Environmental Impact Screening Committee

PROJECT DESCRIPTION FOR SCREENING
IKHIL UGFI 02 / J-35 GAS WELL
2011 / 2012 DRILLING AND FACILITIES TIE-IN PROGRAM
IKHIL, NWT

1100802

September 30, 2011

IMG-Golder Corporation

Canadian Petroleum Engineering Inc.

EXECUTIVE SUMMARY

THE PROJECT

Utility Group Facilities Inc. (UGFI) is reviewing plans to drill and complete a new well offsetting the Ikhil J-35 well as part of the existing Inuvik Gas Project in the Mackenzie Delta, commencing in the winter of 2011/2012. This well (UGFI 02/J-35) will provide a redundant source of gas to supply the Northwest Territories Power Corporation (NWTPC; for power generation) and the Town of Inuvik for heating and domestic appliance use for the community. The new well will replace the K-35 well which is no longer capable of production. The activity associated with this Project will include the building of a winter access to the Ikhil well sites, construction of a snow / ice pad, mobilization of an Akita Equtak Drilling Ltd. (Akita Equtak) drilling rig from southern Canada to the location, the drilling of one well including completion and tie-in activities on the well, and then subsequent demobilization of all equipment back to Inuvik and southern Canada. An on-site camp will be established to accommodate up to 60 personnel. The camp will be equipped with a water and a heated sewage storage system that is capable of handling all of the wastes created in the camp. All wastewater will be taken to Inuvik for disposal / treatment. Likewise, all solid wastes will be removed and taken to appropriate disposal sites. The intent is to leave no waste on-site and no sumps will be constructed.

THE PROPONENT

The Project proponent, UGFI, is a wholly owned subsidiary of AltaGas Ltd.

PURPOSE OF THE PROJECT DESCRIPTION

The Project Description report is prepared as an environmental assessment to meet the requirements of the *Inuvialuit Final Agreement* (IFA) and the mandates of regulatory agencies. The Environmental Impact Screening Committee (EISC) screens all proposed developments inside the Inuvialuit Settlement Region (ISR) that may negatively impact the environment and / or Inuvialuit wildlife harvesting, and determines whether a given development warrants further review by the Environmental Impact Review Board (EIRB) or an equivalent government body.

REQUIRED PERMITS

To adhere to all legislation that is relevant to the Project, a number of permits will be applied for. These permits include:

Regulator	***Required Approval***
Inuvialuit Land Administration (ILA)	Land Use Permit and Temporary Right of Way Permit
Northwest Territories Water Board	Class B Water License
National Energy Board (NEB)	Environmental screening; Operations Authorization; Authorization to Drill a Well
Department of Transportation (DOT)	Permit for Temporary Access to a Public Highway

PUBLIC INVOLVEMENT

Formal consultations with the Inuvik Hunters and Trappers Committee (HTC) and community members of the Town of Inuvik were conducted on August 24th, and September 26th, 2011 (respectively) to discuss Project plans, any issues of concern, and proposed mitigation measures. There were no concerns raised during these meetings and on August 25t, 2011, the Inuvik HTC issued a letter to that effect to UGFI.

ENVIRONMENTAL ASSESSMENT

Based on the assessed site conditions, the following Valued Components (VC) were chosen for analysis:

Environmental or Social Component	***Valued Components***
Air and Noise	Air quality Noise levels
Soils and Terrain	Sensitive terrain Permafrost Soil quality
Vegetation	Vegetation communities Sensitive species and rare plants
Wildlife	Barrenground caribou Semi-domestic reindeer Grizzly bear
Aquatic Resources	Water quality Fish and fish habitat
Cultural and Heritage Resources	Archaeology sites
Socio-Economics	Employment and services Social conflicts

The timing of the drilling activity in winter and the mitigation measures to be used are expected to result in no significant effects from the Project work.

The following summarizes the results of the assessment for the Project work including mitigation strategies for any potential negative environmental effects:

Potential Impact	*Mitigation Measures*	*Predicted Residual Effect and Significance*
Air and Noise		
Project activities can impact air quality	• Flaring will only be for short periods of time. • Number of vehicles, heavy equipment and diesel generators will be limited.	Site-specific reduced air quality may occur. *Not Significant*
Project activities can increase noise level in the area	• Noise will be restricted to the immediate vicinity of the work in progress. • The highest noise levels will likely occur from drilling and flaring of gas, which will occur during a short time frame only in a localized area.	Site-specific increased noise levels may occur. *Not Significant*
Terrain and Soils		
Disturbance to sensitive terrain features (i.e., steep terrain)	• Project will be completed under stable, frozen ground conditions. • Winter access on the river channel and use of previously established overland access (Alternate Route) will be used for access to the Project area. • Ramp of snow and ice will be built where ice road meets the land. • Final inspection and clean-up will focus on ice pad around new well site	Site-specific disturbance to steep terrain may occur if adequate snow / ice thickness is not maintained. *Not Significant*
Access route, staging area and temporary camp may alter surface insulation and permafrost	• The Project will be completed under frozen ground conditions. • Winter access follows previously established route. • Equipment will be staged on an ice pad with matting on top. • Temporary camp will be located on an ice pad.	Site-specific melting of permafrost may occur. Not Significant
Spills can affect soil quality.	• A Spill Contingency Plan is in place to handle spills of fuel or hazardous materials. • An Emergence Response Plan is in place. • Storage areas will include secondary containment so that spills or ruptures remain contained on site. • Staged equipment, drill rig and camp will be located on an ice pad with matting on top, creating a barrier which is expected to prevent spills from reaching the vegetation and soil, and allow easier clean-up.	None predicted when clean-up is complete. *Not Significant*
Vegetation		
Disturbance to vegetation communities	• A minimum 20 cm ice / snow cover will be maintained on the overland access route. • Frozen ground and snow cover will allow travel over most vegetation without damage to the root systems. • Final site inspection and clean-up will be conducted with site-specific clean-up conducted on foot to avoid disturbance to vegetation.	Plant material above the snow / ice cover is expected to be crushed or compacted by vehicles and equipment. *Not Significant*
Potential disturbance to sensitive or rare plant species	• Drilling will occur in winter, which will coincide with the dormant period for herbaceous plants. • Winter access follows previously established route along the western escarpment of the Caribou Hills. • Minimum snow / ice cover of 20 cm will help to mitigate possible effects to low-lying vegetation. • Natural revegetation will be promoted by avoiding disturbance of the root zone.	Site-specific disturbance to sensitive or rare plants may occur. *Not Significant*
Wildlife		
Disturbance of barrenground caribou and / or semi-domestic reindeer in their respective wintering ranges	• Wildlife Monitors will scout ahead of equipment to avoid disturbing any observed caribou and / or reindeer. • If any animals are observed, work will cease until the animals leave the area.	Site-specific disturbance to habitat vegetation may occur. Distant, low-level sensory disturbance may occur. *Not Significant*
Encroachment on grizzly	• Wildlife Monitors will scout ahead of equipment to avoid potential bear dens	Distant, low-level

