



File # 125001098_MapBook-NTS-2010.mxd
Metadata 125001098 Date January 2010

Map 25



Legend

- Inuvik-Tuktoyaktuk Highway
- Proposed Highway
- Proposed Bridge
- Wetland
- Wetland (Shaded)
- Wetland (Unshaded)
- Wetland (Shaded)
- Wetland (Unshaded)

- Grassy Bear Migration Zone
- Tundra Owl Site
- Husky Litter
- 100m Setback
- Grassy Bear Migration Zone
- Tundra Owl Site
- Husky Litter
- 100m Setback

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PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale: 1:25,000
UTM Zone 5
NAD83

14140 1/2020/098 MapBook-ITS-Jan2012.mxd
PROJECTNO 123201098 Date January 6, 2012



Map 27



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

Grizzly Bear Den	2005 Route	Borew Symbol
Gravel/Grass/Forest Road	Other Agreements Considered	Archaeology Areas of Interest
	Upward Route	Tundra Ponds
	PWC 1577	Grizzly Bear Mitigation Zone
	Navy Road	Terra Otter Strip
		Muddy Lakes
		100m Contour

1:25,000 Map Book

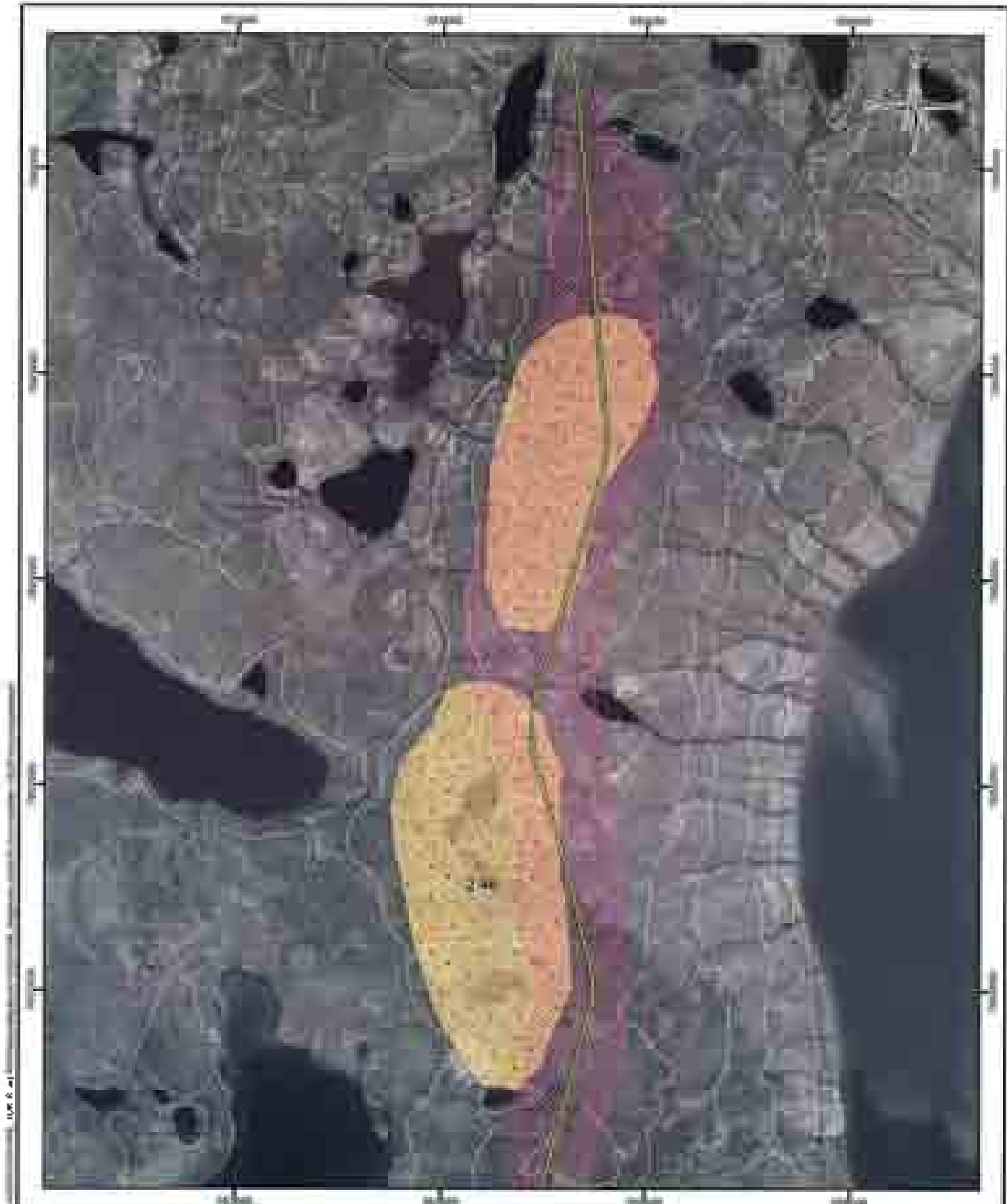
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UTM Zone 8
 NAD83



File No. 1/2-001098, Mapbook-July 2010 (red)
 Project No. 1/2-001098 Date: January 6, 2011

Map 29



1:25,000

ISSUED FOR USE

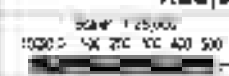
PROPOSED MUVIK-TUKTOYAKTUK HIGHWAY

Legend

- Grizzly Bear Den
- 10m
- Screen Crossing - Potential Bridge
- 2009 Route
- Other Alignment Considerations
- Upward Route
- Poly 1277
- Utility Road

- Consent:
- Benevo-Keeyuik
 - A. & B. Keeyuik
 - Ice Point Polyline
 - Grizzly Bear Liberation Zone
 - Twin Stop Sign
 - Mushy Lanes
 - 200m Settlement

1:25,000 Map Book

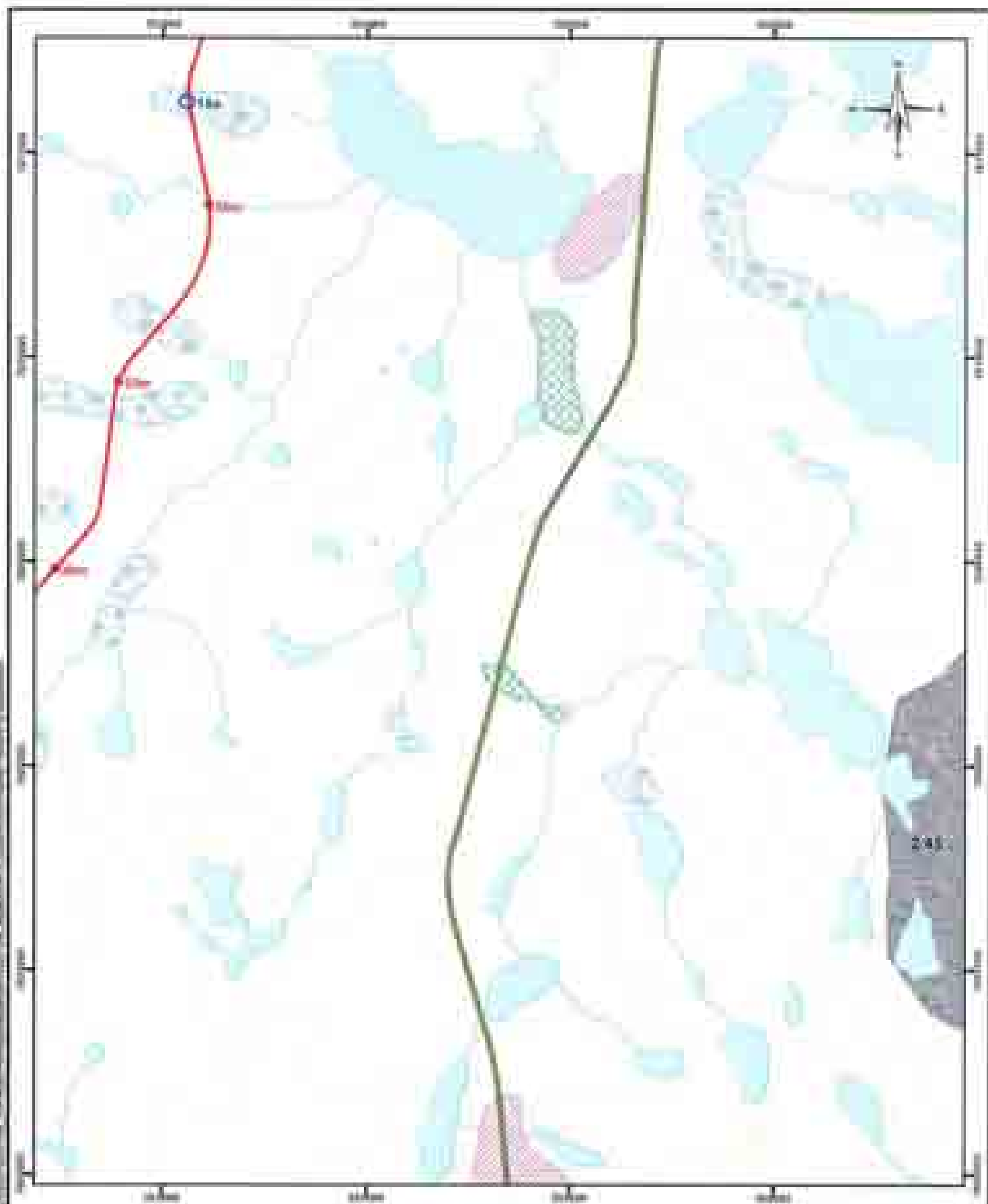


UTM Zone 8
NAD83



File No: 125001008 MapBook Jan 2015 map
Product No: 12501130 Date: January 6, 2015

Map 30



Legend

- Grizzly Bear Corridor
- Proposed Road
- Leland Road
- PWC 1077
- Heavy Road
- 2009 Route
- Other Alignments Considered

- Grassy Bear-Hemlock Zone
- Tern Deer Shed
- Tussock Lushes
- 100m Setback

- Bottle Source
- Archaeology Areas of Interest
- Yukon River Paleopolis

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PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale: 1:25,000
 100m 200 300 400 500
 100m 200 300 400 500

North Arrow
 100m 200 300 400 500



PROJECT NO. 102201038 DATE: January 6, 2010

Map 31



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

-  Cross or Road Den
-  Stream Crossing
-  Stream Crossing - Pump & Bridge
-  2009 Route
-  Other Rightmark Considered
-  US and route
-  RMC 1977
-  Ferry Route

-  Survey Station
-  Boundary Point of Interest
-  Boundary Point of Interest
-  Boundary Point of Interest

1:25,000 Map Book

Scale 1:25,000
1:500 10 200 400 600

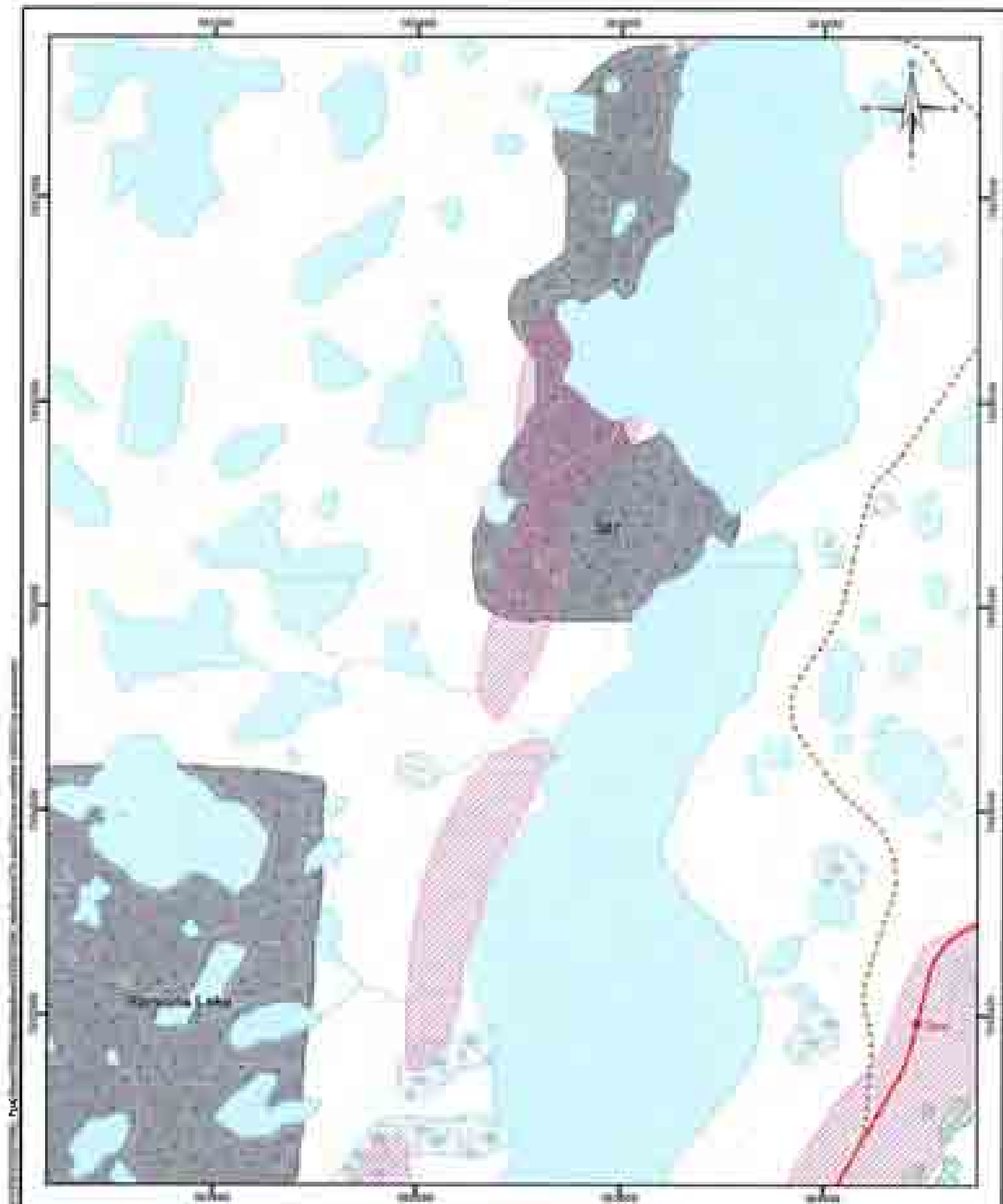
UTM Zone 8
NAD 83



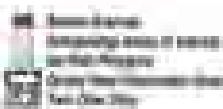
INUVIK TUKTOYAKTUK

INUVIK TUKTOYAKTUK Map Book 2010
Produced by INUVIK TUKTOYAKTUK, March 2010

Map 33



Legend



ISSUED FOR USE

PROPOSED MUŞ-TURKMEYAKTIK HIGHWAY

1:25,000 Map Book

Scale: 1:25,000

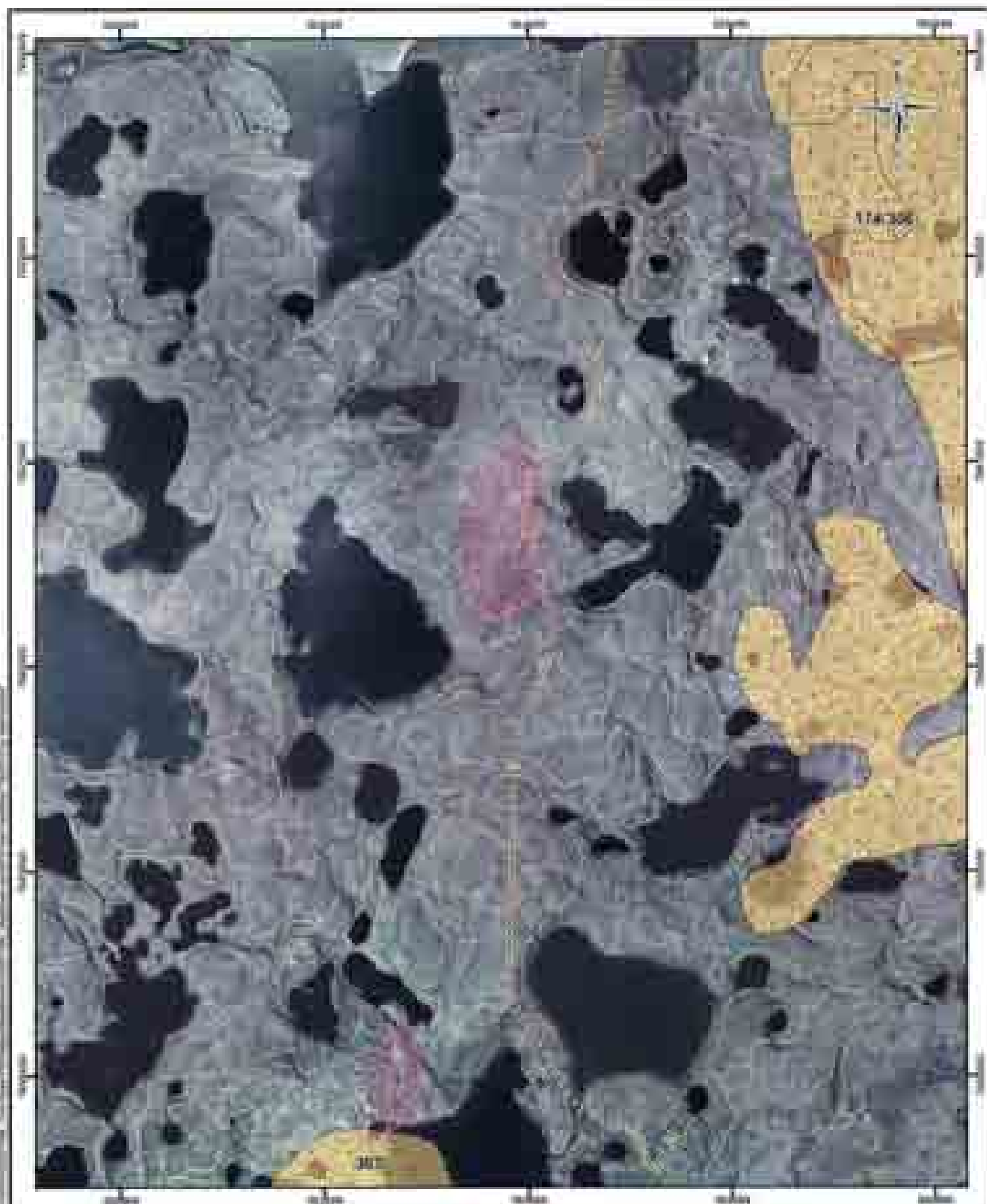
UTM Zone 5

14080

Map No: V23201098, MapBook: TB-2010-100
 Produced: V23201098 Date: January 6, 2010



Map 33



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

- Boundary Survey Point
- Boundary Survey Line
- Stream Crossing
- Powerline Bridge
- Road Bridge
- Main Road

- Barren Source
- Active Source
- Grizzly Bear Den/Rest Zone
- Tundra Zone
- Tundra Zone
- Tundra Zone

1:25,000 Map Book

Scale 1:25,000
UTM Zone 9
NAD83







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PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale 1:25,000
1000 200 300 400 500
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UTM Zone 18
NAD83

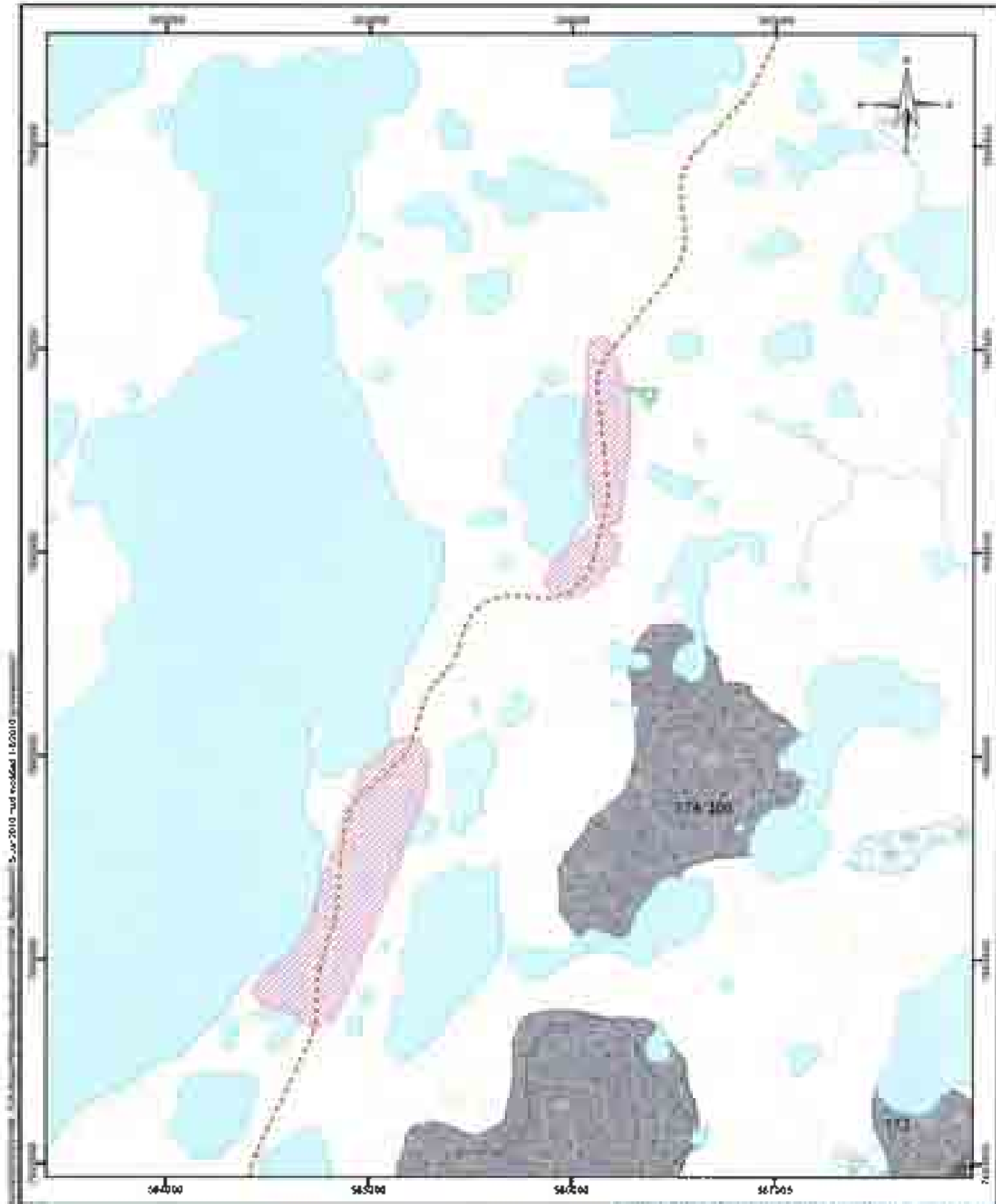


Legend

- Inuvik Airport
- Tuktoyaktuk Airport
- Proposed Road
- Existing Road
- Proposed Road
- Existing Road
- Proposed Road
- Existing Road

- Grizzly Bear Inter-Denominator Zone
- Grizzly Bear Inter-Denominator Zone
- Grizzly Bear Inter-Denominator Zone
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- Grizzly Bear Inter-Denominator Zone
- Grizzly Bear Inter-Denominator Zone
- Grizzly Bear Inter-Denominator Zone
- Grizzly Bear Inter-Denominator Zone

Map 35



Legend

Existing Road/Trail	Proposed Highway	Wetland	Proposed Highway Extension
Proposed Pipeline	Seasonal Road	Wetland	Proposed Pipeline
Proposed Pipeline	Seasonal Road	Water	Proposed Pipeline

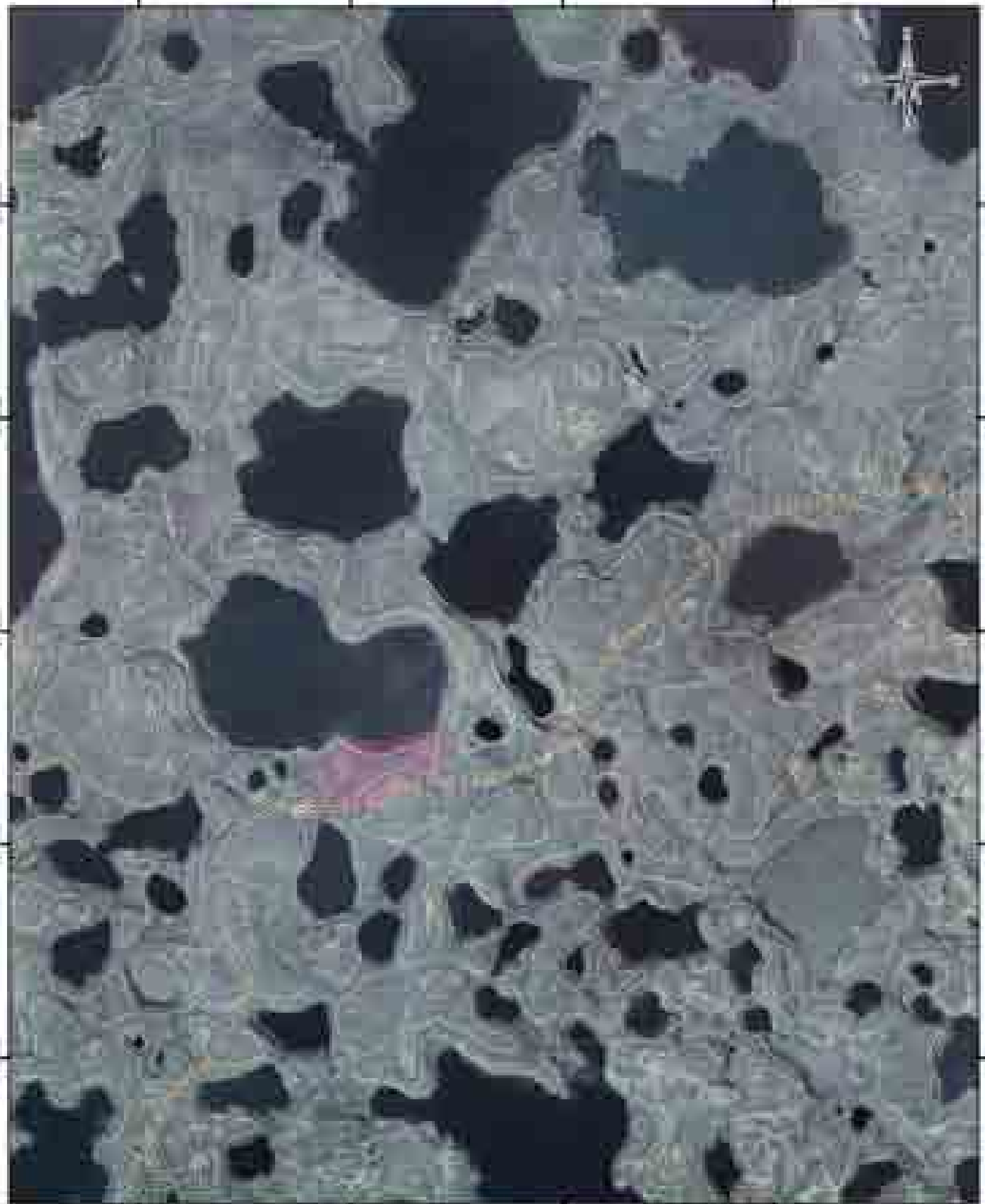
ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale 1:25,000
 UTM Zone 18N
 NAD83

PRJ NO: V21201056, MapBook-MTS-Ja-2010.mxd
 PROJECT NO: V21201056 DATE: January 6, 2010



ISSUED FOR USE

PROPOSED MUVIK-TURKOYARTUK HIGHWAY

Legend

- Village/hamlet
- Road/Highway
- Greenway / Forested Ridge
- Road Right
- Road Right (Continued)
- Road Right
- Road Right

- 200m Buffer Zone
- Archaeological Areas of Interest
- Old Road Polygons
- Greenway Buffer Zone
- Term Outer 50m
- Main Line
- 100m Buffer

1:25,000 Map Book

Scale 1:25,000
1000 200 300 400 500

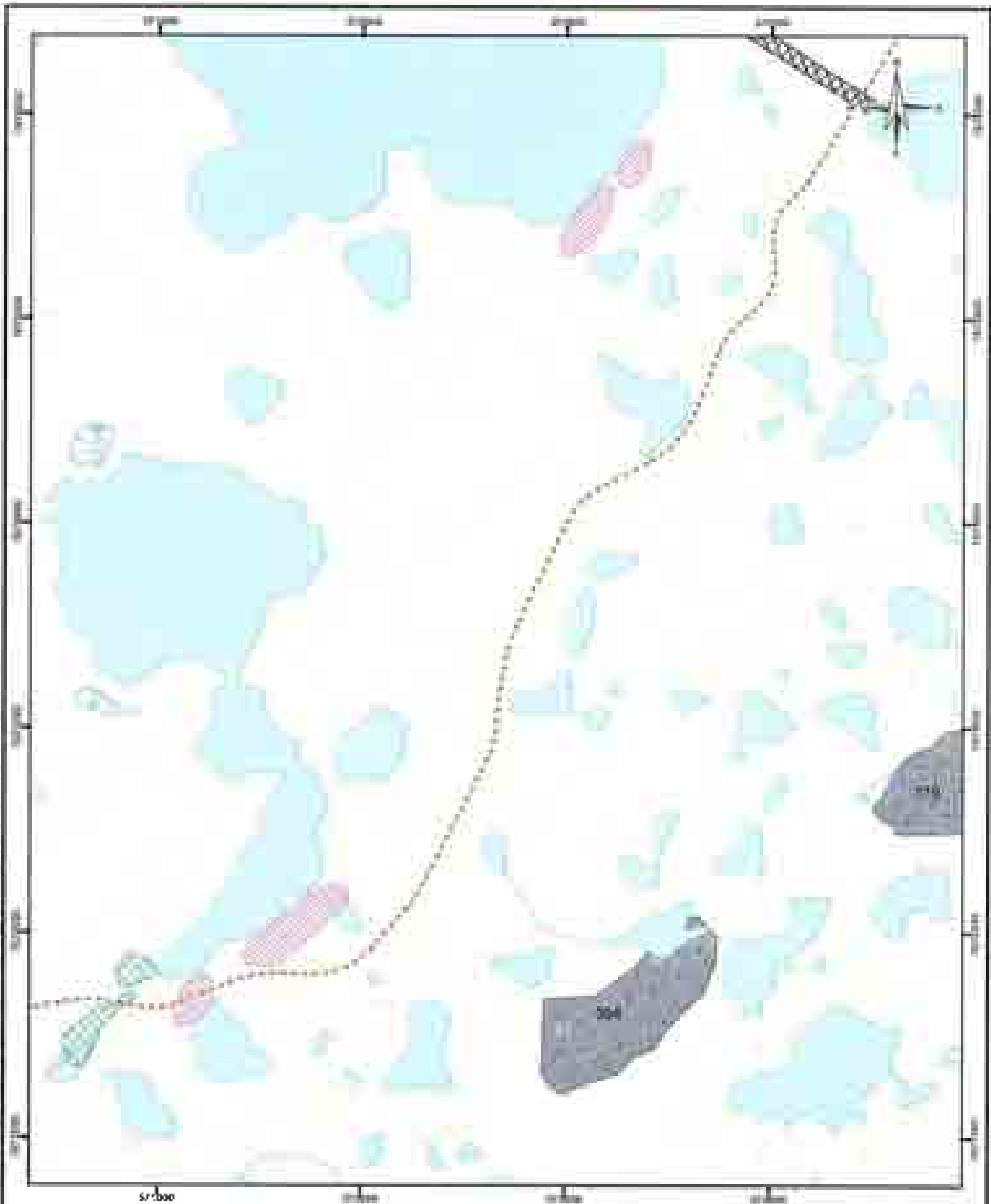
UTM Zone 8
NAD83



File No. V23211008 MapBook Jan2013.mxd
Project No. V23211008 2nd Jan. 2013 2:10

Map 36

As of 2010, the map is dated 1/2010 by Karaman-001



Legend

Solid line	Dashed line	Hatched area	Solid grey area
Dotted line	Cross-hatched area	Diagonal line	Stippled area
Thick solid line	Thick dashed line	Thick hatched area	Thick solid grey area

ISSUED FOR USE

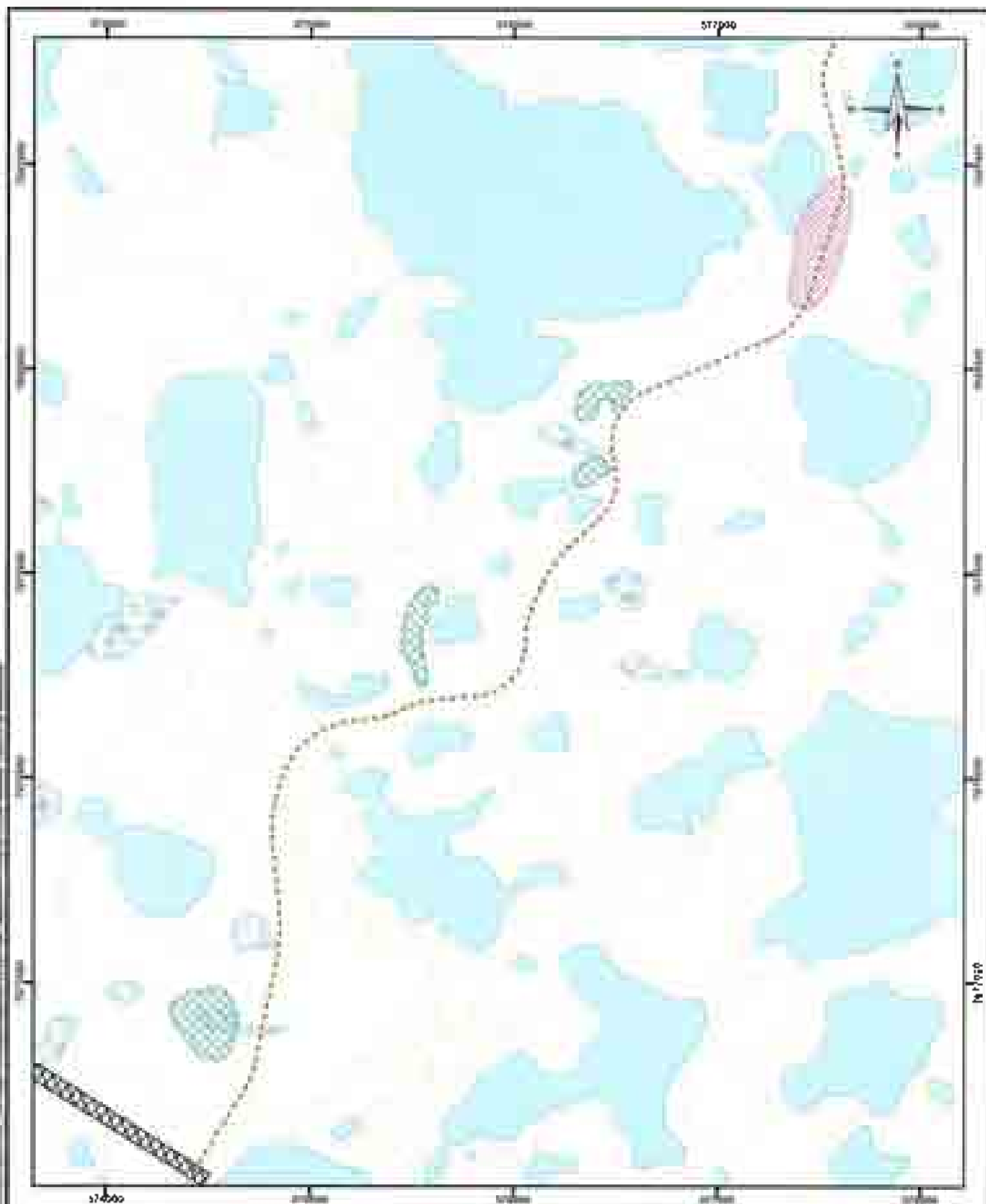
PROPOSED MUVIÇ-TÜRKÖYARTUK HIGHWAY

1:25,000 Map Book

Scale 1:25,000
UTM Zone 8
NAD83

File No: 1/2130-298_MapBook-17.5-Jan2010.mxd
Project No: 1/2130-298 Date: January 6, 2010

Map 37



Legend

- Existing Roadway
- Watercourse
- Other Regulatory Boundary
- Wetland
- FISC 50/50
- Road Right-of-Way

- Cultural
- Wetland
- Sand

- Borrow Source
- Archaeology Area of Interest
- Ice Road Polygon
- Grizzly Bear Habitation Zone
- Farm Other Strip
- Muddy Lake
- 100m Service

ISSUED FOR USE

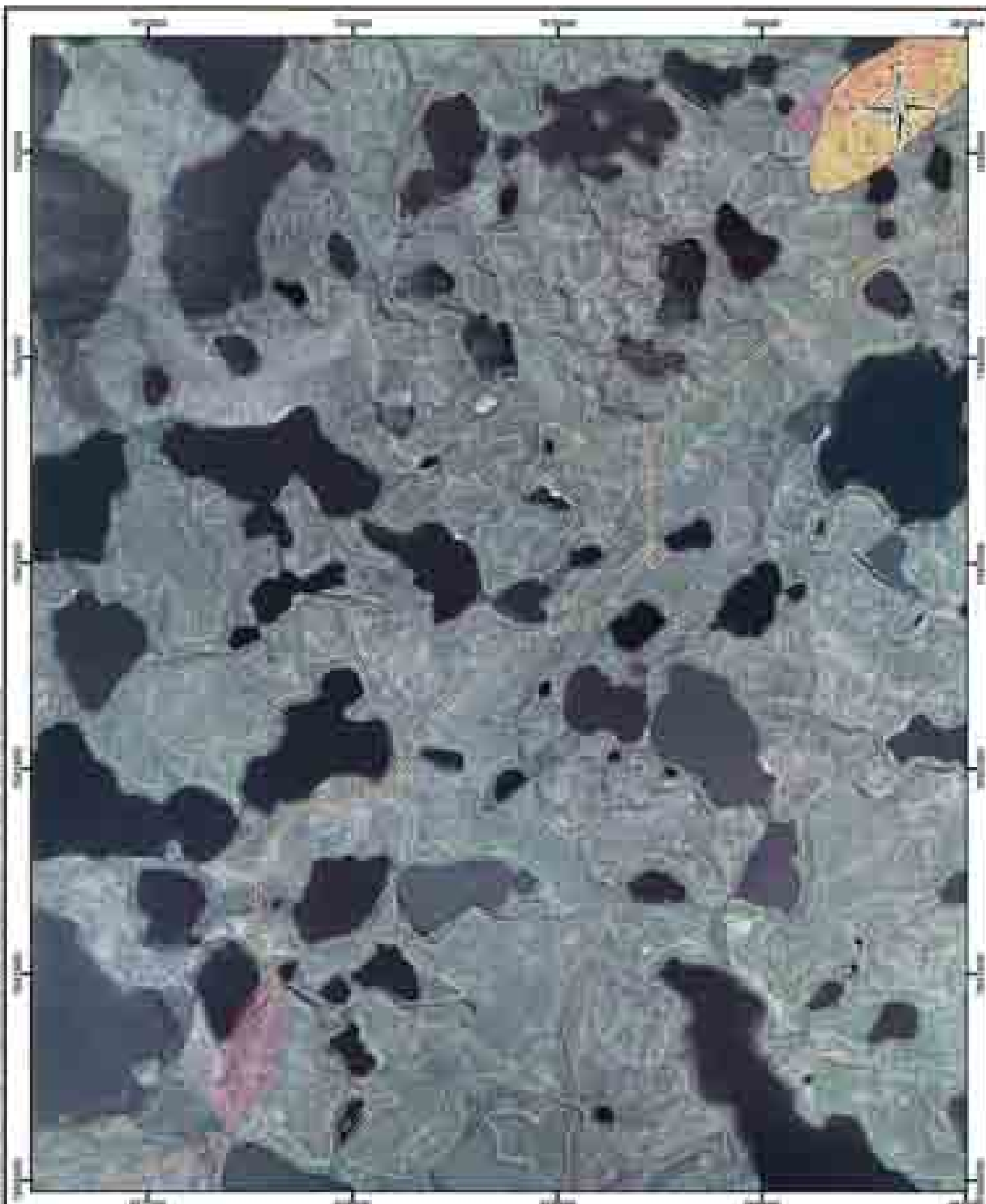
PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale 1:25,000
 UTM Zone 8
 NAD83
 File No: 152120-258_MapBook-NTS-2015.mxd
 Produced: 02/02/2016 Date: January 6, 2016



Map 38



ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

Grassy Bear Mobster Zone	100m Buffer
Grassy Bear Mobster Zone	100m Buffer
Grassy Bear Mobster Zone	100m Buffer
Grassy Bear Mobster Zone	100m Buffer

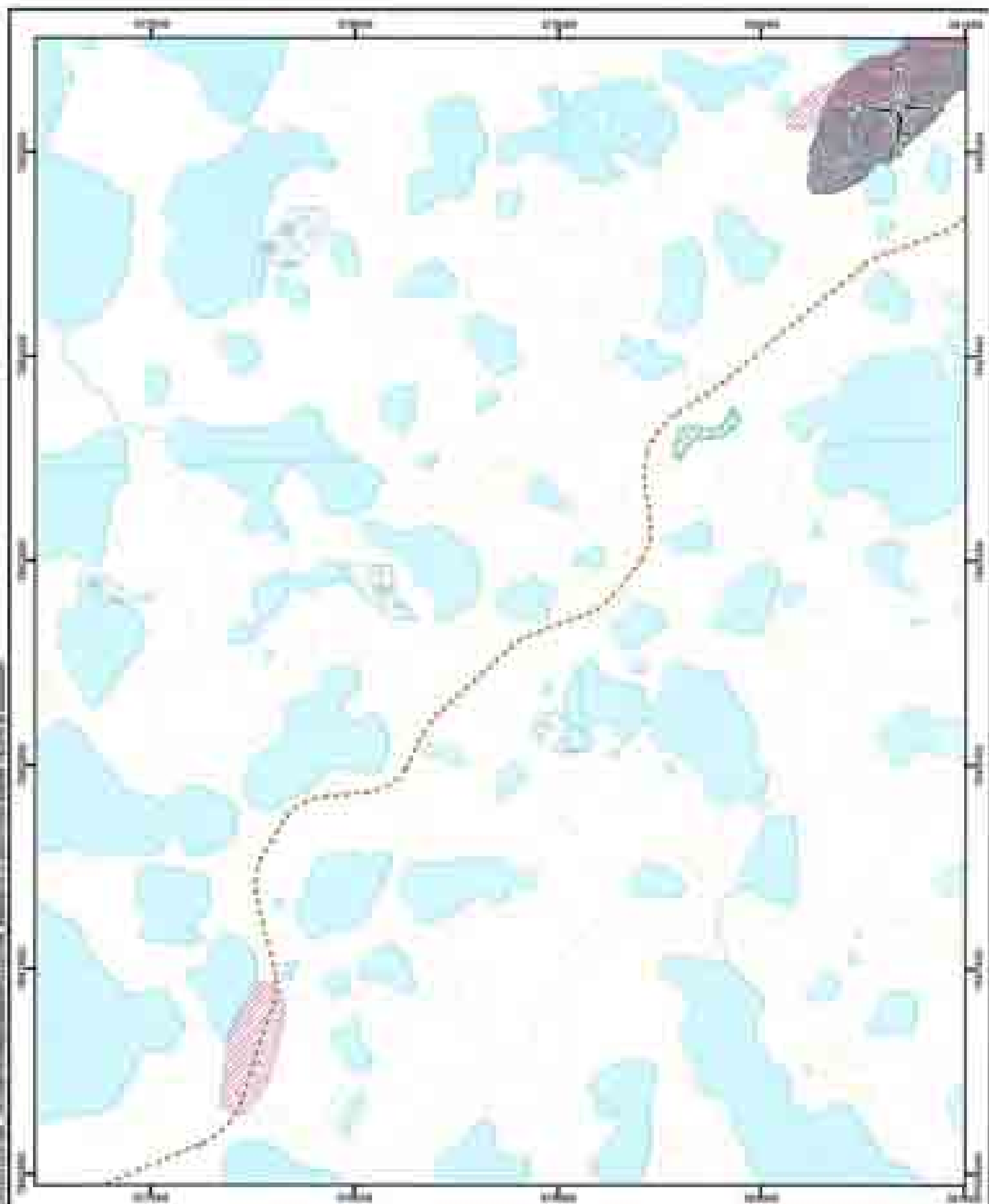
Grassy Bear Mobster Zone	Grassy Bear Mobster Zone
Grassy Bear Mobster Zone	Grassy Bear Mobster Zone
Grassy Bear Mobster Zone	Grassy Bear Mobster Zone
Grassy Bear Mobster Zone	Grassy Bear Mobster Zone