Potential Impact	*Mitigation Measures*	*Predicted Residual Effect and Significance*
bear habitat and / or den sites	and / or conflicts with bears. • Newly identified den sites will be avoided by at least 300 m.	sensory disturbance may occur. *Not Significant*
Attraction of bears to camps and work areas can lead to bear-human conflict	• Camp will be kept clean, with use of bear-proof containers. • Wildlife Monitors will communicate bear sightings. • Personnel will have bear safety training.	None predicted. *Not Significant*
Encroachment on waterfowl habitat and / or nesting sites	• Winter access follows previously established route. • Minimum snow cover requirements will help to mitigate possible effects to low-lying vegetation. • Camp will be constructed on ice pad. • Ice pad will be build up around new wellsite and serve as staging area.	Limited disturbance to above-ground vegetation habitat may occur. *Not Significant*
Aquatic Resources		
Wastewater disposal can affect receiving water bodies and with this, fish and fish habitat	• All wastewater will be collected and transported to the Town of Inuvik or further south for appropriate disposal. • All drilling waste will be collected and transported to the Town of Inuvik or further south for appropriate disposal.	No effects to water quality are predicted. *Not Significant*
Spills can impact water quality	• A Spill Contingency Plan is in place to address spills of fuel or hazardous materials. • Sites for storage of fuels, lubricating oils, chemicals, or other hazardous materials will be located a minimum of 100 m away from water bodies, and surface drainages. • Storage areas will include secondary containment so that spills or ruptures remain contained on-site. • Hazardous materials transportation operators will be licensed and adhere to approved emergency response and spill response plans.	None expected when clean-up is complete. *Not Significant*
Cultural and Heritage Resources		
Loss or damage of cultural resources including archaeology sites	• Known archaeology sites have been identified in the region surrounding the Project area and will be avoided by at least 100 m. • In the event that previously unknown archaeology sites are discovered during drilling work, work will cease at that location and the PWNHC and the communities will be notified and consulted for advice on mitigation.	None expected. *Not Significant*
Socio Economics		
Employment and community services will be affected	• Equal opportunity will be given to local employment and service, supply and contracting services by using the IRC Business List to source required services.	None expected. *Not Significant*
Social conflict in regional communities stemming from cultural separation and alcohol and / or drug abuse	• Procedures and policies in the CPE HSE Manual will be followed.	None expected. *Not Significant*

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PROJECT DESCRIPTION FOR SCREENING OF THE UGFI 02 / J-35 IKHIL 2011 / 2012 DRILLING AND FACILITIES TIE-IN PROGRAM; IKHIL, NWT

2 CONTACT NAME AND ADDRESS

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3 REGULATORY APPROVALS

Utility Group Facilities Inc. (UGFI) is submitting this Project Description (PD) to the Inuvialuit Environmental Impact Screening Committee (EISC) for its approval. The proposed Project (Figure 1 and Figure 2, Appendix A) is located on Inuvialuit 7(1)(a) lands in the Mackenzie Delta within the Inuvialuit Settlement Region (ISR) of the Northwest Territories (NWT). The proposed Project requires approval under the *Inuvialuit Final Agreement* (IFA). The EISC will be responsible for carrying out a screening of the Project under the IFA. Required permits and approvals, and the federal and territorial agencies responsible for Project approvals, are listed in Table 3.1.

UGFI will contact the appropriate regulatory agencies as listed in Table 3.1 and submit the required permit and license applications.

Table 3.1 Approvals Required for the Proposed Project

Agency and Contact Person	*Required Approval*
Patrice Stuart Land Use Applications Manager Inuvialuit Land Administration (ILA) P.O. Box 290 Tuktoyaktuk, NT X0E 1C0	Land Use Permit and Temporary Right-of-Way Permit *Inuvialuit Final Agreement*
Christine Inglangasuk Environmental Impact Screening Coordinator Environmental Impact Screening Committee (EISC)	Approval of the Project Description *Inuvialuit Final Agreement*

P.O. Box 2120 Inuvik, NT X0E 0T0	
John McCarthy Chief Conservation Officer National Energy Board (NEB) 444 – 7th Ave S.W. Calgary, AB T2P 0X8	Environmental screening under the *Canadian Environmental Assessment Act*; Authorization to Drill a Well and Operations Authorization under the *Canada Oil and Gas Operations Act*
Eddie T. Dillon (Chair) NWT Water Board PO Box 2531 125 Mackenzie Road Suite 302, Professional Building Inuvik, NT X0E 0T0	Class B Water License *NWT Waters Act* *NWT Water Regulations*
Gurdev Jagpal Regional Superintendent Inuvik Region 1st Floor Mack Travel Building 149 Mackenzie Road Inuvik, NT X0E 0T0	Permit for Temporary Access to a Public Highway *Public Highways Act*

4 LOCATION

The Ikhil reservoir is located in the Caribou Hills approximately 50 kilometres (km) north-west of the town of Inuvik. The Ikhil K-35 well, drilled in 1986 is centrally located in PL-06, which covers a subsurface area of approximately 25 square kilometres (km^2). In 1998, two additional wells were drilled into the reservoir, Ikhil J-35 and Ikhil N-26. The Ikhil J-35 well is still producing but the N-26 well was abandoned as non-productive in 1998.

The geographical location of the existing Ikhil J-35 well is:

Latitude: 68° 44' 35.582" N

Longitude: 134° 08' 34.928" W

Grid: Unit J Section 35

The Universal Transverse Mercator (UTM) coordinates for the well site are:

7,625,791.58N, 534,673.64 E

Ground elevation at the location is approximately 150 metres (m) above sea level.

The existing pipeline, which delivers gas from the production facility, located between the Ikhil K-35 and J-35 wells to the town of Inuvik, follows the top of the Caribou Hills until it drops down into the surrounding Delta landscape after crossing Douglas Creek (the only above ground section of the pipeline). The pipeline right-of-way (ROW) is 10 m wide and approximately 50 km in length. The locations of the pipeline, wells and production facility are shown in Figure 1 (Appendix A).

The Ikhil well sites and production facility are located on Inuvialuit private lands as described under Section 7(1) (a) of the IFA of 1984. Both surface and subsurface rights are held, with the lands administered by the ILA.

For the purposes of this PD, the following definitions are used:

The ***Ikhil Gas Project*** includes the existing Ikhil well sites, gathering pipelines, production facility, and pipeline right-of-way (ROW) to Inuvik (as shown in Figure 1).

The ***Project*** refers to the 2011/2012 work proposed in this PD; that is the development of a new well (Utility Group Facilities Inc. [UGFI] 02 / J-35) and associated structures as described in Section 5 (as shown in Figures 2 and 3).

The ***Project area*** refers to the general area of Caribou Hills potentially affected by the 2011/2012 work that is proposed in this PD. It includes the winter access, new well-pad area and new tie-in line to the existing production facility.

This PD was developed jointly by Canadian Petroleum Engineering Inc. (CPE) and IMG-Golder Corp. (IMG-Golder). CPE provided the Project-specific technical data and IMG-Golder was responsible of the environmental assessment and mitigation sections.

5 DEVELOPMENT SUMMARY

Project Description

UGFI is reviewing plans to drill and complete a new well offsetting the Ikhil J-35 well as part of the existing Inuvik Gas Project in the Mackenzie Delta, commencing in the winter of 2011/2012. This well (UGFI 02/J-35) will provide a redundant source of gas to supply the Northwest Territories Power Corporation (NWTPC; for power generation) and the Town of Inuvik for heating and domestic appliance use for the community. The new well will replace the K-35 well which is no longer capable of production. Figure 3 shows the new well location.

The Ikhil Gas Development Plan (Submission 06-97-03) was initially proposed by the Inuvialuit Petroleum Corporation (IPC) as Operator of the Ikhil Gas Project at that time. The project was reviewed by the EISC during meetings held July 28 to 31, 1997 and was approved. It was determined by the EISC that "the development will have no significant negative impact on the environment or Inuvialuit harvesting in the Inuvialuit Settlement Region [IFA Section 11(13)(a)]." The Ikhil Gas Development Plan was subsequently submitted to the National Energy Board (NEB) on August 29, 1997 and approval received on December 24, 1997. In the Development Plan, IPC planned to use the K-35 well and to drill two additional wells to provide a secure supply of gas for the Town of Inuvik.

The additional two wells were drilled in 1998; however, one of those wells (N-26) was dry and abandoned and was not a viable source well. K-35 is now shut in and will be used as a pressure monitoring well. J-35 is currently the supply source for gas from the Ikhil gas pool which has

supplied gas to the Town of Inuvik since start-up in May of 1999. UGFI is now the operator of the field and facility and plans to drill a new well approximately 100 m (down hole) offset to J-35 this upcoming winter as part of the ongoing field development of the Ikhil Gas Project. The surface location of the proposed well is generally governed by the geometry of the gas reservoir. The specific siting of the proposed well can be adjusted by directionally drilling into the reservoir in the best location to intersect the gas sands that are believed to be present while allowing the surface location to be sited near the J-35 well.

2011 / 2012 Program

The activity associated with this Project will include the building of a winter access to the Ikhil well sites (Figure 2), construction of a snow / ice pad, mobilization of an Akita Equtak Drilling Ltd. (Akita Equtak) drilling rig from southern Canada to the location, the drilling of one well including completion and tie-in activities on the well, and then subsequent demobilization of all equipment back to Inuvik and southern Canada.

The winter access to the new well site will branch off the Inuvik to Tuktoyaktuk ice road to the base of Blueberry Hill following what is known as the “Alternate Route”, which is the same route used for initial well drilling and production facility construction in 1997/1998/1999, in 2009 and 2011 when work-over operations were conducted on the Ikhil K-35 well and from time-to-time for replenishment of operating supplies, diesel and gravel. The winter access is approximately 8 km in length and will be built to accommodate all the heavy loads associated with construction and the rig mobilization. The winter access consists of an ice road, following the Mackenzie River East Channel and an existing overland access. Water for the access and location construction (including the ice pad) will be withdrawn only from the Mackenzie River.

Akita Equtak will supply a drilling rig for the Project and a camp to accommodate up to 60 personnel on-site. The camp will be equipped with a water and a heated sewage storage system that is capable of handling all of the wastes generated in the camp. Sewage will be taken to Inuvik for disposal / treatment. Likewise, all solid wastes will be removed and taken to appropriate disposal sites. The intent is to leave no wastes on site.

UGFI intends to site the new well as close as possible to the J-35 well to minimize tie-in costs, work activity and any surface disturbance in the immediate area (Figure 3). This new well will provide a second well to back-up the J-35 well in the event of an operational failure. The new well may be drilled directionally to reduce the overall foot print and the length of tie-in. Two additional sands above and below the main Ikhil sand are prospective in the new well to provide additional gas reserves.

The land area required for the new well location is small and will have minimal impact on the surface landscape at the site. The new well site will be located within 100 m of the J-35 well site, and an area no more than 100 m by 160 m (1.6 ha) will be required for the ice pad to conduct the drilling, stage the equipment and facilitate the camp. The permanent gravel pad required for the well head equipment and connection to the above ground gathering line will be similar to the K-35 and J-35 gravel pads and utilize approximately 0.03 ha (equivalent to 10 m by 30 m) of surface area.

The well site will be constructed with a small teardrop centre area of gravel which will house the permanent well site production equipment once the well is drilled. The remaining well site area required to support the drill rig and camp will be constructed with a snow/ice pad surrounded by a snow/ice containment berm. The rig and camp will be placed on rig matting on top of the ice pad. This procedure, which has been used successfully in the past, will protect the ice pad from melting during the drilling program and from contamination. No sumps will be excavated, all waste will be collected in aboveground tanks and trucked off-site for appropriate disposal.

In order to minimize any ground effects, all stationary fuel tanks on location will be double walled or will be located within a self berm skid. Refuelling of vehicles will be conducted following a strict refuelling procedure and using approved conventional fuel transfer equipment. As mentioned previously the camp will be self-contained with sanitary wastes stored and transported off-site for disposal in an approved manner. The drilling program will also be self–contained and conducted in a zero discharge manner.

Drilling fluids will be treated and recycled to the greatest extent possible and waste fluids remaining at the end of the Project will be transported off-site and disposed of at a proper facility. All drill cuttings will also be trucked away for disposal at an appropriate site.

The well depth for the new well will be approximately 1,200 m total vertical depth (TVD), similar to the J-35 and K-35 well depths. The drilling operation is expected to be completed in approximately 14 days. The completion program for the new well will be similar to the J-35 completion, although other minor changes will be evaluated in the design stage of the well programming. Once this well is completed, the surface equipment and above ground gathering line from K-35 will be relocated to the new well site and a pipeline tie-in completed to the Ikhil production facilities.