1:25,000 Map Book

Sheet 100,000
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INUVIK-TUKTOYAKTUK HIGHWAY
 PROJECT NO. 100,000-100,000-100,000-100,000
 REVISION 100,000-100,000-100,000-100,000





Legend

- Existing Road/Trail
- Proposed Road/Trail
- Crown Land
- Private Land
- 100m Buffer
- 100m Buffer
- 100m Buffer
- 100m Buffer

- Town
- Village
- Hamlet
- Settlement

ISSUED FOR USE

- Battle Sites
- Archaeological Areas of Interest
- Ice-Rush Polygons
- Grizzly Bear Information Zone
- Twin Otter Strip
- Husky Litter
- 1000m Suburb

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale: 1:25,000
1000 0 100 200 300 400 500

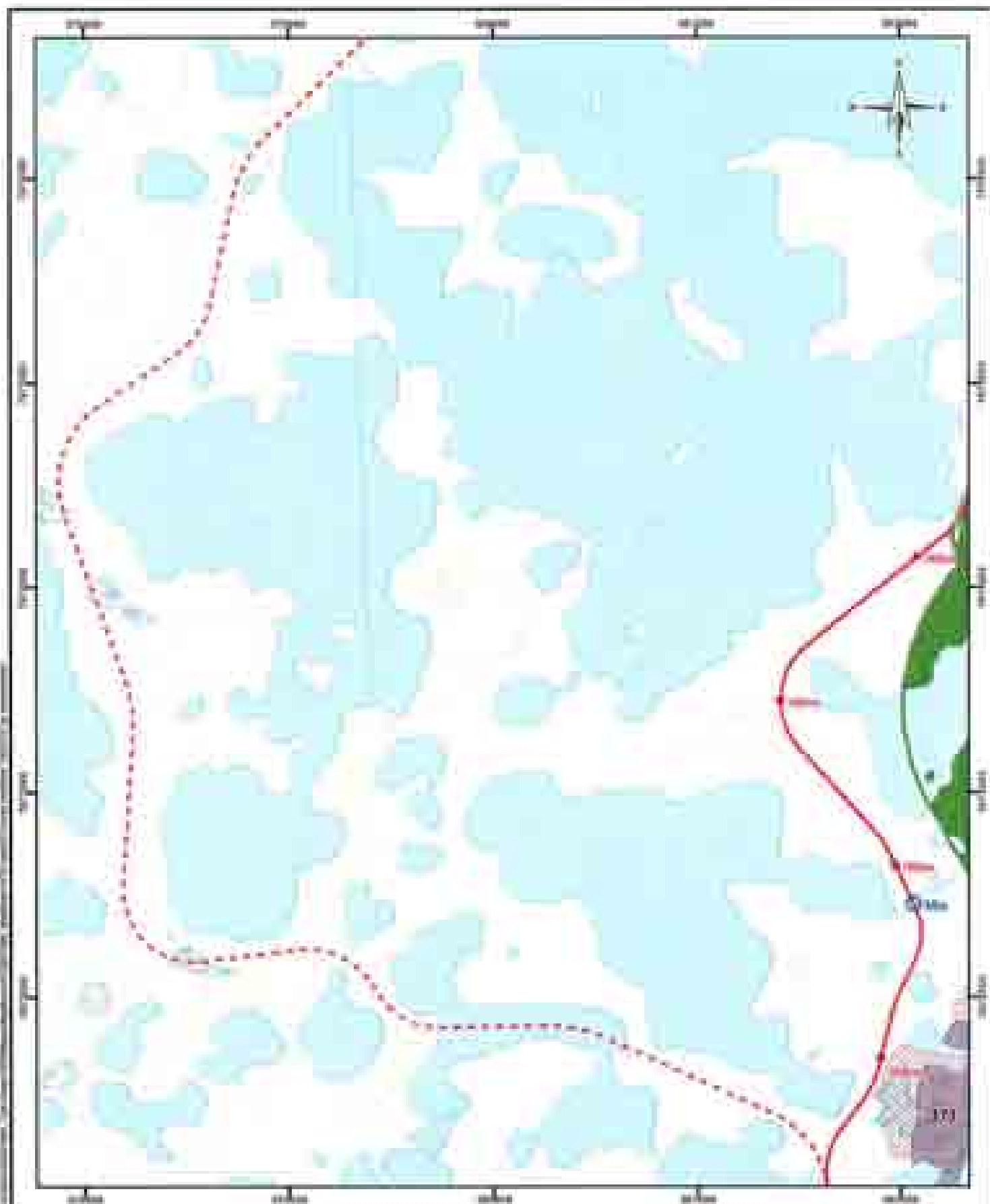
North Arrow

Map Book

Map 39

Project: Inuvik-Tuktoyaktuk Highway
Map Book: 1:25,000
Map 39
Map Book: 1:25,000
Map 39

Map 39



Legend

- Grizzly Bear Den
- Grizzly Bear Crossing
- Grizzly Crossing - Potential Bridge
- 2009 Route
- Other Alignments Considered
- Leeward Route
- PWC 1977
- Heavy Road

- Conduit
- Watercourse
- Waterbody
- Wetland
- Sand

- Borne Snags
- Archipelago Area of Interest
- Ice-Rip Regions
- Grizzly Bear Movement Zone
- Twin Otter Strip
- Husky Level
- 100m Seacast

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale 1:25,000

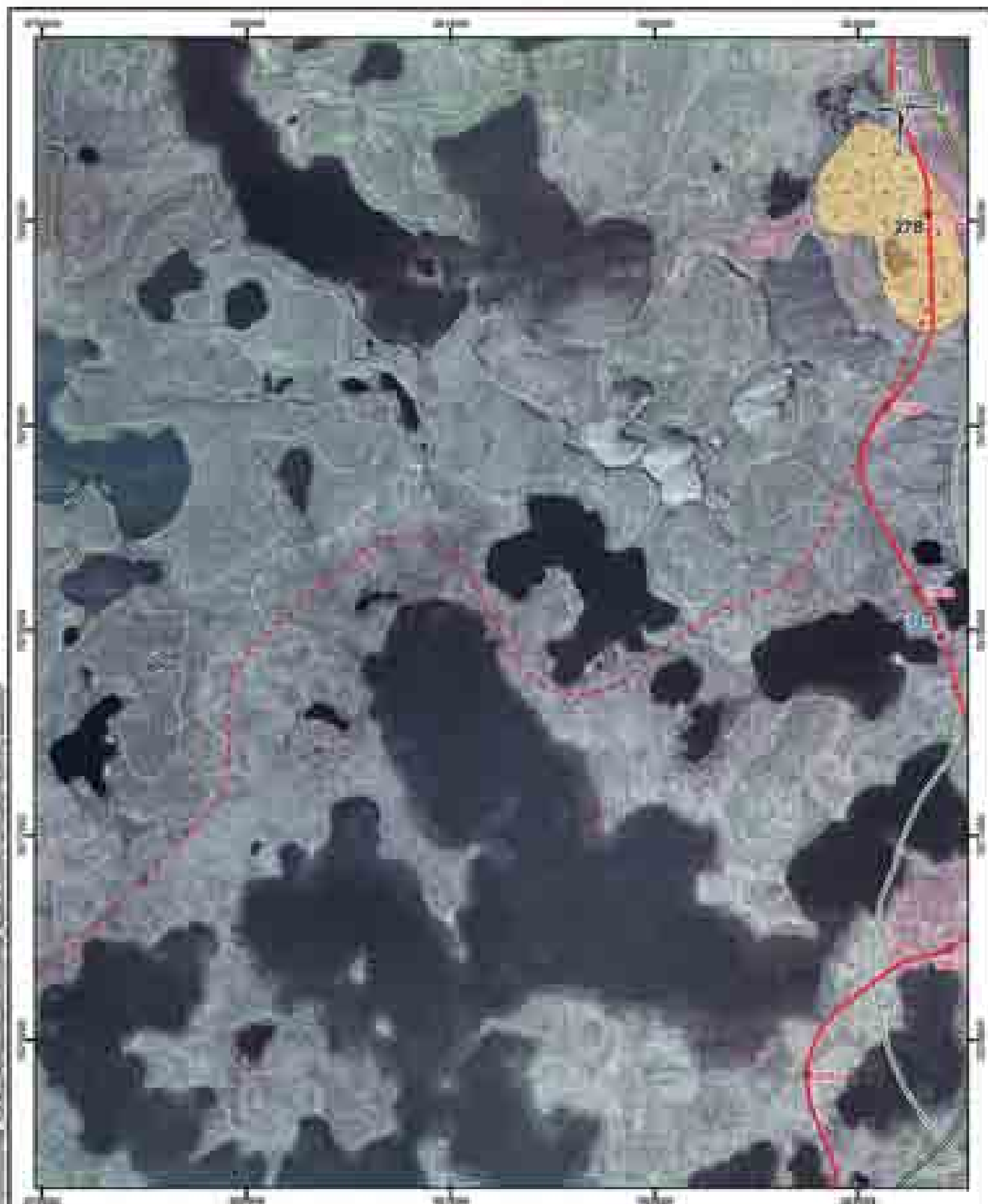
1000 0 100 200 300 400 500

UTM Zone 8
44Q93

FILE NO. V21201096 MapBook ATS Jan 2010 TMD
PROJECT NO. V21201096 DATE January 6, 2010



Map 40



ISSUED FOR CBE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Legend

- Bear Den
- Cratering
- Cratering - Potential Bridge
- 2009 Route
- Other Agreements Locations
- Johann Road
- RMT 1677
- Navy Road

- Contour 1:3
- Borehole Shallow
- Archaeology Areas of Interest
- Ice River Polygon
- Grizzly Bear Habitat Zone
- Freshwater Sink
- Mudflat Lagoon
- 100m Setback

1:25,000 Map Book

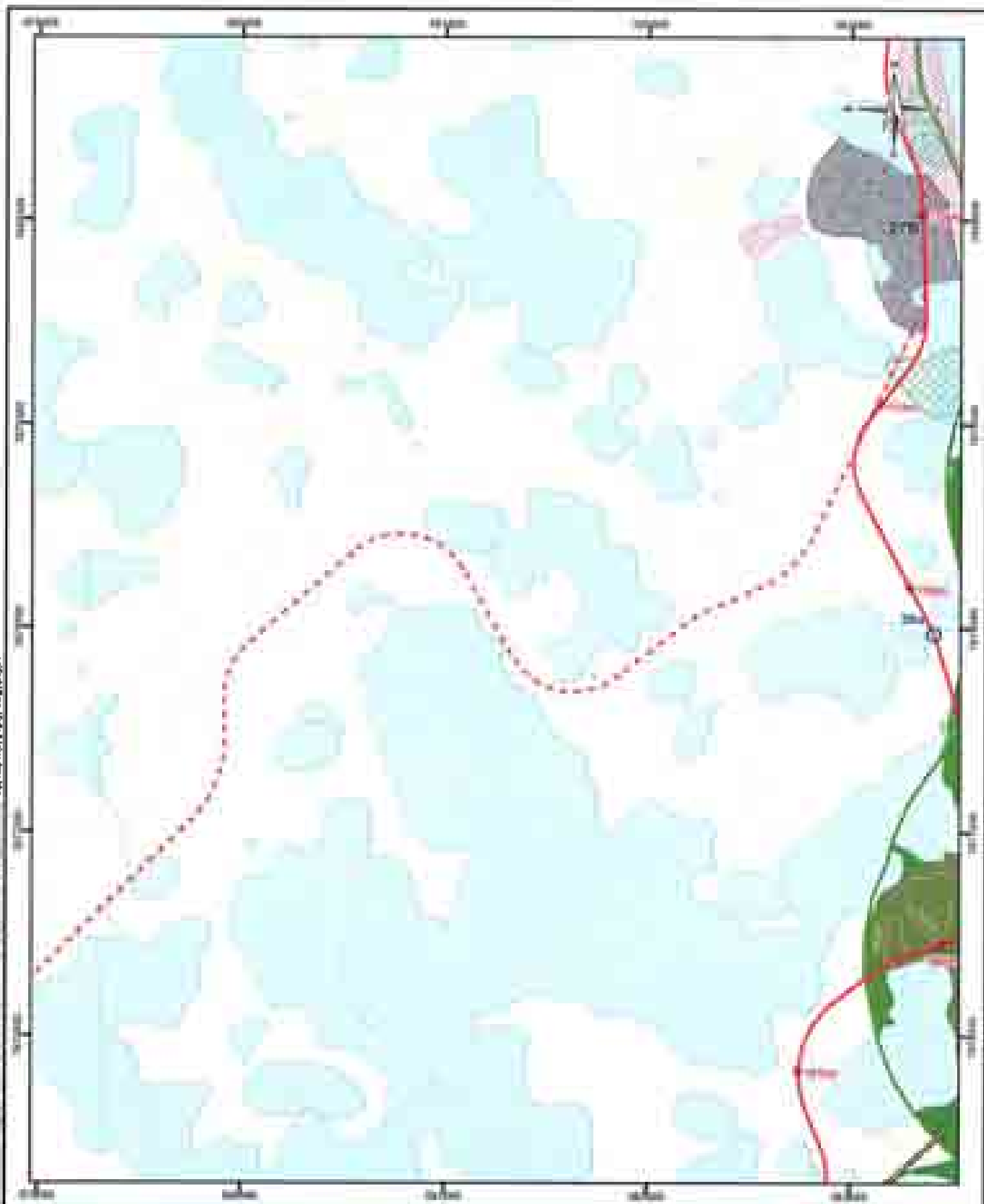
Scale 1:25,000
1000 0 100 200 300 400 500

North Arrow



Path: V:\2011\200 MapBook\ch2510.mxd
Project: V:\2011\200 ch2510.mxd
Date: January 6, 2011

Map 41



Legend

Existing Road	Proposed Highway	Waterway	Boundary
Waterway	Proposed Highway	Waterway	Boundary
Waterway	Proposed Highway	Waterway	Boundary
Waterway	Proposed Highway	Waterway	Boundary

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

1:25,000 Map Book

Scale 1:25,000
1000 200 300 400 500
UTM Zone 8
NAD83

Map 41 - 10/10/10
10/10/10 - 10/10/10
10/10/10 - 10/10/10

Map 41

APPENDIX C

APPENDIX C TYPICAL SPILL CONTINGENCY AND EMERGENCY RESPONSE PLAN

E. GRUBEN'S TRANSPORT LTD.



OIL POLLUTION EMERGENCY PLAN (OPEP)

Prepared By:
E. GRUBEN'S TRANSPORT LTD.
For the Oil Handling Facility

AT

TUKTOYAKTUK, NORTHWEST TERRITORIES

Located at:
Longitude: 133 01' 55' W
Latitude: 69 27' 15"N

Revised August 1, 2004

E. GRUBEN'S TRANSPORT LTD.



OIL POLLUTION EMERGENCY PLAN – Tuktoyaktuk

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E. GRUBEN'S TRANSPORT LTD.



1.0 PURPOSE

E. Gruben's Transport Ltd. Petroleum Products (EGTPP) was created in February 1999 to provide fuel sales, dispensing and delivery services in the community of Tuktoyaktuk. EGTPP's mandate is to purchase, transport, store, distribute and sell refined petroleum products to residents and private industry in a safe, economic, efficient and reliable manner.

Amendments to the Canada Shipping Act (CSA) now requires owners of the Oil Handling Facility (OHF's) to be prepared to respond to water-borne Oil Pollution Incidents (OPI's) during the loading and/or off-loading of bulk petroleum-based products. EGTPP is a privately owned corporation that is required to comply with CSA standards. EGTPP owns and operates 2 OHF's that is subject to the CSA. EGTPP will comply as part of its overall commitment to environmental responsibility.

The CSA requires that all OHF's have an Oil Pollution Emergency Plan (OPEP) in place that documents how it will respond, contain and recover a water-borne OPI up to a maximum of 1,000 litres. The Canadian Coast Guard (CCG) is the lead Federal Government agency responsible for regulating compliance under the CSA and is mandated to be the first level responder to all OPI's in excess of 1,000 litres, in the Arctic waters. CCG's Arctic Response Strategy outlines its role and methodology for carrying out its mandate.

This OPEP includes plans to respond to both water-borne and land-based OPI's. In all likelihood, any OPI for which EGTPP will have ultimate authority to respond will occur on land. However, given the close proximity of EGTPP's OHF's to water, the probability of a land-based OPI impacting a marine environment is reasonably sufficient to warrant both response regimes.

It is important to note the nature of the contractual agreement the EGTPP has in place for the supply and delivery of petroleum-based products. EGTPP has contracts with the Government of the Northwest Territories (GNWT) and the Beaufort Oilfield Support Services Ltd. (BOSS) for either supply or delivery of such petroleum products. BOSS uses a tug and barge configuration to deliver the fuel supply to the community of Tuktoyaktuk. The barges are generally 120 to 150 feet in length and each barge is capable of carrying 300,000 to 500,000 litres of fuel. Pumps onboard the barge and four-inch floating hose, owned by BOSS, are used to discharge the fuel from the cargo hold to EGTPP's shore connection. The discharge rate at Tuktoyaktuk averages about 50,000 litres per hour.

EGT purchases the fuel in Hay River, NT. This means that EGT is the owner of the petroleum products once the fuel is delivered into the BOSS barges in Hay River. Delivery in the context of the agreement means the physical transfer of bulk petroleum products from IOL or its agent or agents in Hay River into BOSS barges. Therefore, in strict contractual terms, if an OPI were to occur while the fuel was in transit or being discharged at a community, then EGT would be the "polluter of record". As operator of the OHF, EGTPP would be fully involved in responding to the OPI.

E. GRUBEN'S TRANSPORT LTD.



2.0 DECLARATION

Pursuant to the relevant provisions of the CSA, I, Russell Newmark, CEO of E. Gruben's Transport Ltd., located in the Hamlet of Tuktoyaktuk, Northwest Territories, declare:

That the E. Gruben's Transport Ltd. Petroleum Products will report and respond to the OPI's, where it has the jurisdiction to do so, in accordance with this OPEP when the OPI occurs as a result of unloading bulk petroleum-based products from a marine vessel.

The persons listed below are hereby authorized to implement this OPEP:

1. **Mr. Russell Newmark, Vice-President, CEO**
E.Gruben's Transport Ltd.
P.O.Box 177
Tuktoyaktuk, NT X0E 1C0

Phone: (867) 977-7000 Fax: (867) 977-7040

Email Address: rnewmark@egrubens.com

2. **Mr. Willie Moore, Operations Manager**
E. Gruben's Transport Ltd.
P. O. Box 177
Tuktoyaktuk, NT X0E 1C0

Phone: (867) 977-7000 Fax: (867) 977-7040

Email Address: willie@egrubens.com

3. **Mr. Merven Gruben, General Manager**
E. Gruben's Transport Ltd. Petroleum Products
P.O. Box 177
Tuktoyaktuk, NT X0E 1C0

Phone: (867) 977-7000 Fax: (867) 977-7040

Email Address: mgruben@egrubens.com

A handwritten signature in dark ink, appearing to read 'Russell Newmark', is written over a faint, circular, textured background.

Russell Newmark

9/22/04

Date

E. GRUBEN'S TRANSPORT LTD.



3.0 OIL POLLUTION EMERGENCY PLAN MAINTENANCE AND CONTROL

The individual responsible for maintaining, updating and controlling the distribution of this OPEP and any amendments made thereto is:

Mr. Russell Newmark, CEO
E. Gruben's Transport Ltd.
P.O. Box 177
Tuktoyaktuk, NT X0E 1C0

Phone: (867) 977-7000 Fax: (867) 977-7040
Email Address: rnewmark@egrubens.com

This OPEP will be reviewed:

- 1) Annually, on or before June 1st in each bulk fuel re-supply season.
- 2) As changes to marine shipping and environmental legislation come into effect.
- 3) During any on-site training and exercise.
- 4) After each and every OPI.

Changes to phone numbers and names of those individuals identified in this OPEP will be made on an as and when required basis and distributed to all those organizations and/or individuals who have a copy of this OPEP.