Project Location

All drilling activities will take place within the existing Production Licence PL-06 on Inuvialuit lands where both surface and subsurface rights are held by the Inuvialuit. The PL-06 is 2,506 ha in size encompassing sections 25, 26, 34, 35, 36, 44, 45, and 46. The J-35 and K-35 well sites, gathering lines and production facilities are located centrally within the PL-06 and cover approximately 0.7 ha in total. The new well, facilities and tie-in pipeline will add less than 0.1 ha of additional surface disturbance to the existing Ikhil Gas Project (Figure 3).

5.1 WINTER ACCESS

The proposed winter access is composed of two sections (Figure 2):

1. An ice road on the Mackenzie River East Channel connecting eastward from the Inuvik to Tuktoyaktuk ice road to the bottom of Blueberry Hill. The entire ice road from Inuvik to this location is approximately 58 km in length, with approximately 50 km of the route using the official Inuvik to Tuktoyaktuk ice road. The final section of ice road will lead eastward from the ice road on the East Channel (Figure 2). This ice road will lead approximately 4 km eastward to the bottom of Blueberry Hill.

The Government of the Northwest Territories (GNWT) Department of Transport (DOT) will be contacted with a request that the ice road be constructed after freeze-up in December and January so that UGFI is able to commence drilling operations early in February.

2. From the bottom of Blueberry Hill, an established overland access leads up a seasonal drainage valley to the Ikhil wells and production facility (this access is called the "Alternate Route"). UGFI is proposing to use this existing access to construct the overland portion of the winter access. This route was used for initial well drilling and production facility construction in 1997/1998/1999, in 2009 and 2011 when work-over operations were conducted on the Ikhil K-35 well and from time-to-time for replenishment of operating supplies, diesel and gravel.

The ice road and overland access will be built to accommodate all of the heavy loads associated with construction and the rig mobilization. Water for the entire winter access will be taken exclusively from the Mackenzie River.

Operations to establish the ice road include ice profiling, flooding of thin ice sections and the initial snow ploughing required for opening the road. Snow and ice will be piled up to form ramps for crossing onto the land. No banks will be cut to access the land. Maintenance snow ploughing of the road will take place to enable vehicle access for the duration of the Project.

The overland access route will be constructed using proven Arctic construction practices. A snow cat will be used to pack the snow cover and then a low-ground pressure vehicle (LGPV) will begin flooding the access. After a base has been established, water trucks with balloon tires will build the ice thickness to achieve a thickness of at least 20 cm (8 inches). Regular water trucks will be used to move water from the Mackenzie River to the LGPVs. A local contractor will be tasked with the development and construction of the entire winter access.

There are several weeks of contingency within the planned schedule to accommodate a delayed freeze-up date and other unforeseen weather events.

5.2 WELL SITE PREPARATION

The well location will be prepared after freeze-up in mid-January 2012 to meet a scheduled spud date of February 1, 2012. The well site will be covered with a 20 cm thick snow / ice pad measuring approximately 100 m by 160 m and will be surrounded by a snow / ice containment berm. The water will be trucked from the Mackenzie River. Snow blades on construction equipment at the well site will be fitted with mushroom shoes to limit potential for damage to the vegetation and soil cover during construction.

A small teardrop gravel pad measuring approximately 10 by 30 m will be placed immediately around the well site area on a liner mat. The first 20 cm of gravel will be placed on the ground prior to constructing the ice pad. The ice pad will then be built around and level with the gravel pad. After the well has been completed and prior to demobilizing the equipment, the gravel pad thickness will be increased to a thickness to 1 m or more.

5.3 DRILLING RIG

A small conventional oilfield drilling rig supplied by Akita Equtak, with a rated capacity of 1,400 m, will be used to conduct the drilling. The drilling rig, well consumables and well service equipment will be trucked from southern Canada to Inuvik in mid-January and staged at Akita Equtak's property in Inuvik. Construction equipment and rig mobilization equipment will be sourced in Inuvik from Inuvialuit companies wherever possible.

The rig will be mobilized from the staging area to the well site, using the winter access, in late January 2012. The rig will be placed on rig matting on top of the snow / ice pad. This procedure, which has been used in the past, will protect the ice pad from melting.

All stationary fuel tanks will be double walled or will be located within a self-berm skid. Refuelling of vehicles will take place using approved conventional fuel transfer equipment. The staging and drilling facilities will be located at a minimum of 100 m away from any existing water body.

To support local businesses, construction and support equipment, supplies, and fuel will be procured locally, to the greatest extent possible.

5.4 CAMP

A 60 person rated camp will be sourced from Akita Equtak as that camp is already in Inuvik. The camp will be mobilized from the staging area in Inuvik to the well site using the winter access in late January 2012. The camp will be placed on rig matting on top of the snow / ice pad. This procedure, which has been used in the past, will protect the ice pad from melting. Additionally, the camp will be located at least 100 m away from any existing water body.

To support local businesses, construction and support equipment, catering services, supplies, potable water and fuel will be procured locally, to the greatest extent possible, and transported from Inuvik to the Project site using the winter access.

The camp will be a standard winterized Atco Structures site camp that will be hauled to the site by trucks (an estimated 21 loads for the camp structure, 2 loads for the generators, one load for the sewage tank and 3 loads for rig matting). The units will be installed on rig matting when they arrive at the lease.

The camp consists of the following units:

- Unit #1 (12 feet [ft] x 54 ft) - 8 man bed unit;
- Unit #2 (12 ft x 54 ft) - 4 man bed and dry stores unit;
- Unit #3 (12 ft x 54 ft) - 1 man bed, freezers, washroom unit;
- Unit #4 (12 ft x 54 ft) - 3 man bed, kitchen unit;
- Unit #5 (12 ft x 54 ft) - 3 man bed, dining room unit;

- Unit #6 (12 ft x 54 ft) - 3 man bed, dining room unit;
- Unit #7 (12 ft x 54 ft - 3 man bed, washroom unit;
- Unit #8 (12 ft x 54 ft) - 8 man bed unit;
- Unit #9 (12 ft x 54 ft) - 7 man bed unit;
- Unit #10 (12 ft x 54 ft) - 3 man bed, washroom unit;
- Unit #11 (12 ft x 54 ft) - 3 man bed, lounge unit;
- Unit #12 (12 ft x 54 ft) - 3 man bed, lounge unit;
- Unit #13 (12 ft x 54 ft) - 3 man bed, recreation room unit;
- Unit #14 (12 ft x 54 ft) - 8 man bed unit;
- Unit #15 (12 ft x 60 ft) - office unit;
- Unit #16 (12 ft x 60 ft) - office unit;
- Unit #17 (12 ft x 60 ft) - office and first aid unit;
- Unit #18 (14 ft x 30 ft) - mud room unit;
- Unit #19 (14 ft x 30 ft) - laundry unit;
- Unit #20 (12 ft x 48 ft) - water treatment and storage unit; and
- Unit #21 (12 ft x 48 ft) - water treatment and storage unit.