4.0 OIL POLLUTION EMERGENCY PLAN AND OTHER EMERGENCY RESPONSE ORGANIZATIONS

EGTPP recognizes that there are other organizations in the community of Tuktoyaktuk that have plans in place for dealing with emergencies and will need to be aware of and to a certain extent, involved in the implementation of this OPEP, in the event of an OPI. These organizations include:

- 1) Incorporated Hamlet of Tuktoyaktuk
- 2) Tuktoyaktuk Fire Department
- 3) Tuktoyaktuk RCMP
- 4) Resources Wildlife and Economic Development (RWED)
- 5) Tuktoyaktuk Health Centre

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5.0 SITE SPECIFICATIONS

The Community of Tuktoyaktuk is located at 133 degrees longitude and 69 degrees latitude. The community is on a peninsula that is approximately 1300 m long 90 to 424 meters wide and between 1.5 and 8 meters above sea level.

Tuktoyaktuk receives an average of 7.2 centimetres of rainfall and 65 centimetres of snowfall per year. The mean high temperature for July is 15.2 degrees Celsius and the mean low temperature for July is 6.0 degrees Celsius. Winds are generally from the northwest and average 17.4 kilometres per hour.

6.0 TUKTOYAKTUK OIL HANDLING FACILITY

The OHF is located south of the residential area of the community. The tank farm at the Tuk Canmar site contains a total of 10 tanks for holding three types of petroleum products. The sea-hose connection is currently in the design stage as well as the pipeline system for the tank farm at the Tuk Canmar site.

7.0 ENVIRONMENTALLY SENSITIVE AREAS

The shoreline is continually threatened by erosion due to subsistence from natural melting of ground ice and from regional geological subsistence. Vegetation is salt tolerant on the shoreline. The shoreline is part of an important bird habitat area since the migrant species feed on fish, insects, insect larvae and worms.

Sensitive wildlife in the immediate area of Tuktoyaktuk are whales, seals, fish, polar bears, and waterfowl that could be impacted by a large spill. Whales are hunted during the month of July and into the first two weeks of August. There is also domestic fishery in the Tuktoyaktuk Harbour and the residents usually set up their annual spring and summer hunting and fishing camps along the coastline.

8.0 PROBABLE OIL POLLUTION INCIDENT (OPI) SCENARIOS:

1. An OPI during fuel off-loading within the secondary containment structure of the OHF would be confined within the Tank Farm. The probable cause would be due to human error in allowing a storage tank to be filled to over-capacity. OPI would need to be cleaned-up but it would be contained and pose little immediate threat to human life or to the natural environment.
2. An OPI may also occur as a result of a pipeline failure. The pipeline at Tuktoyaktuk are 4" in diameter. The discharge rate average is 40,000 litres per hour or 666 litres per minute.

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It is highly important that a pipeline could rupture during a discharge. However, in the event of a rupture and depending on where it occurred along the length of the pipeline, the damage could be substantial. For example, if the pipeline broke apart at or near the junction where it enters the OHF, back pressure from the storage tank would allow the release of fuel until a Discharge Officer was able to close the valve to the tank. Fuel in the pipeline would continue to be released until the Pumpman on the barge was able to shut off the pump. Fuel would continue to seep from the pipeline until the pressure inside the line was equalized. The fuel would flow down gradient towards the shore. Because the re-supply is to be continually monitored, the discharge agent would immediately radio to the Pumpman to cease pumping fuel. As much as 660 litres could be discharged into the natural environment as a result.

If the pipelined ruptures at or near the shore manifold, fuel would continue to be released until the pump on the barge was shut off. The entire contents of the pipeline would be emptied and backpressure from the storage tanks would continue to release fuel until the Discharge Officer was able to close the valve to the tank. Between 500 and 1,000 litres could be discharged onto the beach and directly into the Tuktoyaktuk Harbour.

3. BOSS deploys about 100 metres of 4" floating hose to affect the discharge from the barge to the shore manifold. BOSS tests and certifies its hose every year up to a maximum pumping pressure of 150 pounds per square inch. The discharge rate at Tuktoyaktuk is approximately 40 pounds per square inch. It is highly unlikely that the hose would rupture. However, if the hose were to break at its midpoint then fuel would continue to be discharged until the pump was turned off and the contents of the hose would be released into the water. This scenario would produce an OPI of about 1,400 litres.

9.0 OIL POLLUTION INCIDENT (OPI) RESPONSE

There are three (3) activities that must be taken when an OPI occurs. First, there must be a Response, followed by Containment, followed by Recovery. An OPI may be as easy to deal with as noticing a valve leaking, putting down some absorbent material and disposing of the used material in a responsible fashion. This is a very simple scenario but there has been a response, an effort to contain and recovery of the OPI. There are intermediary steps within each of the activities and they are identified below. The sequence of the steps is extremely important and should be followed. However, each OPI will have its own unique characteristics and the sequence may need to be altered to suit the circumstances. Common sense should prevail.

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RESPONDING:

STEP 1 – IDENTIFY THE SOURCE OF THE OPI

- Locate the source of the OPI.
- Contact the BOSS barge by radio and notify that you have an OPI and request that the pumps be shut off.
- Assess the immediate hazards of the OPI.
- If it is safe and within your capability to do so, shut off the source of the OPI.

STEP 2 – SECURE THE AREA

- Assess OPI area and eliminate all sources of ignition.
- Keep the public away from the OPI.
- Determine the direction of the OPI, how quickly it is migrating and what is causing it to migrate (wind, gravity).
- Determine if human life is in danger and alert the RCMP, the Health Centre, the Volunteer Fire Department and the local Renewable Resource Officer.

STEP 3 – INITIATE THE CONTAINMENT OF THE OPI

- Deploy the on-site spill containment equipment as required.
- Notify BOSS of the OPI and request assistance if required.
- Erect barriers to minimize the migrating of the OPI.
- Notify E. Gruben's Transport Ltd. Facilities manager if heavy equipment is required.
- If the OPI can not be contained with the resources available in Tuktoyaktuk then contact the General Manager, Petroleum Products Division at (867) 977-7000 and request assistance.

STEP 4 – REPORTING THE OPI

- When the source of the OPI has been shut down and it is reasonably contained, it must be reported to the NWT Spill Line.
- NWT Spill Report forms are included in the Appendices to the OPEP.

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- Fill out the NWT Spill Report as completely as possible and fax it immediately to **(867) 873-6924**. If a fax machine is not available then you **must** still complete the NWT Spill Report and telephone the NWT Spill Line at **(867) 920-8130** to report the OPI. You can call the NWT Spill Line collect but you **must** tell the Operator that you wish to report an OPI.
- You will be required to report to the NWT Spill Line until the OPI has been recovered. Depending on the severity of the OPI this may take days, weeks or even months.

RECOVERING:

STEP 5 – IMPLEMENT OPI RECOVERY

- Ensure that the OPI has been adequately contained before starting recovery procedures.
- Depending on the characteristics of the OPI, containment and recovery may be done simultaneously.
- If required, set up a decontamination site so that individuals involved with the containment/recovery operation don't spread the OPI beyond its contained limits.
- Assess which recovery method is most suitable and/or efficient for the circumstances, taking into account the amount of fuel to be recovered, where the OPI occurred and the anticipated danger to human life and the natural environment.

10.0 OIL POLLUTION INCIDENT (OPI) CONTAINMENT AND RECOVERY PROCEDURES SCENARIOS

This scenario would only apply to diesel fuel and Jet A-1. Gasoline is a highly volatile liquid and to contain it within a boomed area on the water would endanger the lives of those who are responding to the OPI. The response to a water based gasoline OPI would be to immediately shut off the source of the spill and to clean up with the use of sorbent pads. The goals of responding to water based diesel fuel and Jet A-1 is to minimize the impact on the environment. Accordingly, the approach will be to contain and recover the spill from the area where it is most likely to accumulate. In Tuktoyaktuk, this would be the area bounded by the barge, shore and the booms placed by BOSS.

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10.1 BOOMS

Booms are used to deflect or divert fuel to a defined area so it can be contained and then recovered. BOSS will have deployed booms as part of their spill readiness provisions. It would be redundant for EGTPP to deploy booms in the same place.

RECOVERY

The goal of recovering the spilled fuel is to ensure that as much as possible is recovered as soon as possible therefore minimizing the impact on the environment.

1. DIRECT SUCTION TECHNIQUES

The direct suction technique will be utilized as part of the initial response to the OPI. The community sewage truck will be utilized. A skimmer will be connected to the truck and extraction of the fuel floating on the water will take place. With a tank capacity of about 10,000 litres, in all likelihood, all of the spilled fuel can be recovered. The valves on the truck can be employed to serve as a water/fuel separation function.

2. TRANSFER TO PORTABLE TANK

Once the spilled fuel has been recovered, it can be transferred to a portable storage tank for additional fuel/water separation purposes. If the OPI was of such a magnitude that not all of the spilled fuel could be contained in the sewage truck, then the truck can discharge its first load into the portable tank and return to the scene for a second time.

3. TRANSFER TO EMPTY DRUMS

Once the spilled fuel has been transferred to the portable tank, the fuel has been contained and recovered. However, there still needs to be a final disposition. Accordingly, the containment fuel can be transferred to empty drums for temporary storage. The drums can then be loaded on the barge and sent via Tuktoyaktuk and can be incinerated.

4. USE OF ABSORBENT MATERIAL

Absorbents are materials that soak up fuel either by absorption or adsorption. They are commonly used for final clean-up and recovery of small amounts of fuel. They are effective in recovering thin layers of fuel. In Tuktoyaktuk, sorbent pads will be used for soaking up the residue on the water left behind by the skimmer. Sorbents will also be used for final clean-up in the portable storage tank. The saturated sorbent pads will be placed in open drums. When a drum is full, it will be closed up and sent to Tuktoyaktuk for final disposition.

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11.0 OIL POLLUTION INCIDENT (OPI) PREVENTION AND PREPAREDNESS

It may not be possible to prevent every OPI from occurring but there are several actions that can be taken to prepare for an OPI and to prevent it from having a major impact on human life and the natural environment. Therefore, the following actions will be performed so that the highest level of preparedness is attained:

- At least one member of the Discharge Team have certification under the Supervisor of Oil Transfer Operations (SOTO) course.
- All members of the Discharge Team be trained in OPI containment and recovery operations.
- All members of the Discharge Team be trained in OPI containment and recovery operations.
- The OHF to be inspected by members of the Discharge Team prior to the discharge proceeding, including familiarization with the tankage, valving and re-supply connection.
- All members of the Discharge Team be familiar with the on-site OPI equipment, how to deploy it and use it effectively and efficiently.
- The OPI equipment be located where it is readily accessible and that the boom be deployed in the water around the discharge vessel prior to the discharge commencing.
- Notifying the community based Emergency Response Organizations that the discharge has commenced and request that they “stand-by” if required.

12.0 COMPLIANCE TRAINING AND EXERCISES

The success of any OPI response depends on adequately trained personnel. The level of training has to be tailored to the functions to be performed and the skill levels of the individual.

Basic Marine Oil Spill Response Training is directed towards all members of the Discharge Team and provides training in fundamental OPI containment and response, including basic health and safety size and specifications of the OHF, the proximity of additional OPI resources and equipment and the environmental sensitivities associated with the site. For Tuktoyaktuk, the Discharge Team will be provided a comprehensive BMOSR course, supplemented by refresher training provided every second year.

Training in the areas of Media Relations, Liability Identification will be provided to the individuals who are responsible for implementing this OPEP. At Tuktoyaktuk they are Russell Newmark, Willie Moore and Mervyn Gruben.

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Exercises are equally important to the success of any OPI recovery. The purpose of the Exercise is to reinforce training through hands-on deployment and use of the Discharge Officers to respond to an OPI with the available equipment and identify areas for additional training. They also create an atmosphere to test the effectiveness of this OPEP. Exercises may consist of a tabletop exercise or an operational one. The tabletop version would involve writing up an OPI scenario and going through the OPEP to determine its effectiveness. The operational Exercise would involve the actual deployment and testing of the response equipment under a hypothetical OPI scenario. It is recommended that a tabletop Exercise be conducted annually. Operational Exercises should be conducted every three years in conjunction with CCG.

12.1 TRAINING

E. Gruben's Transport Ltd. recognizes the value of establishing Training Programs in order to provide higher levels of safety in the workplace, higher levels of personnel competence and confidence, opportunities for personal advancement, greater levels of satisfaction amongst personnel in our employ, as well as to satisfy regulatory requirements. We also believe greater and broader training amongst all levels of our personnel will help us produce a higher quality of work for our clients and will result in greater opportunities for the company to gain new work and new clients.

E. Gruben's Transport Ltd. will provide and/or support includes both formal and informal training, on-the-job and classroom training, safety-specific and skill-specific training.

Training and skills-assessment will begin on hiring. New employees will receive basic orientation on safety standards and procedures which are standard procedures for company operations.

Basic Safety Program training, WHMIS, First Aid and TDG programs will be carried out periodically in house as required. As well, programs in Safety Program Supervision, Hazard Identification and Control and Incident Investigation will be provided to supervisory personnel at minimum, in order that such information and developed procedures can be passed down to all personnel through safety meetings.

Programs such as Oil Field Swamper, Oil Field Hauler, Light Duty Vehicle Operator, Heavy Equipment Training, Class 3 and Class 1 Driving Courses, Contaminated Soils and PCB Hauling, and Asbestos Abatement Courses have been and will be offered as operations require.

Many subjects related to new tasks and procedures, or to address newly identified hazards, will be addressed at safety meetings and daily tailgate meetings.

Much of the training which takes place falls under the general heading of On The Job Training.

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12.1.1 Safety Training Certificates

1. DRIVERS LICENSE
2. FIRST AID/CPR
3. TDG
4. H2S ALIVE/AWARENESS
5. WHMIS
6. TRUCK DRIVING
7. AIR BRAKES
8. GENERAL OILFIELD DRIVER IMPROVEMENT
9. OIL FIELD HAULER
10. LIGHT DUTY VEHICLE
11. OIL FIELD SWAMPER
12. HEAVY EQUIPMENT
13. WELDING
14. ENVIRONMENTAL AWARENESS
15. GENERAL SAFETY
16. POWER LINE SAFETY
17. ASBESTOS REMEDIATION
18. HAZWOPER 40 Hour Course
19. ACCIDENT INVESTIGATION
20. HAZARD IDENTIFICATION
21. SUPERVISORS HEALTH AND SAFETY PROGRAM

12.1.2 Employee Files

Employee files should contain records and copies of all training certificates and licences, both those issued by E.Gruben's Transport Ltd. for in-house training, and also licencing and certification provided by government agencies, training institutions and regulators. Employee files should contain personal information including:

1. Payroll related personal information.
2. Driver License Information (including copy of driver's licence)
3. List of Personal Training Certificates (copies of those certificates)
4. Personal Medical History (this may remain sealed in an envelope and returned at end of employment term)
5. EGT Tuk Base Rules & Policies – Sign off
6. EGT Vehicle Policy – Sign off
7. Drug & Alcohol – Sign off
8. HSE Hand book – Sign off
9. Safety Orientation Acknowledgement Form

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Employees receive from E. Gruben's Transport Ltd.:

1. Drug & Alcohol Policy
2. Vehicle Policy
3. EGT Camp Rules
4. Emergency Information
5. HSE Handbook
6. Copies of any certification for any training programs arranged by or conducted in-house by E. Gruben's Transport Ltd.

12.1.3 On the Job Training (OJT)

The purpose of on-the-job training (OJT) is to address the development of on-going job skills. With a disciplined approach to OJT, the worker is provided with the practical knowledge and skills required to perform a job task in a safe, efficient manner that complies with company procedure.

Procedures

OJT must be provided as a means of transferring task knowledge from competent workers to workers who do not have operational experience to conduct the task safely.

Personnel competent in work site and related job tasks must provide on-the-job training as prescribed in documented procedures.

Basic Steps for OJT include:

- Provide written procedures and demonstrate to the trainee how you want it done;
- Observe the trainee as he/she does the task;
- Correct any mistakes made by the trainee in a professional manner – be patient;
- Have the trainee repeat the task until he/she does it right – to your satisfaction; and,
- Have the trainee do it one more time for good measure to reinforce the memory of how to do it correctly.

Topics

Some types of skills are well suited for workers to learn through OJT. Below is a list of appropriate OJT topics:

Approved work procedures:

- Critical tasks;
- Equipment operation;
- Proper use of tools;

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- Understanding signage and warning symbols;
- Hand signals; and,
- Personal Protective Equipment.

OJT can also be an effective follow-up to reinforce classroom instruction.

Record Keeping

A record of OJT must be signed by a supervisor and the worker to acknowledge task competency and is maintained on file within the company.

See a sample “Checklist for Developing and OJT Program” on the following page

Mandatory Certification Training

Federal, Provincial and Territorial legislation stipulates mandatory certification training requirements for operations under their specific jurisdiction. The following outlines requirements for Transportation of Dangerous Goods (TDG) and Workplace Hazardous Materials Information System (WHMIS) training.

Other mandatory training specific to your operation may be required. Refer to the pertinent legislation that applies to your operation to ensure compliance to legislated training requirements.

Workplace Hazardous Materials Information System (WHMIS)

The aim of WHMIS is to reduce accidents and injuries in the workplace through a system of hazard communication. Its focus is the handling, storage, use and disposal of hazardous materials. It is the employer's responsibility to convey required information to workers through labels, material safety data sheets (MSDS), and worker education.

Under WHMIS legislation, suppliers of controlled product and employers who handle controlled product are responsible for putting WHMIS into effect. Employer's whose workers use, handle, store and dispose of controlled products, and are thereby exposed to the potential hazards of those products, must provide appropriate training.

WHMIS training provided to workers includes the following topics:

- Hazardous chemicals;
- Labelling and hazard symbols;
- Safe Handling, storage, use and disposal measures;

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- Material Safety Data Sheet (MSDS); and,
- Personal Protective Equipment (PPE)

WHMIS worker training also includes:

- Acquisition of knowledge so workers know about WHMIS, what they need to know and why they need to know.
- Learning of procedures so workers know how they are to use, handle, store and dispose of hazardous materials; and
- Learning how those procedures get applied on the job.

The employer must keep a copy of any WHMIS certificates of training issued. Certificates must be kept valid and confirmed by current employer.

Transportation of Dangerous Goods (TDG)

In 1992, the Federal Government of Canada passed the Transportation of Dangerous Goods (TDG) Act to promote public safety in the handling, shipping, transportation and receiving of dangerous goods by air, rail, road and marine modes.

The regulations deal with four main areas.

Classification;
Documentation;
Safety marks; and,
Training.

Anyone shipping, transporting, receiving or otherwise handling dangerous goods for the purpose of transporting them must be trained or working under the direct supervisor of someone trained and certified.

The certificate of training must include the data of the initial training, the date of expiry and the aspects for which the person was trained. The certificate is valid for a 36-month period then must be renewed. Anyone offering, handling or transporting dangerous goods must be able to produce a "Certificate of Training" if asked to do so by an officer.

The TDG training provided includes the following topics:

- Classification, documentation and safety marks;
- Special provisions;
- Dangerous occurrence reporting.
- Emergency response actions;

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- Special equipment requirements; and,
- Use of safety equipment.

The employer must keep a copy of any training certificates issued.

Recommended Training

Employees and contractors must be trained in safe work practices. The training required varies depending upon the location and the type of work being performed.

A sample of basic training requirements for a worker includes:

- First Aid/CPR
- H2S Alive (or equivalent);
- Fire fighting;
- Chemical handling (WHMIS/TDG);
- Equipment operation; and,
- Environmental awareness.

Proof of certification must be available onsite prior to commencing work.

Training Summary

Companies are responsible for meeting health standards, worker safety, and ensuring the preservation of the environment while conducting their work. Worker training is an investment in achieving these goals.

Establishing programs to enable workers to learn and apply the knowledge they need into their daily routines has many benefits:

- Companies can demonstrate due diligence in meeting legislation requirements;
- Training helps to facilitate reliable communication; and,
- Workers gain confidence to perform their jobs properly and safely.

The petroleum industry requires companies to develop competence in their work force by:

- Assessing training requirements.

12.2. COMMUNICATION

12.2.1 Role of Communication

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The important role that communication plays in health, safety and environmental protection cannot be overemphasized.

Important messages need to be communicated numerous times in different ways to ensure the people hear and understand. To make communication effective, your organization climate must encourage people to listen actively. This means encouraging people to check their interpretations, ask when they do not understand, voice their opinions, and let people know they have been understood.

Being a good corporate citizen is supported by open and honest communication with your workforce, the local communities and your business partners.

This section emphasizes two critical communication areas:

1. Management communication; and,
2. Company Safety Meetings such as:
 - Regular weekly management meetings
 - Regular monthly management meetings
 - Daily health, safety and environment meetings
 - Daily tailgate meetings.

The more employees and contractors know about the HSE program, the better able they will be to support it.

In initiating communications, management makes itself more accessible to others working for the company. This will ultimately result in greater participation of workers, contractors and subcontractors in the development and maintenance of HSE programs. It will also lead to higher morale and improved health, safety and environmental performance, along with improved workplace productivity.

12.2.2 Communication Frequency

Regular communication with employees, contractors and subcontractors should include describing the company's commitment to HSE performance and explaining why HSE is important and whom it affects.

Hold meetings for these communications where senior managers and the majority of employees, contractors and subcontractors are present.

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It is important for management and supervisors to tour work-sites, observe work practices and talk to workers about HSE issues. The frequency of tours will vary according to your type of operations and locations of your sites.

Conducting safety orientations, providing instruction and practice with experienced guidance and meeting mandatory training requirements are also part of a good communication process.

In addition, special programs like the new worker program, and specialized training and information sessions demonstrate the commitment companies have for their workers, the environment and the communities in which they work.

12.2.3 Management Communication

Management will communicate clearly and regularly the company's commitment to excellent HSE performance to all workers, contractors, subcontractors, suppliers, clients, and other stakeholders.

12.2.4 Communication of Expectations

Establishing expectations with people requires regular communication of the following topics:

- HSE program goals and performance expectations;
- Why HSE is important and who it affects;
- Hazardous conditions and corrective measures;
- Allocation of HSE responsibilities;
- Best practices;
- Incident and accident reporting procedures; and,
- Regulatory issues.