Two generators will be used; they measure 12 ft x 40 ft and are each equipped with a double walled 19,000 Litre (l) fuel tank. The estimated consumption of the units is 2,700 l per day. Fuel will be resupplied on a weekly basis using fuel trucks from Inuvik.

During camp operations, all wastewater will be stored in a 400 barrel heated sewage storage tank (12 ft diameter and 20 ft high). On average, there will be one vacuum truck per day scheduled to remove sewage from the tank and transport it to Inuvik for disposal.

Water from the Mackenzie River will be stored and treated to potable water quality standards in the water treatment modules. Alternatively, potable water may be trucked from Inuvik.

All garbage will be collected, sorted and stored in wildlife proof containers. All waste will be transported off-site and disposed off at appropriate facilities (Section 7).

5.5 PIPELINE TIE-IN TO NEW WELL

The K-35 wellsite production equipment and flow line will be purged, dismantled, and inspected for its suitability for reuse on the new well. It is anticipated that all of the K-35 production equipment will be reused. The new pipeline connecting the new UGFI 02 / J-35 well with the production facility will be aligned with the existing J-35 pipeline to the greatest extent possible.

5.6 DRILLING PROGRAM

Conductor, Rat Hole and Mouse Hole

An auger rig will be brought to location to construct a cellar of 2 m in diameter and set a cellar cribbing, then drill and set 20 m of 508 millimetres (mm) by 339.7 mm insulated conductor pipe, this conductor pipe will be cemented using permafrost cement.

The rig will then drill both the rat hole and mouse hole prior to departing from the location. The conductor hole, mouse hole and rat hole will be drilled dry.

Move In and Rig Up the Drilling Rig

The rig will be moved in and fully rigged in, fully winterized and a rig inspection will be conducted jointly by the rig manager and the company supervisor, prior to undertaking any drilling activity. Rig up will include rigging in a 339.7 diverter system for drilling the surface hole.

Drilling the Well

Upon completing the rig inspection, the rig manager and company supervisor will conduct a safety meeting and review the drilling plan with the rig crews and the service company representatives prior to undertaking the drilling activity.

The well will be spudded with a 311 mm bit; drilling will proceed to surface casing setting depth which will be approximately 420 m Kelly Bushing (KB). The casing shoe will be set a minimum of 20 m below the unconsolidated Alluvial Plain into the more consolidated Delta Plain. Wiper trips will be conducted as necessary while drilling the surface to ensure good well cleaning. Prior to reaching casing setting depth (no less than 10 m and no greater than 15 m above the estimated casing setting depth), the drilling tools will be pulled from the well and all tools will be double measured to confirm actual drilled depth.

Note that this well may be deviated and may be directionally drilled prior to setting the surface casing.

Drilling fluid will be cooled for this section of the well, temperature will be maintained between minus 2 and plus 2 degrees Celsius (^{0}C) to the greatest extent possible.

Upon reaching the casing setting depth, the well and drilling fluid will be conditioned to run casing. While conditioning the well, the drill string will be reciprocated; a short trip of a minimum of 20 singles will be conducted. After the “dummy trip” has been completed, the well will be circulated for a minimum of two bottoms up time or until the shale shakers have minimal cuttings observed to be coming from the well.

After the well and drilling fluids have been conditioned, “pull out of hole” (POH) will follow to run casing.

While drilling the surface hole, crews will prepare and visually inspect the 244.5 mm casing prior to running the casing into the well, also all casing running tools will be prepared and inspected to ensure "rig to run casing time" required is kept to a minimum.

Rig to Run 244.5 mm Surface Casing

All casing will have been cleaned, visually inspected and drifted with a proper sized rabbit to ensure the casing has not sustained any damage while in transit.

The casing will be spaced to be within 1 m off of the bottom of the well drilled depth, with the top casing collar to be within a minimum of 0.5 m and a maximum 1.5 m above the rotary table. This is to ensure that all of the handling of cementing heads can be conducted safely.

The circulating head will be made up and the well will be reciprocated and circulated to condition the well and drilling fluid until the well returns are clean at the shale shaker and the well drag, if any, has been removed.

Upon completing well conditioning operations, the casing will be set as low as possible at the rotary table and the casing cementing head will be made up to conduct the first stage of the cementing program.

After the cementing head has been made up and the cement lines have been attached, management and supervisors will conduct a pre-cement safety meeting. After the job safety meeting has been conducted, the first stage of the detailed cementing program will be carried out.

The casing will be reciprocated while cementing and the casing will be set as close to the bottom as possible.

Samples will be caught throughout the cement mixing sequence and placed in a water bath with a temperature range between plus 5^0C and minus 5^0C to monitor the cement setting progress.

After the first-stage cementing program has been completed, the following processes will occur:

- the float will be bumped and confirmed to be holding;
- the casing cement stage tool will be opened; and
- the upper portion of the well will be circulated until the first stage cement has achieved an initial set that is able to support the upper cement column.

After the initial set has been achieved on the first stage lower cement, circulating equipment can be rigged out and preparations for conducting the second-stage of the cementing program can proceed.

The second-stage cementing will be conducted using a drill pipe (DP) inner cementing string, install base of the cementing head to top casing collar and pick up DP cementing string as per the detailed cementing program including the following steps:

- run the cementing string to approximately 10 m above the opening ports of the casing cement stage tool;
- make up the upper cementing head assembly and establish circulation;
- pump a minimum of 2 times bottoms up to ensure annulus is free and clean prior to undertaking cementing operations;
- make up surface cementing head, conduct pre-cementing safety meeting as per the first stage and undertake cementing program;
- conduct pressure test for leaks, and cement casing as per detailed cementing program;
- catch samples of the cement mix throughout the cementing activity, place samples in a water bath of approximately 1^0C and monitor the cement setting progress;
- continue mixing and pumping cement until cement returns have arrived at surface;
- when cement returns are observed at the surface, the cement mixing will be stopped and the plug launcher released. The stage tool will be closed as per service company representative instructions;
- after stage tool has been closed bleed back running string and measure volume of flow back, flow back should not exceed 0.5 m^3;
- monitor the conductor and casing annulus, to ensure that the cement does not drop back;
- while waiting on cement (at least 24 hours), weld on the casing bowl;
- prepare to and rig up the blow-out-preventers (BOP);
- after BOP rig up has been completed, pressure test BOP, kill and choke manifold, Kelly cock, and all of the auxiliary well control equipment;
- when pressure testing the blind rams also pressure test the casing to 14,000 kilo pascal (kpa); and
- log and record all pressure tests.

Main Hole Section

Upon drilling out the casing shoe, a new hole of a maximum of 5 m in diameter will be drilled. The well will be circulated to a uniform mud weight and a pressure integrity test (PIT) casing shoe test conducted.

After the casing shoe test has been completed, the well will be drilled and directionally steered to the bottom well coordinates that will be determined. The well will be drilled to within 10 to 15 m above the top of the projected productive sand.

The drilling tools will be tripped out of the well and the directional tools will be taken out of the drilling assembly.

When the drilling fluid parameters, as determined in the drilling fluid program, have been achieved, the drill ahead to total depth will commence and the drilling fluids returns monitored closely.

Upon reaching the total depth, the following procedures will apply:

- the well and drilling fluid will be conditioned by circulating and reciprocating the drill string for a minimum of three bottom ups time has been achieved;
- after circulating and conditioning the well, make a wiper trip to the casing shoe and ensure pulling and running pipe speeds do not cause excessive hydraulic surges;
- when back on bottom continue to circulate and reciprocate the drill string and condition the well to run electric logs;
- pull out of the well to log, double strap the drill string to confirm final depth;
- rig to and run logs;
- after the logging program has been completed, run into the well with a short bottom hole assembly to condition the well for casing;
- while circulating and conditioning the well and the drilling fluid to run casing, reciprocate the drill string slowly and monitor the returns for both fluid losses and volume of cuttings that are coming over the shale shakers;
- after the well and drilling fluid have been conditioned, pull out of the well to run casing;
- rig to and run casing as per the detailed casing and cementing program, care must be taken to torque all of the casing connectors to the manufactures specification;
- run the production casing string and cement the casing using a two stage cementing program; and
- while logging the well, crews will prepare and inspect the casing string, the casing will be numbered and double measured, all casing will be drifted with a full size rabbit, to ensure it meets manufacturer's specified drift clearances.

5.7 COMPLETION PROGRAM

The main objective of the completion / testing program is to gain direct pressure and flow characteristics of Upper and Lower Aklak gas sands at 1,050 m TVD and 1,150 m TVD (estimated), respectively. The final depths and zones to be looked at will be confirmed post open hole logging of the well bore.

The planned testing program is as follows:

- tests during the drilling may be done to measure initial flows and pressures from the potential gas sands, these tests will be done during the drilling phase;

- after post drilling evaluation the well will be cased if there are indications of commercial natural gas in the wellbore;
- the completion will commence after appropriate time intervals to allow for Production casing cement to cure and reconfiguration of on-site equipment for the pending flow tests;
- potential zones will be perforated and flowed to contained systems that will allow for the measurement of gas rate, temperatures and pressures; the produced natural gas will be flared to atmosphere; down hole pressure data will be gathered;
- it is anticipated that gas flared volumes will reflect the anticipated reserves being investigated and will be specified by the NEB re testing and flare volumes;
- flare volumes will be kept to a minimum that will allow for the establishment of the reserve potential being tested;
- the surface equipment that will be utilized will be sized and of a suitable pressure rating for the service intended;
- gas, liquid samples and flows will be gathered, analyzed and data made available to regulators;
- all liquids produced will be gathered on site, retained in tanks and transported to an appropriate disposal system;
- the zones are expected to produce sweet natural gas with no associated H_2S; reserve potential has been identified but it is not possible to quantify numbers until this testing is completed; and
- the testing program is expected to take 10 days.

5.8 EQUIPMENT

Table 5.1 provides a preliminary list of equipment that will be required to complete the Project.

Table 5.1 Preliminary Equipment List for the Project

Equipment	*Quantity*
Akita Rig 14	1
60 person camp (including associated equipment)	1
Truck shop	1
Double walled fuel tank, 50,000 litres	1
Loader	2
Snow plough	1
Caterpillar	1
Water truck	1

Equipment	Quantity
Vacuum truck	1
Drilling Supervisor pickup	1
Rig Manager pickup	1
Ambulance	1
Service company pickup	3

5.9 PERSONNEL

Table 5.2 outlines the approximate number of personnel required for completion of the Project. The table outlines the total number of personnel required for the Project; however, there are a maximum of 60 people on-site at any given moment during the Project.

Table 5.2 Personnel Required for the Project

Position	Drilling Well	Testing Well
Drilling crew	15	15
Rig manager	1	1
Drilling supervisor	2	2
UGFI observer	1	2
Logistics supervisor	1	1
Water / vacuum truck operator	3	2
Loader operator	2	2
Roustabout	4	4
Catering service	6	6
Wildlife Monitor	2	2
Environmental Monitor	2	2
Medic	1	1
Mud service	1	1
Cementing	2	1
Mud logger	2	-
Mud cooler / watcher	2	-
Power tong operator	2	2
Electric wireline logging	3	3
Slick line truck and operator	-	2
Perforators	-	2
Packers / down hole tool operator	-	1
Capilary string operator	-	1
N2 truck and operator	-	2
Coil tubing truck and operator	-	2
Pressure tank testing supervisor	-	2
Pressure tank crew	-	4

Position	*Drilling Well*	*Testing Well*
Well service supervisor	-	1
Testing supervisor	-	1
Wellhead technician	-	1
DTS cable monitoring	3	1
Total	**55**	**67**

5.10 WATER NEEDS AND SOURCES

Water that will be used for construction of the entire winter access, the snow / ice pad and for camp use, if required, will be obtained from the Mackenzie River channels. The intake hoses will be screened according to current regulations to avoid fish entrainment (DFO 2005). The NWT Operational Statement for the construction of Ice bridges and snow Fills (DFO 2010) will be followed.

No water will be taken from a land-locked water body where drawdown and related fisheries concerns may be an issue. Potable water will be provided to the camp either by treating river water or by truck from Inuvik.

It is estimated that daily water needs will be above 100 cubic metres (m^3) during winter access construction. A Class B water licence from the NWT Water Board will be applied for.

5.11 WASTE MANAGEMENT

UGFI is responsible for all waste products generated from the Project and will manage the waste materials, to minimize any potential threat to the environment or to public health. UGFI will ensure that waste handling and disposal procedures are carried out in accordance with all applicable legislation including NEB waste treatment guidelines, Government of the Northwest Territories waste management and disposal guidelines, Department of Transportation rules and regulations, and others. All waste generated during the Project will be transported off-site. An integrated waste management system will be used to ensure that wastes generated by the proposed Project are disposed of in a manner that does not adversely affect the environment, public health, or safety.