12.2.5 Types of Communication

To communicate company commitment to health safety and environmental excellence, management can do any or all of the following:

- Go to work sites to observe operations and engage workers in discussions of HSE matters;
- Send motivational letters or memos to employees;
- Participate in committees and meetings;
- Include HSE topics as regular agenda items in meetings;
- Highlight HSE accomplishments at company functions;
- Provide detailed job instruction for new, transferred or temporarily assigned personnel;
- Hold regular safety meetings for all staff;

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- Recognize workers who work safely; and,
- Provide regular feedback to all employees on safety performance or concerns.

12.3 MEETINGS

Bringing people together on a regular basis to hear and talk about the different HSE programs, procedures, and topics helps to set clear expectations and fosters commitment to incorporate what they learn into their day-to-day work.

The communication guidelines contained below are not intended to be exhaustive.

12.3.1 Regular or Start-Up Health, Safety & Environmental Meetings

All operator work groups engaged in northern operations shall participate in regularly scheduled safety meetings at least monthly or weekly for construction. Additional specific meetings are called as required (i.e. pre-job and tailgate meetings).

It is essential that site leadership attend and participate in as many safety meetings as possible.

Safety meetings are held to ensure that all personnel understand the operational steps and protective measures pertaining to the potential hazards of the job. The specific purposes of these meetings can include:

- Comprehensive identification of safety issues;
- Pre-job and/or task analysis for hazard prevention;
- Establishing protocols; and,
- Emergency response requirements at the beginning of a project or scope of work.

Meeting Details:

1. To help ensure the meeting makes effective use of time and accomplishes its goals, prepare an outline or agenda. This can be an informal list of items to discuss. Examples of topics on the agenda could include:

- Purpose of meeting;
- Organizational announcements;
- Progress reports;
- Objectives;
- Accomplishments;
- Assistance or resources needed;
- Incidents and Near Miss occurrences;
- Areas of concern and opportunities for improvement;
- Review of hazards and potential risks;

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- Identify “next steps”;
 - Set time and date for next meeting; and,
 - Identify possible issues to be covered in the next meeting.
2. Ask participants to share their HSE experiences since the last meeting. Focus on the positives. Encourage proactive thinking about HSE.
 3. Effectively manage the time used in the meeting.
 4. Start and end at designated times; and,
 5. Keep the meeting focused by having a facilitator or chairperson.

A sample general meeting agenda can be found on the next page.

12.3.2 Pre-Shift Meetings

Pre-Shift Meetings shall be held before:

- Starting work each morning;
- Starting a new shift; and,
- Undertaking of non-routine jobs.

Additional meetings are also held when:

- There has been a significant change in the way work is being carried out; and
- The supervisor deems it appropriate.

The objectives of the pre-shift meetings are to:

- Keep all members of the work team informed of the day-to-day opportunities and challenges of working safe;
- Inform workers of the forecasted days activities;
- Identify the unique hazards and required control measures to prevent injuries;
- Review basic safe work practices;
- Inform workers of the activities of the other workers and how their activities will interact; and
- Allow a shift supervisor to assess the emotional and physical capacity of crew and ensure all are prepared for work.

The pre-shift meeting allows the shift supervisor to:

- Ensure all onsite personnel are appropriately trained to carry out their assigned duties;
- Ensure certifications and permits are valid and current;
- Identify possible human hazards such as:

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1. Physical and/or emotional fatigue;
 2. Use of medication;
 3. Stress;
 4. Emotional distress; and
 5. Effects of drugs or alcohol.;
- Identify interpersonal issues amongst team;
 - Manage new or green workers in order to identify to the rest of the crew;
 - Ensure that new workers have completed pre-job orientations and required safety training; and
 - Identify and control work site visitors.

Meeting Details

The pre-shift meetings allow for the review and reinforcement of basic safe work practices and can include the following topics:

- The importance of a proactive approach to safety;
- The necessity of teamwork to ensure a safe work environment for everyone;
- The right and legal obligation of a worker to stop work if the conditions are unsafe or there is a potential for a safety issue to arise;
- Procedures for working alone;
- Basic radio communication;
- Understanding limits of worker responsibility, training limitations and competency;
- The importance of reporting unsafe conditions or practices to the supervisor such as:
 - a) Poor housekeeping;
 - b) Blocked walkways;
 - c) Improper or damaged PPE;
 - d) Slippery floors; and
 - e) Exposed electrical wires.
- Unsafe acts relevant to the work being conducted such as:
 - a) Improper use of chemicals;
 - b) By-passing safety devices;
 - c) Not using PPE;
 - d) Improper lifting;
 - e) Non-clean-up of spills; and
 - f) Working alone without controls.

Position Handover Duties

The pre-shift meeting creates the opportunity for necessary cross shift information to be communicated. Each employee coming off a shift will ensure that their cross shift or relief worker is fully informed of any information that relates to their position including:

- Current activities being performed;
- Outstanding work permits;

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- Current lockout;
- Wildlife cautions;
- Work status;
- Known hazards.

Emergency Response Procedures

During the pre-shift meeting emergency response procedures are reviewed including:

- Current activities;
- Meeting area in case of an emergency;
- Procedures to account for all employees, visitors and contractors;
- Assigned roles of all personnel;
- Response protocol specific to the area of activity;
- Location of safety stations onsite (fire fighting equipment, first aid, eyewash, and communications)
- Emergency escape procedures and routes;
- Shut down procedures;
- Rescue and medical duties for assigned employees; and,
- Procedures for reporting an emergency.

12.3.3 Tailgate Meetings

Tailgate meetings occur as and when needed and are the responsibility of all workers.

Supervisors or workers can initiate tailgate meetings when the need arises in order to identify a safety issue or review the appropriate work or safety procedure associated with a work assignment. Tailgate meetings should be called whenever the conditions of the job change (for example, for changing weather, different available equipment, change in personnel) or whenever the task itself changes. They should be called when new potential hazards are identified. They should also be called whenever workers or supervisors feel that more complete communication and understanding of the task-at-hand is desirable.

12.3.4 Orientations

Pre-job and pre-employment orientations provide the opportunity to present an overall picture of the company's HSE program and commitment, the rights and responsibilities of both workers and management, the company's expectations and policy's, as well as details of particular contracts and clients' requirements. This also provides the opportunity for new employees to complete employment sign-up procedures and the gathering of required employee information for employee files.

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The orientation, because of its in-depth approach, can set the overall tone for the entire term of a new employee's employment, as well as reinforce attitudes and policies for returning employees, and introduce new procedures and policies.

The orientation may be the first opportunity the company has to thoroughly indoctrinate and thoroughly warn an employee about the work situation he or she is entering.

It is critical that all new employees should receive an orientation and that all long-term employees should receive a new orientation at the beginning of every major work season.

The subjects which will be addressed in the E. Gruben's Transport Ltd. orientation include those on the following Safety Orientation Checklist and Sign-Up Form, as well as any conditions particular to individual client jobs.

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Safety Orientation Checklist and Sign-Up Form

I, _____ have participated in the E. Gruben's Transport Ltd. Orientation, which outlines company policies, safety procedures, alcohol and drug policy, and responsibilities of employees and subcontract personnel.

The Orientation covered the following topics:

☐ Management and Staff Emergency Contacts	☐ Abandoned Vehicle Protocol
☐ Emergency Contact Numbers – Non-Company	☐ Establishment of the Roadside as a Workplace Protocol
☐ Emergency Response Chart	☐ Ice Road Safety
☐ Company Reporting Organization	☐ Emergency Radio Procedures
☐ HS&E Guiding Principles	☐ Spill Response Procedures
☐ Workers' Responsibilities	☐ Emergency Response
☐ Subcontractor Responsibilities	☐ Hazard Identification
☐ Enforcement of Rules and Procedures	☐ Near Miss and Incident Reporting
☐ Alcohol and Drug Policy	☐ Accident Reporting and WCB Requirements
☐ General Safety Rules	☐ Accident and Incident Investigation Summary
☐ Personal Protective Equipment	☐ Right To Refuse Unsafe Work
☐ Tuk Base Camp Rules	☐ Meetings
☐ Small Vehicle Policy	☐ Job safety Analysis
☐ Journey Management Procedures	
☐ Completion of Administrative Forms:	
- Medical History	
- Training Certificates	
- Driver's License and Driver's Abstract Form	
- Payroll Information Form	
- TD1 and TD1 NT Income Tax Form	

I certify that I understand and accept my responsibilities and company rules as outlined in the Employee Orientation Presentation.

I acknowledge that I understand and accept the terms of the company Drug and Alcohol Policy, including the requirements for Pre-Employment, Post-Incident and Reasonable Cause Testing.

I acknowledge that I understand and accept the terms of the company Tuk Base Camp Rules, including the possible requirement for searches of rooms and personal effects.

Signature: _____

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Witness: _____

Position: _____

Date: _____

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12.4. ACCIDENT/INCIDENT INVESTIGATION & REPORTING

12.4.1 Investigation and Reporting

Investigation and reporting are critical steps in preventing a similar incident or accident from recurring. The investigation is intended to determine the root cause or causes of an incident or accident as opposed to finding fault.

Incident and accident reporting is also useful because it helps identify:

- Training Needs;
- Problems with work procedures;
- Problems with work site conditions;
- Needs for Personal Protective Equipment PPE, Safety & Emergency Equipment;
- Failures in communication

It also helps collect information necessary for completing insurance reports, for complying with regulatory requirements and for gathering statistical information used to calculate statistics and identify incident trends so that the effectiveness of the HSE program can be measured.

The steps in developing an investigation analysis procedure should include:

- Implementing an incident reporting system;
- Preparing investigation procedures;
- Establishing a process to ensure required corrective actions are completed; and
- Sharing the lessons learned from the incident investigations with workers to prevent a recurrence.

Types of events to investigate and report include

- Fatalities;
- Injuries or occupational illnesses that prevent a worker from performing regular tasks;
- Injuries that can be treated at the work site and injuries that require treatment by a medical professional;
- Any emergency or loss, such as a motor vehicle accident, fire, explosion, vandalism;
- Environmental damage or loss; and,
- Near misses;

Supervisors will manage the response to the event and notify the appropriate authorities where necessary.

When to prepare reports

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Reports of an incident should be prepared immediately after the event has occurred and kept on file to ensure requirements for regulatory compliance have been met.

In the case of serious accidents and environmental incidents, the accident/incident scene should be preserved to ensure important evidence is not lost or disturbed and details are not forgotten. The law mandates this for a serious injury accident or fatality.

To ensure incident reporting is consistent, appropriate report forms should be available at all work sites as required by regulatory agencies and company policy.

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Implementation

All E. Gruben's Transport Ltd. personnel must be encouraged to report all incidents and must be informed that this is part of their responsibilities as employees.

E. Gruben's Transport Ltd. has developed incident report forms and has provided training for senior management and job supervisors to complete investigations and complete the required paperwork. Written procedures follow this section and report forms are included in the forms appendix of this manual.

Incident Investigation and Follow-Up

Incident investigation and follow-up assists in determining root causes of incidents and helps prevent incidents from recurring. This can only be done with proper investigation and analysis.

Job Supervisors are initially responsible for the investigation of all incidents, regardless of their severity. Depending on the actual or potential severity of the incident an alternate investigation leader may be appointed. The E. Gruben's Transport Ltd. Safety/Loss Control Officer will provide assistance as required, as will any members of the senior management team. Senior management will also review all Incident Investigations.

Findings from investigations may to the recommendation that changes be made to work procedures, methodologies, management systems and corporate policies.

Training

Superior quality can be delivered to an investigation if the investigation team leader has been trained in investigation techniques. Depending on the severity of the incident, insurance investigators or government authorities may also be required to conduct an investigation and/or may require information provided by in-house investigations.

There is a benefit in training work site supervisors in investigation techniques and providing them with a logical approach in determining the underlying or root causes of incidents. E. Gruben's Transport Ltd. has provided Incident Investigation training to all its senior management and job supervisors, and will continue to provide training as new supervisors come into the system. These skills are transferable and can be used to evaluate hazardous job site situations to prevent incidents.

Investigative Purpose

The purpose of investigations is to identify direct and underlying factors that contributed to an incident and the root causes behind those factors.

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For example, worker driving a vehicle has a tire explode. He panics, loses control of the vehicle, and is seriously injured. Both the exploding tire and the panicked reaction of the driver to the explosion are contributing factors to the incident.

The root causes behind these factors may be:

- An excessive workload, causing driver fatigue which impaired his ability to respond effectively;
- Inadequate purchasing controls, which allowed tires to be purchased that were undersized for the truck's weight;
- Inadequate pre-tip inspection procedures, which prevented the driver from noticing the tires were under-inflated; and/or,
- Overloading the vehicle.

Investigative Procedure

After being notified of an incident, the on-site supervisor should survey the area to determine if the work must be stopped to prevent injuries and preserve evidence. The on-site supervisor notifies his management and an investigation leader is appointed. The following decisions must be made:

- Determine if government authorities and insurance investigators should be called; and
- Determine if legal advice is required;

The investigation leader directs the gathering of evidence, which is to include:

- Interviewing witnesses and the people involved;
- Photographing the site to record evidence and damage; and
- Creating scale drawings and diagrams.

If insurance investigators or government or other regulatory authorities are called in, the investigation leader will assist them as required.

Once evidence has been collected, then the investigator can complete the investigation process, which includes:

- Determining the immediate and root causes of the incident;
- Completing the investigation report;
- Developing recommendations to prevent a recurrence;
- Prioritizing a list of corrective actions identifying responsible parties and target dates for completion;
- Submitting completed reports and recommendations to management and, if required, to the insurance company and government;
- Discussing the report and recommendations with everyone who was working on the site at the time of the incident and with all other employees that are affected by the incident; and,

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Consideration should also be given to circulating any learnings and recommendations throughout industry.

Individuals who are assigned action items then carry out the investigator's recommendations and provide feedback to management on a monthly basis until all actions are completed and signed off. Only once there is verification that all recommended corrective actions have been completed can the incident report be closed out.

Investigation Analysis Process

INCIDENT	ACTION	INITIAL REPORTING	ANALYSIS	SYSTEM IMPROVEMENT
Contact with Energy resulting in undesired event	- Protect crew - Care for injuries - Contain incident - Preserve the scene - Notify Superintendent - Mobilize support - Recovery	Immediate causes: - Acts - Substandard conditions - Contributing factors	Investigation leader chosen depending on incident or severity Identify basic or "root" cause(s): - Personal factors - Job/system factors (controls that failed)	Corrective actions to prevent recurrence: - Assign responsible person(s) for implementing corrective action - Set time to completion - Track progress - Communicate lessons learned to others

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Incident Statistics

Incident statistics are compiled for use in the company's HSE performance assessment and for third party use.

Frequency of lost-time injury incidents (including fatalities) and severity of lost-time injury incidents are calculated quarterly.

Calculations are based on the following:

Lost Time Injury Frequency = Number of lost-time injuries x 200,000/Number of hours worked.

Recordable Injury Frequency = Number of lost-time injuries + Number of medical aid injuries
Number of restricted work injuries x 200,000/Number of hours worked.

Injury severity = Number of lost days x 200,000/Number of hours worked.

Rates are a better measure than simply counting the number of incidents because they take into account the level of worker activity. Therefore, a comparison of performance between time periods is valid.

Incident Reporting & Investigation Summary

Proper incident reporting and investigation processes will ensure that E. Gruben's Transport Ltd. is:

- Accountable for any actual or potentially serious events;
- Better able to determine the root cause of the incident; and
- Enabled to make the changes necessary to avoid any re-occurrences.

This process also enables the company to demonstrate its responsibility to the workforce, their families, and the communities in which we work.

12.4.2 Accident/Incident Investigation Procedures

Accident/incident investigation is a vital part of E. Gruben's Transport Ltd.'s Health and Safety Program. No other activity produces such quick results as the prompt reporting and investigation of accidents and "near miss" incidents. Therefore, we provide the following written procedures and guidelines for use in the completion of Accident/Incident Investigations

Investigation of an incident or accident involves much more than filling out a report form. It is a process of gathering factual information and drawing conclusions; the report form is only the documentation and the summary of that process.

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The purpose of an accident investigation is to determine the causes and put corrective measures in place to prevent a recurrence. It is not to find fault or fix blame. Serious accidents or incidents with a high potential for injury or damage will require an in-depth investigation but every incident is a signal of problems that need to be corrected.

Understanding Accidents

Many theories and models exist that explain how accidents happen. How an accident investigation is conducted will, in many cases, depend on the investigator's beliefs about the causes of accidents. A particular accident theory can strongly influence the organization's investigation process and can provide direction to its entire occupational health and safety management system. It is important therefore to explore our understanding of accident causation.

Incident Sequence Model

In the early days of occupational health and safety, most methods used to prevent accidents and injuries tended to focus on the worker and "fixing the worker". Today, we feel that a much broader approach is required. This broader approach looks at supervision and worker involvement.

The Incident Sequence Model is a management system based model of accident theory. It is a modification of accident "domino" theories and says that incidents occur much like dominos falling in sequence. The sequence starts on the left with each "domino" knocking over the one to the right.

To use the model in conducting an investigation, we will start on the right and move left in reverse sequence.

Effect

This is the result of consequences of the incident: injury or illness; damaged tools, equipment or machinery – the loss. In the case of a near miss or close call, there is no loss. The severity of the loss varies and is largely the result of chance (luck).

Incident

In order to better understand the investigation process, it is important to clarify our definition of the terms "accident" and "incident". These can include:

- Injury, illness or disease or fatality;
- Damaged tools, equipment or machinery; and
- Damaged material or property, including environmental damage.

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This differs from dictionary definitions of “accident” which tend to emphasize factors such as “happening without observable cause” “arising from unknown causes” etc. This leaves the perception that accidents just happen and that they cannot be prevented.

In health and safety, the term “incident” is used in a broad sense to include accidents and other unplanned events which, under slightly different circumstances, could have resulted in harm to people or damage to equipment, machinery or property. These are often referred to as “near misses” or “close calls”.

This then is the unplanned event that precedes the loss or close call. It is the exposure to the hazard or the contact that could result in harm or damage. Incidents are commonly classified as follows:

- Struck against (running or bumping into);
- Struck by (hit by a moving object);
- Fall to lower level (either the body falls or the object falls and hits the body);
- Fall on same level (slip and fall, top over);
- Caught in (pinch and nip points);
- Caught on (snagged, hung);
- Caught between (crushed or amputated);
- Contact with (electricity, heat, cold, radiation, caustics, toxics, noise); and
- Overstress/overexertion/overload

Immediate Causes

These are the hazards that existed immediately prior to the occurrence of an incident or accident. A hazard is defined as any unsafe practice or unsafe condition that has the potential to cause injury, illness, disease or damage to property, equipment and the environment. Immediate causes are usually easily identified and they are broken down into two types.

These are Unsafe Practices and Unsafe Conditions.

Unsafe Practices

These are the hazardous practices and behaviors that permit the occurrence of an incident, for example, failure to lock out equipment, failure to wear eye protection, overloading, poor driving practices, etc.

Unsafe Conditions

These are hazardous conditions that permit the occurrence of an incident, for example, inadequate guards or barriers, defective tools, poor housekeeping, weather conditions, etc.

Many investigators have a tendency to focus only on the immediate causes of an accident. But in order to prevent a repetition of what happened, you must dig deeper. It may be tempting to pin the accident on something a worker did or did not do and let it go at that. However, there is rarely, if

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ever, a single cause behind an incident or accident. Even the simplest incidents occur from a combination of causes.

Immediate causes are also called direct causes. They are the symptoms of deeper problems and the investigation must go beyond the immediate causes to identify the underlying causes.

Underlying Causes

These are real causes behind the symptoms; the reasons why the immediate causes existed. The underlying causes are not as apparent as the immediate causes. They are also referred to as root causes, basic or indirect causes.

Underlying causes can be identified by asking probing questions about the unsafe practices and unsafe conditions identified as the immediate causes. Here are some examples:

- Why was the equipment not locked out? Is there a lockout/tag-out procedure in place? Are workers aware of the procedure? Are workers trained in using the procedure?
- Why did the worker not wear eye protection? Is eye protection available? Is the wearing of eye protection enforced by the supervisor? Was the worker aware of the need for eye protection?
- Why did the worker remove the guard? Was there a lack of maintenance? Is the machine poorly designed? Was the worker aware of the hazard?
- Why was debris on the floor? Was this a rushed job? Is there any individual accountability for clean-up?
- Analysis of the answers to these probing questions will lead to the identification of underlying causal factors in two main categories – personal and work environment:

Personal Factors:

- Inadequate physical capability
- Inadequate mental capability
- Physical stress
- Mental stress
- Lack of knowledge
- Lack of skill
- Improper motivation

Work Environment Factors:

- Inadequate leadership/supervision
- Inadequate engineering
- Inadequate purchasing
- Inadequate maintenance
- Inadequate tools and equipment
- Inadequate work standards

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- Wear and tear
- Abuse/misuse

Management System Defects:

Underlying causal factors can be linked to defects in the health and safety management system. There are three key areas to consider:

- System Components: The system may be lacking some important elements.
- System standards: The standards are not clear or specific enough. They may be inappropriate.
- Conformance with System Standards: People in the organization are not following or complying with the established standards.

12.4.3 Applying the Incident Sequence Model:

The Incident Sequence Model has been applied to a simplified form called the Incident Analysis Worksheet. The work sheet can be used during an investigation to record information related to each key element of the model. This information forms the basis for the final Incident Investigation Report.

12.4.4 Why Investigate?

Accidents are caused. They don't just happen. The causes of accidents can be determined through proper investigation, therefore injuries can be prevented if the causes of accidents are corrected. Unless the causes are corrected, the same thing will happen again and again.

The most important reason for investigation accidents is to prevent injury and illness to workers. There are other reasons to consider such as the costs of accidents and the legal requirements to investigate.

12.4.5 Costs

The prevention of accidents through effective investigations can result in considerable savings in both direct and indirect costs.

Direct costs include the insured costs of Worker's Compensation payments to an injured worker while away from work and medical expenses incurred from the worker's injuries.

Indirect costs are other hidden costs of an accident and are most often uninsured. Indirect costs account for a large amount of the true cost of an accident and it is estimated that on average they exceed direct costs by a 4:1 ratio. Indirect costs may include:

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- Repair of damage to material/equipment or replacement cost;
- Wages paid for time lost by the injured worker, other than Worker's Compensation payments (ie. medical appointments after returning to work);
- Wages paid for time lost by other workers (ie. those who stopped working to assist following the accident or who took part in the investigation, or who could not work without the damaged equipment or material);
- Overtime work necessitated by the incident;
- Wages paid for the time of the supervisor(s) investigating the incident;
- Time spent by management and administrative staff on accident-related activities;
- Decreased output when the injured worker returns to work;
- Reduced productivity during a replacement workers learning period;
- Uninsured medical costs (on-site medical and first aid services); and
- Miscellaneous costs such as public liability claims, legal fees, equipment rental costs, etc.

12.4.6 Legal Requirements

Occupational Health and Safety Act:

The Occupational Health and Safety Act applies whenever there is a serious injury on a worksite, or an incident that has the potential for causing serious injury to occur. If an injury or incident listed below occurs at a worksite, the employer responsible for the worksite must notify a Labour OH&S Director of Inspection as soon as possible. Examples include:

- An injury or accident that results in death;
- An injury or accident that results in a worker being admitted to an unplanned or uncontrolled explosion, fire or flood that causes a serious injury or that has the potential of causing a serious injury;
- The collapse or upset of a crane, derrick or hoist; or
- The collapse or failure of any component of a building or structure necessary for the structural integrity of the building or structure.

In addition, the employer is required to investigate any other serious injury or any other incident that has the potential for serious injury. Since these "other" serious injuries and incidents are not defined in the Act it is important that nE. Gruben's Transport Ltd.'s investigation policy clearly identify them.

Workers' Compensation Act

While E. Gruben's Transport Ltd. will be dealing primarily with the Occupational Health and Safety Act, there are other obligations and responsibilities under the Workers' Compensation Act whenever a worker suffers personal injury on the worksite, or is entitled to medical aid as a result of an accident. If the accident is likely to disable the worker for more than the day of the incident, E. Gruben's Transport Ltd. is required to:

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- Report the accident to the Worker's Compensation Board within 72 hours;
- Notify the Board within 24 hours of learning that the worker has returned to work or is able to do so;

The WC Act contains additional details about what E. Gruben's Transport Ltd. is required to do, and to make available in regard to accident investigations. E. Gruben's Transport Ltd. must be familiar with the WC Act and what is expected in case of an accident.

12.4.7 Other Benefits of Accident/Incident Investigation:

- Providing accurate, unbiased descriptions of what happened. A summary of the incident is useful for communicating with employees, family members or third parties like insurance companies
- Revealing hazards not discovered through hazards assessments and inspections
- Identifying trends
- Tracking accidents/incidents
- Improving morale of employees

12.4.8 What Should Be Investigated?

It is obvious that accidents resulting in death or serious injury must be thoroughly investigated.

However, studies show that for every accident resulting in death or serious injury there were a large number of similar accidents and incidents (unplanned events) resulting in property damage, minor injuries with no injuries at all. Therefore, minor injury accidents, near-miss incidents and property damage accidents with the potential for serious injury should be investigated to identify and

12.4.9 Who Should Investigate?

The supervisor should investigate the accidents and incidents in his or her area of responsibility. As discussed earlier, E. Gruben's Transport Ltd. as an employer, has a legal requirement to investigate those incidents defined in legislation. A definition of employer in the Act is "any person designed by an employer or his representative". This could be the foreman, the lead hand, the superintendent, etc.

A team approach is recommended and whenever possible the supervisor should be assisted in the investigation by a safety committee member or the municipal health and safety coordinator (if one

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exists). Safety is a line function, therefore the prime responsibility for accident/incident investigation lies with the supervisor.

12.4.10 Reporting of Accidents/Incidents

Prompt reporting of an accident/incident to the supervisor is essential. This enables the supervisor to carry out an investigation while the events are still fresh in the minds of those involved.

Failure to Report an Accident/Incident

Workers fail to report accidents or incidents for some or all of the following reasons:

- Fear of discipline;
- Concern for their own safety record;
- Concern for reputation;
- Fear of medical treatment and/or medical personnel;
- Desire to avoid work interruption;
- Desire to keep a clear record;
- Desire to avoid “red tape”;
- Concern for the reaction of other workers (peer pressure); and
- Lack of understanding of the importance of reporting.

Supervisors can encourage reporting by:

- Reacting positively to the report;
- Training employees in reporting procedures and emphasizing its importance;
- Acting promptly on the report;
- Providing feedback; and
- Following up with corrective measures.

12.4.11 Investigation Preparation

Preparation for an investigation begins with the development of an investigation process described in E. Gruben's Transport Ltd's investigation policy. The policy outlines the intent of the investigation and the procedures E. Gruben's Transport Ltd. uses in reporting an accident or incident and proceeding with investigation. Areas that are included in the policy are:

- What types of incidents and accidents are to be investigated;
- Notification procedures and contact list (ie. OH&S, Emergency Response, family members, etc.);
- People involved in the investigation team;
- What report form(s) are used for various investigations; and
- The review process after the investigation is complete.

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Most supervisors do not conduct many investigations in their career, which makes the investigation procedures a seldom performed task within many organizations. A regular review of the municipal investigation policy and procedure will assist in prompt and correct response by front line supervisors at the worksite.

Before undertaking an investigation, the supervisor must have the necessary tools to do the job, including:

- Training in accident investigation techniques;
- Safety equipment clothing for the area(s) likely to be entered;
- Required permits and notification forms;
- An Investigation kit which should include the following
 1. Investigation Report Forms
 2. Investigation guide or checklist
 3. Writing material for notes, statements, sketches, etc.
 4. Pencils, pens
 5. Photographic or video equipment, if appropriate (cannot be used in an explosive atmosphere)
 6. Testing equipment
 7. Measuring tape
 8. DO NOT ENTER tape

12.4.12 The Investigation Process

The investigation process involves four phases:

1. Gathering facts -- investigation techniques and methods are designed to produce facts. A fact is something that actually exists or has actually occurred; something known by observation or examination to be true or real.
2. Analyzing and evaluating the facts -- this is a systematic and thorough study of the facts to determine causes and recommend corrective measures.
3. Documenting findings -- a written report is necessary to communicate the findings of the investigation to management and affected employees and to ensure proper follow-up takes place.
4. Following-up -- this is essential to ensure that corrective actions are taken to prevent recurrence and that the recommended controls, measures, practices, etc. are working effectively.

These phases should not be thought of as being separate and distinct but can occur concurrently. Analysis and evaluation begins while the facts are being gathered (ie. while getting an overview of the incident) and can continue well into the documenting of findings. The investigator must be careful not to let early analysis lead to premature conclusions.

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Carrying out an investigation:

When a serious accident occurs, the immediate response is to contact emergency services and take control of the situation. This is necessary to ensure that:

- No further injury or damage occurs by identifying and controlling imminent danger hazards.
- Injured persons are properly cared for.
- The scene of the incident/accident is secured and physical evidence is not disturbed before the investigation team, the police and/or OH&S Officer arrive.

A complete investigation involves the following activities in each of the phases of the investigation process.

Gathering Facts

Get an overview. Basic information about who was involved in the incident or accident and the general conditions at the time of the occurrence will help you decide on the scope of the investigation and who or what may be required to provide further information. An overview of the incident often uncovers the unsafe acts or conditions which directly contributed to the incident. Continuing the investigation will allow you to uncover the underlying or root causes.

Gather information at the scene. Make notes of what you observe and also take photographs and/or draw diagrams, sketches, etc. Look for things such as:

- Positions of injured workers;
- Condition of equipment and material;
- Where objects are in relation to each other;
- The angle something came from or the force behind an object;
- Safety devices that were in use and their positions;
- Housekeeping in the area;
- Noise and lighting levels.

Once the details of the scene have been carefully recorded, broken equipment or samples of materials may be moved for later analysis by experts. Before removing anything, ensure that the authorities having jurisdiction (police, fire, labour, etc.) have authorized this move.

Interview Witnesses

The interviewing of witnesses is your biggest challenge in conducting an investigation. It can be hard to get all of the information you need, or to sort out what really happened from the conflicting descriptions you get. A certain amount of distortion is natural because:

- Different people have different perceptions;
- Information may be overlooked because the witnesses are under emotional stress;
- People may “cover for” themselves or each other in an attempt to avoid further trouble.

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Exactly which questions you should ask will depend on the circumstances of the incident. You should know what they are if you keep an open mind and follow-up on whatever seems relevant as you proceed. However there are seven basic questions you should include in any interview:

1. Where were you when the accident happened?
2. What were you doing at the time?
3. What was (were) the injured worker(s) doing at the time?
4. What did you see and hear?
5. What were the environmental conditions like at the time?
6. What do you think caused the accident?
7. How do you think we could prevent a similar accident in the future?

The following techniques can help your interviews be more effective:

- Conduct the interview at the scene if possible, or in a comfortable place such as a private office;
- Interview one person at a time and privately;
- Keep the interview positive and try to put the person at ease;
- Allow the person to tell their story about the accident;
- Ask open-ended questions, not leading questions;
- Do not talk down to the person or rush them to answer quickly;
- Paraphrase what people tell you to make sure you understand;
- Make notes of key points;
- If needed, obtain a written statement from the witness;
- Thank the person and ask them to come back to you if they think of anything else;

Analyze and Evaluate Facts to Determine Causes

Analysis of the factual information you have gathered is necessary to determine the causes of the accident or incident. There are two types of causes to identify: immediate and underlying.

Recommend Corrections

To prevent a recurrence of the accident or incident, specific corrective action must be applied both to the immediate causes and the defects identified in the management system. Corrective action for the immediate causes will usually be short-term; those for the defects in the management system, long-term.

Short-Term Corrections

Corrective actions for immediate causes often can be implemented quickly and are usually short term. The focus is on the control or elimination of hazards. Some hazards can be eliminated but most will need to be controlled.

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There are three approaches to hazard control:

1. **Engineering Controls:** These are “hard” controls such as installing guards around moving machinery parts; ventilation systems to remove toxic fumes and vapors; fitting heavy equipment with rollover protection, etc.
2. **Administrative Controls:** These are “soft” controls such as policies, safe work practices, job procedures, training, job scheduling, rotation of workers, etc.
3. **Personal Protective Equipment (PPE):** PPE is the “last” line of defense against hazards and should be used only to supplement engineering and administrative controls. PPE includes respiratory, head, eye, hearing, foot, limb, body and fall protection.

Long-Term Corrections

Correction of the organization's management system defects will normally take longer. The failures or weaknesses in the management system must be corrected in order to reduce the probability of similar incidents occurring in the future. Each corrective action, whether short-term or long-term, should be assigned a target date for completion. The corrections may be implemented in stages, depending on hazard priority, training requirements, budget, and so on.

Determine Cost

Whenever you can, determine both the direct costs and the indirect hidden costs. The true costs of an accident will be important in helping management determine which recommendations will be implemented and in what order. While these costs reflect the financial burden of the company that experienced the accident, the cost to the a worker from the effects of an injury or illness and disruption of lifestyle is immeasurable.

Document the Findings of the Investigation

Write the Investigation Report. The report is a comprehensive summary of the findings of the investigation. We have tailored simple report forms to our general needs at E. Grubens's Transport Ltd. However, more complicated reporting may be required if the seriousness of the incident warrants it. For example, a fatal accident investigations should contain more detail than a “standard report form” will allow.

Completed reports are distributed to senior management and are discussed at our regular management meetings. We also discuss relevant information at our safety meetings and post some investigation results.

Follow Up

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Once the report is complete and the corrections determined, it is essential to follow-up and see that the corrective actions take place as scheduled, particularly if the correction will involve action at several different stages. It is important not to rely on memory or to assume that other persons will take care of the action assigned to them. Check to make sure that the specified action is working effectively to correct the problem.

Involve other people in the follow-up when appropriate. Follow-up information should be documented along with the original report.

Summary

An accident or a near-miss is not something that just happens out of the blue. It is a signal that something is out of order with the management of health and safety. An investigation is necessary to find out what that “something” is.

It should be a thorough examination that tells you not only what happened, but why it happened. The goal is not to find someone to blame for what happened, but to prevent it from happening again. With thorough reporting and analysis over time, investigations can reveal important trends and interrelationships, and can lead to valuable corrective actions.

An investigation, therefore, is not just a reaction to a specific incident. It has a much broader role in improving the quality and effectiveness of a health and safety program.

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14.0 EMERGENCY CONTACT LIST

EGT MANAGEMENT & STAFF

Tuk Base Camp and Night Security (24 hours/day)	TEL: 867-977-7000 FAX: 867-977-7040
Tuk Base Camp Manager Doug Saunders	TEL: 867-977-7017 CELL:867-777-1391
Night Security Cellphone	CELL:867-777-1654
Safety/Loss Control Jim Stevens	TEL: 867-977-7011 CELL:867-777-1173
Superintendent of Operations Willie Moore	TEL: 867-777-4975 CELL:867-777-6119 CELL:867-777-1108
Project Manager Bob Stefure	TEL: 867-977-7014 CELL:867-777-1524
Chief Executive Officer Russell Newmark	TEL: 867-977-7008 CELL:867-777-1794
EGT/POL Management Merven Gruben	TEL: 867-977-7004 CELL:867-777-1067
EGT Inuvik Office	TEL: 867-777-4975 FAX: 867-777-4374

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OUTSIDE AGENCIES

Tuk Health Centre	TEL: 867-977-2321
Tuk RCMP	TEL: 867-977-1111
Tuk Fire Department	TEL: 867-977-2222
Inuvik Hospital	TEL: 867-777-8000
Inuvik RCMP	TEL: 867-777-1111
Inuvik Fire Department	TEL: 867-777-2222
Inuvik Renewable Resources	TEL: 867-777-7230
Workers' Compensation Board – Accident Reporting	TEL: 1-800-661-0792
Northwest Territories Spill Line	TEL: 867-920-8130

APPENDIX D

APPENDIX D PREVIOUS EISC DECISIONS AND REGULATORY INPUTS



ENVIRONMENTAL IMPACT SCREENING COMMITTEE

NAME OF PROPONENT: Department of Transportation (GNWT) and the Hamlet of Tuktoyaktuk Hamlet (Batchelor/Gruben)

PROJECT DESCRIPTION: Tuktoyaktuk to Granular Source 177 All-Weather Access Road, Tuktoyaktuk, NT [12/08-02]

DECISION OF THE SCREENING PANEL (circled):

1. The development will have no such significant negative impact and may proceed without environmental impact assessment and review under the Inuvialuit Final Agreement. [IFA s. 11. (17) (a)]
2. The development if authorized subject to environmental terms and conditions recommended by the screening committee, will have no such significant negative impact and may proceed without environmental assessment and review under the Inuvialuit Final Agreement. [IFA s. 11(17)(b)]
3. The development could have significant negative environmental impact and is subject to assessment and review under the Inuvialuit Final Agreement. [IFA s. 11. (17) (c)]
4. The development proposal has deficiencies of a nature that warrant a termination of its consideration and the submission of another project description. [IFA s. 11. (17) (d)]

Signed on the 11 day of January 2009.

Fred McFarland, Chair

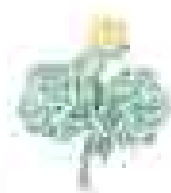
Patrick Gruben, Inuvialuit Member

Morris George, YTG Member

Elizabeth Gordon, Inuvialuit Member

Johnny Lennie, Canada Member

Darren Nasogaluak, Inuvialuit Member



ENVIRONMENTAL IMPACT SCREENING COMMITTEE

January 20, 2009

Submission Number: [12/08-02]

Department of Transportation
Policy, Planning, and Environment
Government of the Northwest Territories
PO Box 1320
Yellowknife, NT X1A-2L9

Hamlet of Tuktoyaktuk
Box 120
Tuktoyaktuk NT X0E

ATTENTION: RHONDA BATCHELOR

ATTENTION: MERVIN GRUBEN

Dear Sir/Madam:

RE: GNWT/Tuk Hamlet (Batchelor/Gruben) Tuktoyaktuk to Granular Source 177 All-Weather Access Road, Tuktoyaktuk, NT

During a meeting held January 14-16, 2009 the Environmental Impact Screening Committee (EISC) screened the above noted project description to determine if the proposed development could have a significant negative environmental impact. Based on the information provided the EISC concluded that the development, if authorized subject to the environmental terms and conditions recommended by the Screening Committee, will have no significant negative impact on the environment in the Inuvialuit Settlement Region [IFA Section 11(17)b]. A copy of the decision is attached.

Subject to a final decision by the licensing or permitting authority, the issuance of appropriate permits and approvals may proceed.

The EISC's decision is based on the information on the following:

- project description, dated December 2008
- the Environmental Management Plan, received on January 9, 2009; and
- the supplemental information provided verbally by the developer at the EISC meeting on January 15, 2009. This additional information included:
 - No road grading during the summer of 2009;
 - No quarrying will take place in the summer of 2009; and
 - Geotextile fabric will be used for the entire road length.

The Committee also utilized advice from Fisheries and Oceans Canada, Indian and Northern Affairs Canada, Fisheries Joint Management Committee, Wildlife Advisory Council (NWT) and the Tuktoyaktuk Hunters and Trappers Committee in the making its determination on this proposed development. The letters of advice are attached for the information of the developer.

Based on the information available, the Committee determined that additional mitigation is required in order to prevent any significant negative impacts to the environment and wildlife. The objective of the recommended additional mitigation measures is to reduce, to the maximum extent possible, impacts on the environment and wildlife specifically the barren ground grizzly bear population, the barren ground caribou found in the study area and the fish resources of the area.

Grizzly bears are listed as species of "special concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Death of a denning grizzly bear due to the disturbance is considered an adverse impact on the population. This grizzly bear population is harvested under a quota system and any incidental bear kill will impact on the community's quota.

The barren ground caribou population, identified as the Cape Bathurst caribou herd, is presently not hunted due to low numbers. Construction activities and the improved access to this part of the herd's range are potential sources of disturbance to this herd. Once the herd has recovered to a level where a sustainable harvest is possible, the improved access to the herd will be a source of concern.

The fish populations found in the streams and the larger lakes of the project area could be vulnerable to over-exploitation due to the improved access to these areas.

The recommended additional mitigation measures are as follows:

- To avoid any significant adverse impacts on the grizzly bear population a bear den survey should be taken prior to the commencement of construction activities, including the building of the winter ice road. The GNWT, Department of Environment and Natural Resources (ENR), should be consulted prior to the bear den survey. If active bear dens are located, the developer should stay 300 metres from the den site to avoid disturbing the bears.
- To avoid disturbing caribou, the developer should cease activities when caribou are within 500 metres of an active development site.
- The developer has indicated that some equipment will be stored at the quarry site over the summer of 2009. The equipment storage area should be secured so as to prevent hazardous materials from entering into the environment.
- Similarly, if a service area is to be used at the quarry site, it should be lined to prevent hazardous materials from entering into the environment.
- The recommended changes to the proposed winter ice road alignment by the Tuktoyaktuk Hunters and Trappers Committee should be adopted to lessen the overall footprint of the road by utilizing existing portage routes.
- A fish management and monitoring plan should be developed for the stream crossing and fish lakes within the study area in order to maintain viable fish stocks. The development of this fish management plan should include the participation of the Fisheries Joint Management Committee, Fisheries and Oceans Canada and the Inuvik and Tuktoyaktuk Hunters and Trappers Committees. This plan should be submitted to the EISC prior to the commencement of the 2009-2010 construction season.
- A wildlife management and monitoring plan should be developed for grizzly bears, caribou and any other wildlife populations potentially impacted by the construction and operation of the road and quarry as well as the improved access the road affords. The development of this plan should include the participation of ENR, WMAC (NWT) and the Inuvik and Tuktoyaktuk Hunters and Trappers Committees. This plan should be submitted to the EISC prior to the commencement of the 2009-2010 construction seasons.

The timeline for this proposed development proposal includes the winter of 2009, the winter of 2009-10 and the summer of 2010. Based on the advice received and the acknowledgement by the developer for that management plans should be developed in light of the improved access the project provides, the EISC is approving this project for the 2009 construction season. A revised project description containing the fish and wildlife management and monitoring plans should be

submitted to the EISC for screening prior to the 2009-2010 construction seasons. If there are additional changes to the project description these changes should also be included in the revised project description.

If you have any questions on the above, please do not hesitate to contact the EISC office.

Sincerely,

Barb Chalmers

Barb Chalmers
Environmental Assessment Coordinator

c.c. Fisheries and Oceans Canada
Environment and Natural Resources, GNWT
Fisheries Joint Management Committee
Wildlife Management Advisory Council (NWT)
Tuktoyaktuk Hunters and Trappers Committee
Inuvik Hunters and Trappers Committee
Aklavik Hunters and Trappers Committee

Attachments: Fisheries and Oceans Canada
Environment and Natural Resources, GNWT
Fisheries Joint Management Committee
Indian and Northern Affairs Canada
Wildlife Management Advisory Council (NWT)



Environment Division
Environmental Assessment and Monitoring
Environment and Natural Resources
PO BOX 1320
Yellowknife NT X1A 2L9
Telephone (867) 920-6590
Fax (867) 873-4021

January 12, 2009

Barb Chalmers
Environmental Assessment Coordinator
Environmental Impact Screening Committee
P.O. Box 2120
Inuvik, NT X0E 0T0

Dear Ms. Chalmers:

**Government of the Northwest Territories Department of Transportation and the
Hamlet of Tuktoyaktuk, NT, 12/08-02
Tuktoyaktuk to Granular Source 177 All-Weather Road, Tuktoyaktuk, NT.**

The Department of Environment and Natural Resources (ENR) has reviewed the above application based on its mandated responsibilities under the *Environmental Protection Act*, the *Forest Management Act (FMA)*, the *Forest Protection Act* and the *Wildlife Act*. No significant adverse impacts were identified in this review. An Environmental Management Plan was provided to our department subsequent to the receipt of application and our department has agreed to work with the proponents on enhancements to this plan.