The disposal of all waste generated by the Project, whether they are disposed of in Inuvik or at another site (outside of the territory), will be manifested. This will provide a record of the volume / mass of waste produced and disposed of and where and when the disposal took place. All information generated on waste treatment and disposal will be maintained in a UGFI database to allow for easy and rapid report generation.

5.11.1 Garbage and Solid Wastes

Solid waste material will be segregated into non-hazardous waste matter, hazardous wastes, recyclable beverage containers and recyclable metal / machinery types. The waste materials will be collected, compacted, and stored in suitable wildlife proof containers and shipped for

disposal at an authorized waste facility. Non-hazardous waste will be disposed of at the Inuvik dump site. Recyclable metals or machinery will be trucked south to a site where they can be sold or disposed of. Recyclable beverage containers will be recycled through the NWT *Cash in your Trash* program in Inuvik. Hazardous wastes will be trucked to the Swan Hills Hazardous Waste Disposal plant or other site as applicable.

5.11.2 Sanitary Wastes

All wastewater will be confined in a separate lined and heated tank (Section 5.4) and regularly trucked to Inuvik for disposal. The sewage truck will be used only for transportation of raw sewage to the Inuvik sewage facility.

5.11.3 Hydrocarbons

Accidental spills on-site will be segregated and cleaned up using absorbent material which will then be transported off-site. Areas potentially subject to small spills or oil leaks (such as the refuelling area) will have berms and drip pans in place to provide containment, and then any contaminated material or liquid waste will be drained into an oily waste holding tank. The wastes will then be placed in drums for appropriate disposal off-site.

5.11.4 Drilling Wastes

During the drilling process solid and liquid drilling fluid components will be separated on- site. To the greatest extent possible, the fluid portion will be reused in the drilling fluid. At the conclusion of the Project both solids and liquids will be transported to Ft. Nelson BC or another approved disposal site. No drilling waste sumps or pits will be constructed on-site.

5.12 DEVELOPMENT TIME TABLE

The proposed schedule for carrying out all of the work associated with the drilling and tie-in of the proposed well is provided in Table 5.3.

Table 5.3 2011/2012 Proposed Drilling and Completions Schedule

Activity	*Approximate Date*
Submit PD to EISC	October 3, 2011
Submit water license application to NWT Water Board	Early November
Submit land use permit application to ILA	Early November
Submit permit application to DOT	Early November
EISC decision	Mid-November, 2011
Submit drilling application to NEB	Mid-November, 2011
Commence ice road construction	Mid-December 2011
Commence well site construction	Mid-January 2012
Mobilize rig and well consumables to Inuvik	Mid-January 2012
Mobilize rig and camp to Project location	3rd week of January, 2012

Activity	*Approximate Date*
Spud well	February 1, 2012
Well completed	March 1, 2012
Facilities moved and well tied in	Mid-March, 2012
All equipment demobilized, location cleared	3rd week March, 2012

6 NEW TECHNOLOGY

Use of existing, proven technology is planned for the Project. The Project technology has been selected because of its simplicity, safety and proven track record in the North. New technologies will be evaluated as they arise.

7 ALTERNATIVES

This Project will be completed on previously disturbed land. No sumps will be constructed and winter access follows established routes. No alternatives to this low-impact method have been identified.

8 TRADITIONAL AND OTHER LAND USES

The majority of the Ikhil Gas Project is located within Inuvialuit Private Lands as described under Section 7(1)(a) of the *Inuvialuit Final Agreement* (IFA; 1984). Within this area, both surface and subsurface rights are held, with the ILA administering the lands. The extreme south portion of the Ikhil pipeline and associated facilities are within the Town of Inuvik's boundaries (Golder 1997c; Webb and McDougall 1996).

The components of this 2011/2012 Project are located solely within Inuvialuit 7(1)(a) lands (Figure1 and Figure 2).

The Project falls within the Planning Areas of Inuvik and as identified in the two Inuvialuit Community Conservation Plans (Inuvik ICCP 2008; Aklavik ICCP 2008). The communities have identified a number of special, designated areas that overlap with the Project area or occur in close proximity (Community of Inuvik *et al.* 2008; Community of Aklavik *et al.* 2008). These areas are described in Table 8.1.

For the purpose of this Project, the Inuvik ICCP will be considered the most relevant because of its closest proximity to the Project compared to the other ICCPs. In the previous version (Community of Inuvik *et al.* 2000), the Inuvik ICCP classified the Ikhil Gas Project's (and with that the proposed 2012 Project's) location as *Management Category B* lands.

However, the updated version of the Inuvik ICCP (2008) shows that the land use category for the area in which the Ikhil Gas Project is located has been modified. It now lies within

Management Category E, which calls for stricter protection measures than the original *Management Category B* designation.

The ICCP provides the following definitions for site area designations within the ISR:

Management Category B Lands - 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.

Management Category E Lands - Lands and waters where cultural or renewable resources are of extreme significance and sensitivity. There shall be no development on these areas. These lands and waters shall be managed to eliminate, to the greatest extent possible, potential damage and disruption. This category recommends the highest degree of protection in this document (Community of Inuvik et al. 2008).

Table 8.1 describes special areas that have been identified as important for harvesting activities.

Table 8.1 Special Designated Areas within the Project Area

Special Designated Area / Management Category	***Description***	***Reason for Designation***
Site 701B	Bluenose-West Caribou Herd Winter Range	Important winter habitat for Bluenose-West caribou
Reindeer Reserve[1]	Reindeer Reserve, including Winter Reindeer Range	Rangeland for semi-domestic reindeer herd (no restrictions on development activities); harvesting of the herd has occurred in the past and may again in the future
C2-2G and C2-3G	Grizzly Bear Management Areas; Aklavik-Inuvik and Inuvik	Habitat for grizzly bears
702B	Caribou Hills	Unique successional plant life (transition zone between alluvial taiga and low tundra habitat), berry picking, granular deposits

[1] Identified by DFO 2002.

The west-facing slopes of Caribou Hills were recommended for protection by Panel 9 of the International Biological Programme (IBP) in the 1970s as IBP Site No. 9 because of its unique vegetation (Eng and Green 1998). The Ikhil Gas Project was located to not interfere with this IBP site (Golder 1997c).

The IBP designation and other additional special classifications of various sections of the Caribou Hills (e.g., the Caribou Hills Natural Area of Canadian Significance through Parks Canada; Webb and McDougall 1996) have not been found to result in any additional formal protective measures.

Fish and wildlife are harvested by the Inuvialuit around the Project area, with cabins in the vicinity used throughout the year for hunting, trapping and fishing (Webb and McDougall 1996).

In the Reindeer Station vicinity (just south of the Project area), berry picking is an important activity (Community of Inuvik *et al.* 2008; Webb and McDougall 1996).