If you have any questions or concerns, please do not hesitate to contact Jennifer Bailey, Environmental Regulatory Analyst at 920-6591.

Sincerely,

Jennifer Bailey
Environmental Regulatory Analyst
Environmental Assessment and Monitoring
Environment and Natural Resources



Fisheries and Oceans Pêches et Océans
Canada Canada

P. O. Box 1871
Inuvik, Northwest Territories
X0E 0T0

January 9, 2009

Your file Votre référence
12 08 02 / ILA08TF021

Our file Notre référence
08-HCAA-CA6-00129

Ms. Barb Chalmers
Environmental Impact Screening Committee
P.O. Box 2120
Inuvik, Northwest Territories
X0E0T0

Marilyn Cockney
Inuvialuit Land Administration
P.O. Box 290
Tuktoyaktuk, NT
X0E 1C0

Dear Ms. Chalmers and Ms. Cockney:

Subject: Proposal not likely to result in impacts to fish and fish habitat provided that additional mitigation measures are applied.

Fisheries and Oceans Canada - Fish Habitat Management Program (DFO) received the proposal from the EISC on December 19, 2008 and from the Inuvialuit Land Administration on December 15, 2008. Please refer to the file number and title below:

DFO File No.: **08-HCAA-CA6-00129**
Title: **Tuktoyaktuk to Granular Source 177 Access Road, Tuktoyaktuk, NT**

The proposal has been reviewed to determine whether it is likely to result in impacts to fish and fish habitat which are prohibited by the habitat protection provisions of the *Fisheries Act* or those prohibitions of the *Species at Risk Act* that apply to aquatic species.*

Our review consisted of:

Project Description Screening Tuktoyaktuk to Granular Source 177 Access Road, Tuktoyaktuk, NT – December 2008

We understand that:

- The proponent plans to place the aggregate by end-dumping directly on the surface of the terrain including on the vegetation cover.
- The proponent plans to use mushroom shoes on the bulldozers when clearing snow to ensure that the surface of the right of way is not disturbed.
- The proponent plans to use the winter ice road to transport equipment and crews between Tuktoyaktuk and Source 177.
- Field studies will be conducted in the spring of 2009 to characterize the local hydrology and fish habitat in Sections A and C.

*Those sections most relevant to the review of development proposals include 20, 22, 32 and 35 of the *Fisheries Act* and sections 32, 33 and 58 of the *Species at Risk Act*. For more information please visit www.dfo-mpo.gc.ca.

- Section B is deemed to contain only ephemeral streams and it is thought that the streams are not fish bearing.
- All drainage will be addressed with the installation of standard diameter (800 mm-900 mm) culverts.
- The proponent plans to install silt fencing as necessary to minimize siltation in runoff near water bodies.
- All water extraction will conform to the DFO Winter Water Withdrawal Protocol.

To reduce potential impacts to fish and fish habitat we are recommending the following mitigation measures be included into the proposed plans:

1. The material from Source 177 is defined as “good quality with some fines.” Fines can be detrimental to both fish and fish habitat. DFO recommends the application of sediment control along the edge of the road to prevent sediment from entering the waterways until such time as sufficient vegetation has re-established along the roadside to naturally prevent sediment from entering the water.
2. The use of standard culverts (800 -900 mm) for all stream crossings along the road (as stated on page 5 of the project description) will not be appropriate given the range and lack of information regarding the streams along the proposed route. Improperly installed culverts may form velocity barriers to fish migrants at the outlet, inlet, or within the culvert barrel. Water depths that are too low or water velocities that exceed fish swimming ability may create barriers to fish passage. DFO recommends that each stream crossing be assessed for fish habitat and an appropriate culvert (size and grade) be installed to reflect the needs of the respective fish species in the area. This can be completed in one of two ways:
 - a. As discussed with the contractor (Kiggiak-EBA), during winter construction avoid end-dumping within 10m of each of the streambeds within section B. Using the DFO Ice Bridges and Snow Fills Operational Statement, create an ice bridge over the streams. Appropriate water sources must be identified as per the DFO Winter Water Withdrawal Protocol and the information provided to DFO. Please find information regarding the protocol attached to this letter. If the Ice Bridges and Snow Fills Operational Statement does not apply in some cases, contact DFO for further consultation. Before spring, stabilize the ends of the constructed road near the streambeds. During spring, include the streams in Section B within the planned fish habitat assessment of Sections A and C.
 - b. Complete a pre-construction assessment of all steam crossings along the proposed road route including Section B.
3. DFO recommends post-construction monitoring to assess the effectiveness of any culverts related to fish passage that have been installed in fish-bearing waters.
4. As discussed with Kiggiak-EBA, the use of the DFO Clear Span Bridge Operational Statement for use when necessary during the construction phase. It has been attached for reference.

Provided that the additional mitigation measures described above are incorporated into the proposed plans, DFO has concluded that the proposal is not likely to result in impacts to fish and fish habitat.

As outlined in the project description, Big Lake (Ilkaasuut) is a popular fishing location for the residents of Tuktoyaktuk and the completion of this all-weather road will allow easier access to

this lake, as well as other lakes in the surrounding area. This may result in an increase in fishing, both sport fishing and for subsistence, in water bodies for which there is limited detailed scientific information. DFO Fisheries Management is concerned with the potential increase in fishing pressure in this area and will work with the Fisheries Joint Management Committee, HTCs, local resource users and other stakeholders in monitoring the use of these fisheries in the future.

The proponent will not need to obtain a formal approval from DFO in order to proceed with the proposal.

If the plans have changed or if the description of the proposal is incomplete the proponent should contact this office to determine if the advice in this letter still applies.

Please be advised that any impacts to fish and fish habitat which result from a failure to implement the proposal as described or incorporate the additional mitigation measures included in this letter could lead to corrective action such as enforcement.

If you have any questions please contact the undersigned at (867) 777-7515, by fax at (867) 777-7501, or by email at Amanda.Joynt@dfo-mpo.gc.ca.

Yours sincerely,

(original signed by Amanda Joynt)

Amanda Joynt
Fish Habitat Biologist

Copy: M. Cockney – ILA
L. Porta – FJMC
R. Hoos – EBA Consulting
L. Dow – DFO
B. Hanna – DFO
K. Bill – DFO
T. Stein – DFO
D. Arey – INAC
R. Batchelor – DoT
M. Gruben – Hamlet of Tuktoyaktuk

Attachments:

DFO Winter Water Withdrawal Protocol
Addendum to DFO Winter Withdrawal Protocol
Ice Bridges and Snow Fills Operational Statement
Clear Span Bridge Operational Statement



Indian and Northern
Affairs Canada

Affaires indiennes
et du Nord Canada

DATE: January 12, 2009

Mr. Fred McFarland
Chair
Environmental Impact Screening Committee
Joint Secretariat – Inuvialuit Renewable Resource Committees
P.O. Box 2120
Inuvik, NT, Canada X0E 0T0

Dear Mr. McFarland:

RE: Environmental Impact Screening Committee - January 14-16, 2009 Submissions

Indian and Northern Affairs Canada (North Mackenzie District and Water Resources Division), have reviewed the project submissions to be considered by the Environmental Impact Screening Committee (EISC) during their upcoming January 14-16, 2009 meeting. INAC would like to offer the following comments:

Electronuclearic Studies of Permafrost in the Mackenzie Delta – (Craven – GSC)

- No comments

Mass Balance of the Melville South Ice Cap (Burgess – GSC)

- No comments

Land Management Problems in Hydrocarbon Development Areas with Ice-Rich Permafrost: Detection and Assessment (Pollard – McGill University)

- No comments

Access Road - Tuktoyaktuk to Granular Source 177 (Hamlet of Tuktoyaktuk)

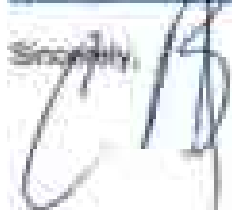
INAC offers the following comments for consideration, and is of the opinion that these issues can be addressed through the regulatory permitting phase of this application.

- The project description states that upon completion of the road construction the mined out sections of the quarry will be re-contoured and re-vegetated to be consistent with surrounding terrain. Will re-seeding techniques be utilized? Will the proponent conduct any monitoring of re-vegetation success and/or site stability?
- Aggregate material from granular source 177 will be used for road construction. Is the proponent aware of the ground ice conditions in this granular deposit? This information may

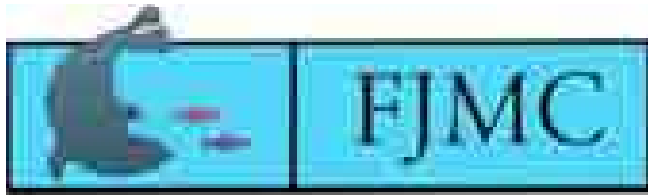
provide some insight into potential environmental issues at site (e.g. subsidence).

- A geotextile underlay is currently being considered for use during road construction, largely to protect the underlying permafrost. Is this being considered for the entire length of the proposed roadway, or specific sections of the road where maintaining the integrity of ice-rich permafrost is imperative to road integrity?
- The proposed route should avoid the location of any pingos in the area by a minimum of 150 metres.
- The project description states that water will be applied to the road during the summer months for dust suppression. This water will be sourced from lakes along the road. INAC supports the proponent's commitment to follow the DFO protocol for water withdrawal.
- The proposed route crosses several ephemeral drainages, as well as some small creeks (<5m in width). The proponent must ensure that natural flows are maintained across the roadway, especially during peak flows of spring freshet. Care should be taken to avoid the pooling of water along the edge of the roadway, as this may result in the thawing of the underlying permafrost. As proposed, the installation of culverts should prevent the pooling of water. However, regular monitoring of the culverts should be performed to ensure that they do not become obstructed with debris.
- The proponent should have a plan for managing thaw subsidence along the entire length of the roadway. The presence of standing water along the roadway may result in the thawing of permafrost and associated subsidence of the ground. The placement of culverts alone may not be able to mitigate this condition.
- Prior to the start of operations, the proponent should update their spill contingency plan to include site-specific contact information, as well as response procedures for spills to land, spills to open water, and spills on/under ice.

Thank you for the opportunity to provide comments on these submissions. If you have questions or comments, please feel free to contact Mr. Robert Jenkins at (867) 669-2574 or robert.jenkins@inac.gc.ca or myself at (867) 777-2997 or conrad.baetz@inac.gc.ca



Conrad Baetz
District Manager
North Mackenzie District
Indian and Northern Affairs Canada



FISHERIES JOINT MANAGEMENT COMMITTEE

Joint Secretariat – Inuvialuit Renewable Resource Committees
Box 2120, Inuvik, NT, X0E 0T0
Tel: (867) 777-2828 Fax: (867) 777-2610 Email: fjmc@jointsec.nt.ca

January 8, 2009

Fred McFarland, Chairperson
Environmental Impact Screening Committee
Box 2120 Inuvik, NT, X0E 0T0

Dear Mr. McFarland:

Re: GNWT-Tuk Hamlet [12 08 02]

The Fisheries Joint Management Committee bases its recommendations to the Environmental Impact Screening Committee on potentially adverse effects of “developments” on the health of fish, marine mammals, their habitats, and traditional uses.

During a teleconference on January 8th, 2009, members of the Fisheries Joint Management Committee had the opportunity to review the project proposal, **GNWT-Tuk Hamlet [12 08 02]**. The construction of an all weather road from Tuktoyaktuk to Granular Source 177 which will provide community access to a much-needed supply of gravel and sand will also have the secondary effect of providing easy year-round access to important fishing lakes, and to Husky Lakes. Some of those areas that will be affected are classified as Category E in the Community Conservation Plan.

One of the consequences of the project, **GNWT-Tuk Hamlet [12 08 02]**, will be increased fishing pressure on the Husky Lakes fishery and on some of the other known fish lakes in the area. This concern was raised by the Tuktoyaktuk HTC and is reflected on page 90 of the project description. Obviously, the FJMC shares those concerns and will be working with the HTC, the IGC and other organizations to develop management approaches that will effectively mitigate those impacts so that they are acceptable to beneficiaries, considerate of the fisheries resources, and especially mindful of the “special management regime” that is contemplated for Husky Lakes. While those concerns are generated by this project, we feel that they are part of a larger picture and need not be resolved through the assessment of this project itself.

That being said, we do have some concerns directly related to the project. First, the project description states that ephemeral streams like the Reindeer Lake System do not contain fish and therefore will not need a fisheries authorization. Although ephemeral streams do not contain fish suitable for the traditional fishery, they may well provide seasonal habitat for forage species and other aquatic life important to the ecosystem. Consequently we feel that a spring assessment of these waters should be carried out to

determine their importance and the efforts that should be expended to provide adequate protection.

Second, the impacts of increased fishing pressure on these lakes systems are not clear since there is insufficient data surrounding the capacity, health, and resiliency of these traditional fisheries. Therefore, the FJMC suggests a pre-project fisheries survey of the larger stream crossings and the adjacent lakes to provide a baseline against which future assessments could be measured. We would be pleased to work with the proponents and the DFO to develop a methodology which would be useful, not just for this segment of the road, but in the future, for other construction sections as the road progresses towards Inuvik.

In closing I would emphasize that our Committee sees this as an extremely important project, not so much because of the construction processes that will result, but rather because of the future activities it represents.

Sincerely,

A handwritten signature in black ink, appearing to read 'R. Bell', written in a cursive style.

Robert K. Bell
Chair, Fisheries Joint Management Committee

Cc: IGC
Tuktoyaktuk HTC

faxed ✓
67**Inuvialuit Land Administration**PO Box 230, Tuktoyaktuk, NT X0E 1C0
Tel: 867 977 7100 Fax: 867 977 7101**FACSIMILE**Date: February 4, 2009Cover + 1To: GNWT - DOT R. Batchelor
Humbert of Tuk H. GribbenFax: (867) 920-2565
(867) 977-2110C.C. _____
_____**From:**

- ☐ Chief Land Administrator - Vacant
- ☒ Marilyn Cockney, Land Use Applications Manager
- ☐ Barry Jacobson, GIS Tech. / Land Management Officer
- ☐ Emily Borsy, Land Use Policy Coordinator
- ☐ Christina Carter, Environmental Specialist / Inspector
- ☐ Tina Steen, Office Manager
- ☐ Kendyce Cockney, Secretary / Receptionist
- ☐ Janet Elias, Environmental Monitor Coordinator

Originals:☐ To Be Mailed☐ Not To Be MailedRE: Land Use Permit 1LA08TF021**COMMENTS:**

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Inuvialuit Land Administration

Right to Access Land

RIGHT NUMBER: **ILA08TF021**

TYPE OF RIGHT: **Quarry Licence & Temporary Right-of-Way**

Subject to the Inuvialuit Land Administration Rules and Procedures and the attached terms and conditions, this Right is hereby granted to The Government of the Northwest Territories, Department of Transportation and the Hamlet of Tuktoyaktuk to proceed with the operations described in the application of December 12, 2008 to access Inuvialuit Lands situated near Tuktoyaktuk, NT on 7(1)(a) lands for the purpose of the Tuktoyaktuk to Tuktoyaktuk Source 177 Access Road.

Commencement Date: February 4, 2009

Expiry Date: October 31, 2010

This Right may not be assigned, extended, discontinued, suspended or cancelled without notification and approval by the Inuvialuit Land Administration pursuant to the I.L.A. Rules and Procedures.

Dated this fourth day of February at Tuktoyaktuk, Northwest Territories and signed by:

Marilyn Cestney for
 Todd Romaine
 Chief Land Administrator
 Inuvialuit Land Administration

**CONDITIONS ANNEXED TO AND FORMING PART
OF LAND USE PERMIT NUMBER ILA08TF021**

Part A: Scope of Permit

1. This permit entitles the Government of the Northwest Territories, Department of Transportation (DOT) and the Hamlet of Tuktoyaktuk to conduct the following activities:
 - a) The design and construction of an all-weather access road between the Hamlet of Tuktoyaktuk and the Granular Source 177, approximately 19 km south of the Hamlet. The road will be constructed using materials from Source 177. The contractor will use the end-dump construction method, comprising quarrying, hauling, spreading, grading, and compaction of materials along the route. A winter access road of 24.2 km in length will also be constructed to support crew and equipment transport to Source 177.

The current road project is a continuation of previous work done in 2000-2004, when 30,000 cubic metres of material were quarried from Source 177 and placed along Section B of the currently proposed route. The project team anticipates that between 400,000 and 450,000 cubic metres of material will be required for this project. After the material is removed from Source 177, and the road construction is complete, the contractor will clean-up and contour the quarry.
2. The Permit is issued subject to the conditions contained herein with respect to the use of land for the activities and area identified in Part A, Item 1 of this permit.
3. Compliance with the terms and conditions of this permit does not absolve the Permittee from responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

Part B: Definitions

- "Administrator"** means the Administrator of the Inuvialuit Land Administration named pursuant to the By-Laws of the IRC;
- "Agreement"** means the *Western Arctic Claim – Inuvialuit Final Agreement (IFA)*;
- "Dogleg"** means clearing a line, trail or right-of-way that is curved sufficiently so that no part of the clearing beyond the curve is visible when approached from either direction;
- "Inspector"** means an Inspector designated by the Administrator under the IFA - IIA Rules and Procedures;
- "ILA"** means the Inuvialuit Land Administration;
- "Sewage"** means any substance which goes down a drain be it from a sink, shower or toilet;

Part C: Conditions Applying to All Activities as per Section 6 (14) Obligations of a Right of the IIA Rules and Procedures

1.	The Holder shall comply with and be bound by the provisions of the Inuvialuit Land Administration Rules and Procedures (IIA Rules) and by the laws of general application. [Sec. 6(14) (c) & 3 (2)]	PROVISIONS AND LAWS
2.	The Holder shall carry out the Operation solely at the Holders own risk and shall have no right of action against the Inuvialuit for alleged loss or damage arising therefrom. Granted of Access to Inuvialuit Land by the Inuvialuit does not create the responsibility on their part for damages suffered by the user. [Sec. 4(10)]	RIGHT HOLDER'S RISK
3.	This Right is granted to the Holder with the understanding that the Holder shall pay a fair compensation for Access to Inuvialuit Land as per Schedules set out in the IIA Rules. [Sec. 6(14) (d)]	COMPENSATION FOR ACCESS
4.	The Holder shall compensate the Inuvialuit for any damage to Inuvialuit Lands or for any diminution of the value of Inuvialuit interest in such Lands. [Sec. 6(14) (e)]	COMPENSATION FOR LAND DAMAGE
5.	The Holder shall compensate the Inuvialuit or any directly affected third person(s) for any damage or accidents caused as a result of the Occupancy or Operation(s) carried out during the Term of the Right. [Sec. 6(14) (f)]	COMPENSATION DURING OCCUPANCY
6.	The Holder has the obligation to provide Inuvialuit employment and opportunities for Inuvialuit businesses as well as arrangements for education and training programs for Inuvialuit. [Sec. 6(14) (g) & (h), 6(16) (b)]	EMPLOYMENT
7.	Notwithstanding the expiry or termination of this Right, the Holder remains responsible for his obligations arising under the terms and conditions of the Right or under the Rules until such a time as the IIA Administrator issues a Letter of Clearance. [Sec. 6(30)]	OBLIGATIONS
8.	The IIA Administrator may, after notification to the Holder, cancel this Right where the Holder has violated, or continues to violate after having been informed by the IIA Administrator, any terms and conditions as set out in this Agreement. [Sec. 5(5)]	CANCELLATION
9.	The Holder shall endeavour to discharge all obligations and terminate all cleanup and land reclamation measures within one year after the termination of the Right. [Sec. 6 (31)]	RECLAMATION AND CLEAN UP
10.	The IIA Administrator shall conduct inspections on a regular basis during the term of this Right with Inspection Fees and any associated travel or lodging costs payable by the Holder. [Sec. 8(4) to 8(6)]	INSPECTIONS

Part D: Conditions Applying to All Activities as per Section 6 (20) Variable Terms and Conditions of the ILA Rules and Procedures

NOTIFICATION

1.	The Permittee's Field Supervisor shall contact the Administrator at (867) 977-7100 at least seventy two (72) hours prior to the commencement of this land use operation.	CONTACT ADMINISTRATOR
2.	The Permittee shall provide in writing to the Administrator, at least forty-eight (48) hours prior to commencement of this land use operation, the following information: (a) person, or persons, in charge of the field operation to whom notices, orders, and reports may be served; (b) alternates; and (c) all methods for contacting the above person(s).	IDENTIFY AGENT
3.	The Permittee shall advise the Administrator at least ten (10) days prior to the completion of the land use operation of (a) the plan for removal or storage of equipment and materials, and (b) when final clean-up and restoration of the land used will be completed.	REPORTS BEFORE REMOVAL
4.	The Permittee shall submit in writing to the Administrator, all amendment requests prior to the proposed amended activity commencing.	AMENDMENTS
5.	The Permittee shall submit a progress report to the Administrator every seven (7) days during this land use operation.	PROGRESS
6.	The Permittee shall not conduct any overland movement of equipment or vehicles unless the ground surface is in a state capable of fully supporting equipment without rutting or gouging.	OVERLAND MOVEMENT
7.	The Administrator, for the purpose of this operation, designates April 15, 2009, as spring break-up.	SPRING BREAK-UP

LOCATION AND AREA

8.	The Permittee shall not conduct this land use operation on any lands not designated in the accepted application.	PLANS
9.	The Permittee shall not conduct any part of the land use operation within three hundred (300) metres of any privately owned or leased land or structure.	PRIVATE PROPERTY
10.	The Permittee shall use existing lines or roads where possible.	EXISTING LINES ROADS

11.	The Permittee shall locate all camps on gravel, sand or other durable land.	CAMP LOCATION
12.	The Permittee shall use an existing campsite, when possible.	EXISTING CAMP
13.	The Permittee shall locate all lines, trails and rights-of-way to be constructed parallel to water bodies a minimum of fifty (50) metres from the ordinary high water mark except at crossings, unless otherwise approved by the H.A.	PARALLELING STREAMS
14.	The Permittee shall not construct parallel lines or roads unless authorized by the Administrator.	PARALLEL ROADS
15.	The Permittee shall not conduct a quarry operation within one hundred (100) metres of the ordinary high water mark of any water body.	LOCATION OF OPERATION
16.	The Permittee shall scout proposed lines and routes to select the best location for crossing streams and avoiding terrain obstacles prior to the movement of any vehicle that exerts pressure on the ground in excess of 35 Kpa.	DETOURS AND CROSSINGS
17.	The Permittee shall not make any water body crossings that are greater than five (5) meters in length, when constructing permanent roads.	WATER BODY CROSSINGS; PERMANENT ROADS
18.	The Permittee shall not fence any part of the land use area.	FENCE PROHIBITED
19.	The Administrator reserves the right to impose closure of any area to the Permittee in periods when dangers to natural resources are severe.	CLOSURE

TYPE AND SIZE OF EQUIPMENT

20.	The Permittee shall not use any equipment except of the type, size, and number that is listed in the accepted application.	ONLY APPROVED EQUIPMENT
21.	The Permittee shall equip bulldozer blades used in this operation with "mushroom" type shoes or a similar type of device, which shall be extended twenty (20) centimeters below the cutting edge of the blade.	BULLDOZER BLADES AND SHOES
22.	The Permittee shall, in camps of five (5) personnel or less, maintain the following fire fighting equipment in the base camp and in active readiness: (a) two (2) back-pack bags or cans complete with hand pumps; and (b) at least one (1) of each of the following: pulaskis, axes, and shovels.	FIRE FIGHTING EQUIPMENT
23.	The Permittee shall, in camps of more than five (5) personnel, maintain the following fire fighting equipment in the base camp and in active readiness; (a) four (4) back-pack bags or cans complete with hand pumps; and	FIRE FIGHTING EQUIPMENT

(b) at least two (2) of each of the following: pulaskis, axes, and shovels.

24.	The Permittee shall ensure that all camps consist of less than fifty (50) personnel.	CAMP SIZES

METHODS AND TECHNIQUES

25.	The Permittee shall not conduct vehicle travel in areas without snow-covered surfaces.	VEHICLE TRAVEL
26.	The Permittee shall construct and maintain winter roads that will experience traffic by wheeled-vehicles with a minimum of twenty (20) centimeters packed snow and ice at all times during this land use operation.	WINTER ROADS
27.	The Permittee shall be aware that winter roads will be closed when the surface is no longer frozen enough to support the weight of vehicles without rutting or gouging.	ROAD CLOSURE
28.	The Permittee shall use gradual turns to avoid obstacles and minimize the angle of all turns and corners.	GRADUAL TURNS
29.	The Permittee shall dogleg lines, trails and rights-of-way that approach lakes, streams or public roads.	DOGLEG APPROACHES
30.	The Permittee shall leave a BUFFER strip of undisturbed vegetation at least thirty (30) metres in width between cleared areas and public roads or navigable waterways.	TREE SCREEN
31.	The Permittee shall not clear areas larger than identified in the accepted application.	MINIMIZE AREA CLEARED
32.	The Permittee shall not erect camps or store material on the surface ice of lakes and streams unless authorized by the Administrator.	STORAGE ON ICE
33.	The Permittee shall not store material other than that required for immediate use on the ice surface of water bodies.	STORAGE ON ICE
34.	The Permittee shall ensure that stockpiles of loose materials are managed for re-use and to ensure no contamination of water bodies.	STOCKPILES

TYPE, LOCATION, CAPACITY AND OPERATION OF ALL FACILITIES

35.	The Permittee shall ensure that the land use area is kept clean at all times.	CLEAN WORK AREA
36.	The Permittee shall ensure that less than one hundred (100) litres of water is used daily.	DAILY WATER USE

37.	The Permittee shall, while preparing the access road, make every effort to avoid covering or destroying traps or snares that may be found along these routes.	TRAPS PROTECTION
CONTROL OR PREVENTION OF PONDING OF WATER, FLOODING, EROSION, SLIDES AND SUBSIDENCE OF LAND		
38.	The Permittee shall minimize approach grades on all winter lake and/or stream crossings.	MINIMIZE APPROACH
39.	The Permittee shall not remove any material from below the ordinary high water mark of any water body.	WORK IN WATER BODIES
40.	The land use operation shall not cause obstruction to any natural drainage.	NATURAL DRAINAGE
41.	The Permittee shall not cut any stream bank.	STREAM BANKS
42.	The Permittee shall not use any material other than water and clean snow in the construction of ice bridges.	ICE BRIDGE MATERIAL
43.	The Permittee shall not allow the operation, or any ice bridge constructed, alter the natural drainage or hinder the flow of water.	ICE BRIDGE/ NATURAL DRAINAGE
44.	The Permittee shall not use the bed of streams for access routes except for the purpose of crossing the streams.	STREAM BEDS - ACCESS
45.	The Permittee shall ensure to remove any material or debris that may have been deposited in any stream or water body in the course of operation.	REMOVE DEBRIS
46.	The Permittee shall not ford wet streams.	NO FORDING OF STREAMS
47.	The Permittee shall remove snow fills in stream crossings as the land use operation progresses.	REMOVE WATER CROSSINGS
48.	The Permittee shall construct berms and/or ditches across the right-of-way at intervals of not less than thirty (30) metres on slopes exceeding five per cent (5%) prior to the commencement of the first spring break-up after construction of the right-of-way.	EROSION CONTROL, RIGHTS-OF- WAY
49.	The Permittee shall construct dykes and diversion ditches as authorized in writing by the Administrator.	DYKES/ DIVERSION
50.	The Permittee shall install erosion control structures as the land use operation progresses.	EROSION CONTROL
51.	The Permittee shall insulate the ground surface beneath all structures and facilities associated with this land use operation to prevent:	INSULATE GROUND SURFACE

	(a) any vegetation present from being removed and the melting of permafrost; and	
	(b) the ground settling and/or eroding.	
52.	The Permittee shall immediately suspend overland travel at the first sign of rutting.	PREVENTION OF RUTTING/ SUSPEND OVERLAND TRAVEL
53.	The Permittee shall not move any equipment or vehicles unless the ground surface is in a state capable of fully supporting the equipment or vehicles without rutting or gouging.	VEHICLE MOVEMENT FREEZE-UP
54.	The Permittee shall ensure that the use of vehicles over 1,000 kilograms and exerting a ground pressure of greater than 35 kilopascals in a non-roaded area only occurs when 15 centimetres or more of packed snow and ice covers the area and 30 centimetres of frost depth exists in the area, unless otherwise authorized by H.A.	OFF-ROAD TRAVEL
55.	The Permittee shall detour a minimum of one hundred (100) meters around all sand hills and pingos, unless otherwise authorized in writing by the Administrator.	AVOID SAND HILLS/PINGOS
USE, STORAGE, HANDLING AND ULTIMATE DISPOSAL OF ANY CHEMICAL OR TOXIC MATERIAL		
56.	The Permittee shall not use chemicals in connection with the land use operation that were not identified in the accepted application.	APPROVAL OF CHEMICALS
57.	The Permittee shall ensure that experienced and trained operatives are responsible for all refueling, including monitoring, repairs and maintenance.	EXPERIENCED HANDLERS
58.	The Permittee shall ensure that all parked equipment has a haz-mat/drip tray under it, or be sufficiently diapered (leaky equipment must be repaired immediately).	HAZ-MAT/D RIP TRAYS
59.	The Permittee shall dispose of all combustible waste petroleum products by removal to an approved disposal site.	WASTE PETROLEUM DISPOSAL
60.	The Permittee shall dispose of all toxic or persistent substances in a manner as approved in writing by the Administrator.	WASTE CHEMICAL DISPOSAL
61.	The Permittee shall submit to the Administrator an update of the contingency plan, for chemical and petroleum spills, and emergency response plans if there are any changes in the plans during the life of the permit.	CONTINGENCY /EMERGENCY RESPONSE PLAN

62.	<i>The Permittee shall report all spills immediately to the H/A and the 24 hour Spill Report Line (867) 920-8130, which is in accordance with instructions contained in "Spill Report" form N.W.T. 1752/0593.</i>	<i>REPORT CHEMICAL/ PETROLEUM SPILLS</i>

WILDLIFE AND FISHERIES HABITAT

63.	The Permittee shall minimize damage to wildlife and fish habitat in conducting this land use operation.	HABITAT DAMAGE
64.	The Permittee shall not feed or harass wildlife during this land use operation.	WILDLIFE
65.	The Permittee shall construct and maintain all structures placed in streams frequented by fish, in such a manner that will not obstruct passage of fish.	FREE FISH MOVEMENT
66.	The Permittee shall not obstruct the movement of fish while conducting this land use operation.	FREE FISH MOVEMENT
67.	The Permittee shall use culverts of a size that will ensure the velocity of the stream flow is not increased.	CULVERTS SIZE
68.	The Permittee shall place the bottoms of all culverts installed in streams inhabited by fish at a level that maintains the natural contour of the stream.	CULVERT INSTALLATION
69.	The Permittee shall not allow any employees to harvest fish and wildlife for the duration of this land use operation.	NO HARVESTING
70.	The Permittee shall not destroy or damage beaver dams or lodges.	BEAVER DAMS/LODGES
71.	The Permittee shall not destroy or damage muskrat lodges.	MUSKRAT LODGES
72.	The Permittee shall use food handling and garbage disposal procedures that do not attract bears.	BEAR/MAN CONFLICT
73.	Prior to the commencement of all land use activities, a bear den survey shall be conducted.	BEAR DEN SURVEY
74.	The Permittee shall stay three hundred (300) metres away from all active bear den sites.	BEAR DENS
75.	The Permittee shall cease all land use activities when caribou are within five hundred (500) metres of active development sites.	CARIBOU

STORAGE, HANDLING AND DISPOSAL OF REFUSE OR SEWAGE

76.	The Permittee shall ensure a garbage container is on site.	GARBAGE

77.	The Permittee shall dispose of all sewage and grey water as approved by the Administrator.	SEWAGE DISPOSAL
78.	The Permittee shall remove all garbage and debris, including plastics from the land use area to a disposal site as specified in the accepted application.	REMOVE GARBAGE
79.	The Permittee shall incinerate all combustible garbage and debris, except plastics and waste petroleum, daily, in an approved fuel fired incinerator.	INCINERATION
80.	The Permittee shall keep all garbage and debris in a covered metal container (that is marked with the Permittee's name) until disposed of.	GARBAGE CONTAINER
81.	The Permittee shall remove all plastics, scrap metal, discarded machinery, parts, barrels and kegs, buildings and building material as specified in the accepted application.	REMOVE WASTE MATERIAL

PROTECTION OF HISTORICAL, ARCHAEOLOGICAL AND BURIAL SITES

82.	The Permittee shall not conduct any operation within one hundred and fifty (150) metres of a known or suspected archaeological, historical or traditional land use site.	OPERATION RESTRICTION
83.	The Permittee shall not remove, disturb or displace any archaeological specimen or site.	DISTURBANCE OF SITE
84.	The Permittee shall immediately cease any activity which disturbs an archaeological, historical, and/or burial site and contact the Inuvialuit Land Administration at (867) 977-7100 should an archaeological site or specimen be encountered or disturbed by any land use activity.	CONTACTS
85.	The Permittee shall ensure that all persons working under authority of the permit are aware of these conditions concerning archaeological sites and the land use activity.	NOTIFICATION TO EMPLOYEES
86.	The Permittee shall not conduct activities on this land use permit within three hundred (300) metres of a cabin used for traditional activities including trapping, hunting or fishing.	AVOID CABINS

FUEL STORAGE

87.	The Permittee shall report in writing to the Administrator the location and quantity of all fuel caches within seven (7) days after their establishment	REPORT FUEL LOCATION
88.	The Permittee shall not place any fuel storage containers within one hundred (100) metres of the normal high water mark of any water body.	FUEL BY STREAM
89.	The Permittee shall locate mobile fuel facilities on land when stationary for	FUEL ON LAND

	any period of time exceeding twelve (12) hours.	
90.	The Permittee shall not allow petroleum products to spread to surrounding lands or into water bodies.	FUEL CONTAINMENT
91.	The Permittee shall have one extra fuel storage container on site equal to, or greater than, the size of the largest fuel container.	FUEL/EXTRA CONTAINER
92.	The Permittee shall use containment for fuel storage between 410 and 4,000 litres that are authorized in writing by the Administrator.	FUEL CONTAINMENT
93.	The Permittee shall ensure that all fuel, oil or oily material, lubricants or chemicals that are used during an activity or generated as a result of the activity will be collected in closed containers.	CHEMICAL CONTAINMENT
94.	Fuel caches greater than 1 x 1000 litre (250 gallon) tanks or 10 x 200 litre (45 gallon) drums shall be stored in double-walled tanks and/or be enclosed in an area that is impermeable, to insulate the surrounding environment from any spills. Typically this requires the construction of a storage area, surrounded by a berm and lined with plastic or other impermeable liners, that is 10 per cent greater than the capacity of the largest fuel container placed therein.	FUEL CONTAINMENT
95.	The Permittee shall ensure that all fuel storage containers with a capacity exceeding 4,000 litres are double-walled tanks.	FUEL CONTAINERS
96.	The Permittee shall construct an impermeable berm around each stationary fuel container or group of stationary fuel containers where any one container has a capacity exceeding 4,000 litres as approved by the Administrator.	BERM FUEL CONTAINERS
97.	The volume of the bermed area shall be ten per cent (10%) greater than the capacity of the largest fuel container placed therein.	BERM CAPACITY
98.	The Permittee shall ensure that the berm and the area enclosed by the berm shall be impermeable to petroleum products at all times.	IMPERMEABLE BERM
99.	The Permittee shall line the berm and area enclosed by the berm with a type of plastic film liner approved by the Administrator.	BERM LINER
100.	The Permittee shall: (a) inspect all fuel storage containers on a regular basis (b) repair all leaks immediately.	CHECK FOR LEAKS
101.	The Permittee shall maintain a watchperson at the site at all times when fuel is stored on site.	WATCHPERSON
102.	The Permittee shall not use bladders for transporting or storing petroleum products.	BLADDERS PROHIBITED

103.	The Permittee shall mark all stationary petroleum products storage facilities with flags, posts or similar devices so that they are at all times plainly visible to local vehicle travel.	MARK FUEL LOCATION
104.	The Permittee shall ensure that all fuel container taps and outlets not in use will be kept sealed to prevent leaking.	SEAL OUTLET
105.	The Permittee shall seal all container outlets except the outlet currently in use.	SEAL OUTLET
106.	The Permittee shall mark all fuel containers, including 45-gallon drums, with the Permittee's name and permit number, fuel type and year purchased or filled.	MARK CONTAINERS
107.	The Permittee shall only use stands approved by the Administrator for supporting fuel containers.	FUEL CONTAINER STANDS

METHODS AND TECHNIQUES FOR DEBRIS AND BRUSH DISPOSAL

108.	The Permittee shall ensure that clearing of vegetation is kept to a minimum. Wherever possible the natural vegetation shall be preserved.	VEGETATION PRESERVATION
109.	The Permittee shall dispose of all debris and brush by: (a) windrowing the debris and brush to the side of the line; and (b) making breaks in the windrow of at least seven (7) metres wide at intervals of not more than three hundred and thirty (330) metres.	BRUSH DISPOSAL
110.	The Permittee shall place the brush and debris in a windrow on the downhill side of the clearing.	WINDROW PLACEMENT
111.	The Permittee shall progressively complete disposal of all debris and brush.	PROGRESSIVE DISPOSAL
112.	The Permittee shall dispose of all brush within ten (10) days following the completion of cutting.	BRUSH DISPOSAL/TIME
113.	The Permittee shall dispose of all brush prior to removal of personnel or equipment from the land use area.	BRUSH DISPOSAL
114.	The Permittee shall make the windrow of brush and debris lie flat and compact by: (a) bucking the material into suitable lengths and topping the branches from the stem so that all parts of the brush felled lie flat on the ground surface; and/or (b) crushing with heavy machinery in order to compact the material.	BRUSH DISPOSAL

115.	The Permittee shall dispose of all debris and brush by running heavy machinery over the brush until they are crushed to lie flat on the ground.	BRUSH DISPOSAL
116.	The Permittee shall: (a) bury all debris and brush on the right-of-way or other cleared sites. (b) bury all debris and brush beneath a minimum of one (1) metre of compacted soil, the top of which shall not be more than 0.3 metres above the level of the surrounding ground surface.	BURY BRUSH
117.	The Permittee shall complete total disposal of all debris and brush cleared prior to the expiry date of the Land Use Permit.	BRUSH DISPOSAL/TIMING
118.	The Permittee shall avoid willows where possible.	AVOID WILLOWS
119.	Where necessary the Permittee shall walk down willows rather than cutting them. Any cutting of brush requires the permission of ILA.	WALK DOWN WILLOWS
120.	The Permittee shall spread all cut debris and brush over the areas cleared, prior to completion of the operation or expiry of the Land Use Permit.	SPREAD BRUSH
121.	The Permittee shall not use any self-propelled machinery for clearing the brush.	HAND CROWS ONLY
122.	The Permittee shall cut all brush on the right-of-way that exceeds one (1) metre in height, if any.	SMALL BRUSH
123.	The Permittee shall carry out total disposal of debris and brush in all areas visible from public roads and/or navigable waterways.	PUBLIC VIEW AREAS

RESTORATION OF THE LANDS

124.	The Permittee shall establish vegetation on all areas stripped of vegetation during this land use operation to a minimum of seventy per cent (70%) ground cover.	REVEGETATE STRIPPED AREA
125.	The Permittee shall apply grass seed and fertilizer to areas as authorized in writing by the Administrator.	REPLANT DESIGNATED AREAS
126.	The Permittee shall save the organic soil stripped from the excavation area and place the organic soil over the disturbed area prior to the expiry date of this Land Use Permit.	SAVE AND PLACE ORGANIC SOIL
127.	The Permittee shall commence and foster re-vegetation on the land used, as directed by the Administrator, within one (1) year of the completion of the land use operation.	RE-ESTABLISH VEGETATION
128.	The Permittee shall complete all clean-up and restoration of the lands used	CLEAN-UP

prior to the expiry date of this Permit.

129.	Stripping of overburden must be approved, in writing, by the Administrator prior to commencement of the quarrying operation.	STRIPPING OF OVERBURDEN
130.	The Permittee shall dispose of all overburden as instructed by the Administrator.	DISPOSAL OF OVERBURDEN
131.	The Permittee shall remove all ice bridges prior to spring break-up or completion of the land use operation.	REMOVE ICE BRIDGE
132.	The Permittee shall remove all snow fills from stream crossings prior to spring break-up or completion of the land use operation unless otherwise approved in writing by the Administrator.	REMOVE SNOW FILLS
133.	The Permittee shall restore any trails used by trappers or hunters along access routes by slashing any and all vegetation that may fall across these paths or trails and by removing any other obstructions such as snow piles or debris that may be pushed across the trails.	TRAILS RESTORATION
134.	The Permittee shall plug all boreholes as the land use operation progresses.	PLUG HOLES
135.	The Permittee shall refill and restore borehole craters as the land use operation progresses.	REFILL CRATERS
136.	The Permittee shall remove all wire from the land as the land use operation progresses.	REMOVE WIRE

DISPLAY OF PERMITS AND PERMIT NUMBERS

137.	<i>The Permittee shall display a copy of this Permit in each campsite established to carry out this land use operation.</i>	DISPLAY PERMIT
138.	<i>The Permittee shall keep on hand, at all times during this land use operation, a copy of the Land Use Permit.</i>	COPY OF PERMIT
139.	<i>The Permittee shall display the Land Use Permit number on all vehicles and equipment.</i>	DISPLAY PERMIT NUMBER

ADDITIONAL CONDITIONS

140.	The Permittee shall not conduct its operation within three hundred (300) meters of the shoreline of Husky Lakes and/or within fifty (50) feet of the Husky Lakes trail.	HUSKY LAKES RESTRICTION
141.	The Permittee shall submit to the Administrator, detailed sketches and quarry application forms for each pit required, prior to work commencing.	PRIOR NOTIFICATION
142.	An Environmental Monitor(s) shall be hired through the ILA for the	ENVIRONMENTAL MONITOR

duration of this land use operation.

143.	The Permittee shall maintain the flexibility to use large rubber tired vehicles and other tundra sensitive techniques for road construction to the satisfaction of ILA, depending on snowfall amounts.	ROAD CONSTRUCTION
144.	The Permittee shall ensure that all adequate hydrocarbon containment and spill mitigation measures are in place prior to commencing the refueling operations. Spill response materials must be on-site and readily accessible at all times.	HYDROCARBON CONTAINMENT AND SPILL RESPONSE
145.	The Permittee shall obtain approval by the Administrator before the use of any explosives.	EXPLOSIVES
146.	The Permittee shall adhere to all terms and conditions from all other relevant stakeholders.	ADDITIONAL TERMS & CONDITIONS

Signature of Permittee

Mariela Ordaz for 2. Hawkins
Signature of Administrator

Date

January 23, 2009
Date