The Bluenose-West and Cape Bathurst barrenground caribou (*Rangifer tarandus groenlandicus*) herds are considered important for traditional harvesting, and the Project area may overlap with their winter ranges (Inuvik ICCP 2008; Geomatics 2002). Semi-domestic reindeer (*Rangifer tarrandus tarrandus*) within the Reindeer Reserve may also be harvested in different years (DFO 2002; L. Binder, pers. comm. 2007). Grizzly bears are hunted in certain seasons, with a quota being distributed through local HTCs to communities throughout the ISR (Community of Inuvik *et al.* 2008).

Residents from Inuvik, Tuktoyaktuk, Aklavik and other surrounding communities have traditionally harvested the Bluenose-West and Cape Bathurst caribou herds (Advisory Committee for Cooperation on Wildlife Management [ACCWM] 2011). Concerns for the size of the Bluenose-West caribou herd has been growing since the late 1980s, and surveys have indicated that the herd's population is decreasing. The population decreased from over 106,000 adults in 1987 to less than 18,000 in 2009 (GNWT, ENR 2011b; Section 10.5.1). All resident, non-resident and commercial harvesting ceased in March 2006 within the ISR. Only subsistence harvest of those herds is now allowed around the Project area (ACCWM 2011).

9 COMMUNITY CONSULTATION

Formal consultations were conducted on August 24th, 2011 (meeting with the Inuvik HTC, and September 26, 2011 (Community Consultation Meeting) in Inuvik to discuss Project plans, community concerns and proposed mitigations. Through this process, the community and local organizations were notified of the Project schedule and the technical details of the Project.

Five HTC members attended the meeting with the Inuvik HTC on August 24th, 2011 at the Inuvik HTC office. UGFI (represented by four members) gave a PowerPoint presentation and a detailed discussion followed. Topics involved the anticipated timeline, the processes involved in drilling the new well, the role of Environmental Monitors and the potential for post-Project inspection. Questions and Answers from this meeting are summarized in Table 9.1 and details are provided in Appendix C. On August 25th, 2011, the Inuvik HTC issued a letter to UGFI stating that the members have no concern with the Project (the letter is provided in Appendic C).

For the Community Consultation meeting on September 26th, 2011 (at Ingamo Hall), community members were invited to participate in the evening information sharing / formal presentation session through advertising in the Inuvik Drum newspaper (1/4 page advertisement). The advertising was issued for three consecutive weeks prior to the consultation meetings (on the 8th, 15th and the 22nd of September).

UGFI (represented by four participants) provided the five community attendees with a detailed PowerPoint presentation (Appendix B) describing the background of the existing Ikhil Gas Project, the processes involved in drilling the new well, the proposed time frame and anticipated employment possibilities during the Project. Questions from the attending community members

and answers from UGFI followed after a dinner break. Table 9.1 summarizes these questions and answers and a detailed description is provided in Appendix C.

Table 9.1 August / September Community Consultation Summary

Date and Location	*Attendees*	*Questions*	*Answers*
August 24, 2011 (5 to 6.30 pm); HTC office	Four representatives of UGFI; Five representatives of the Inuvik HTC	Can HTC Members be involved in environmental inspections after Project completion?	Yes, that can be arranged.
		Will Environmental Monitors have the authority to voice concerns?	Yes, we had incidents in the past where minor spills were detected and remediated.
		Is the time frame realistic?	Yes, down south we would drill such a well in four to five days. We allowed plenty of extra time.
		Do you know of any Project related slumps in the area?	No, there are no slumps caused by the Project.
September 26, 2011 (6 to 7.30 pm); Ingamo Hall	Four representatives of UGFI; Five representatives of the Inuvik Community	Will there be any drilling wastes deposited at the site?	No, we will not construct any sumps. All wastes will be transported off-site and disposed of appropriately.
		How likely is it that the new well will be dry?	Not likely, it is very close to the producing J-35 well.
		Could the new well encounter the same problems that K-35 encountered?	No, K-35 is structurally lower. The new well will be drilled structurally higher.
		Will any barging be involved?	No, we will truck everything.
		The schedule seems tight. Did you allow for weather days?	The schedule is very generous. It accounts for extra time that may be needed.
		Do you have all your approvals for the Project in place?	No, we are starting this week with the EISC submission and are in contact with the NEB and ILA as well. They all know of our plans.
		Is a final decision reached whether you will drill the well this year?	No, not yet. But we need to start getting the approvals in place in the case that partners decide to move ahead.
		Do you foresee any issues with the approval process?	No, all should be straight forward. We are talking to the regulators and the HTC has provided us with an approval letter.

10 ENVIRONMENTAL OVERVIEW

Information on existing environmental conditions for the Project area was gathered from previous environmental assessments (e.g., Golder Associates Ltd. [Golder] 1997a) and studies, and personal communication with regulators. Additionally, in the summer of 1997, an ecological and archaeological field survey was conducted that assessed the entire Ikhil Gas Project area

(Golder 1997b). Later that year, an Environmental impact Assessment for the Ikhil Gas Project was submitted to the NEB (Golder 1997c).

For the purpose of this document, species with special conservation status will be considered those that do not have a secure status as a species within the NWT or Canada. Three classification systems for ranking these species will be considered.

Species may be ranked under the Government of Canada's *Species at Risk Act* (SARA), first legislated in 2003 (SARA 2011). SARA designates a national classification for species that have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). These include species designations as "special concern" (may become "threatened" or "endangered" from combination of biological characteristics and identified threats), "threatened" (may become "endangered" if not protected from factors leading to extirpation or extinction), "endangered" (facing extirpation or extinction), "extirpated" (no longer existing in Canada but does elsewhere in the world), and "extinct" (no longer existing anywhere) (SARA 2011). If a species becomes listed as "extirpated", "endangered" or "threatened", people are legally prohibited from killing, harming, harassing or capturing species individuals, nor can they damage or destroy their habitat (SARA 2011).

In addition, there are three schedules that species can be listed under. Species listed under Schedule 1 of the *Species at Risk Act* include those species officially listed by SARA. Species that had been listed by COSEWIC prior to October 1999, but have not been officially protected yet under SARA, are listed under Schedules 2 and 3 (SARA 2011). The species listed under Schedules 2 and 3 are required to be assessed within a certain timeframe.

COSEWIC was created in 1977 to provide a sound assessment of Canadian species and develop a national classification for wildlife species at risk. In 2003, it was established under SARA's mandate to act as its advisory body, and it continues to provide ongoing evaluations of the status of Canadian species. The committee uses the same designations as SARA does for species classifications, but these rankings are not necessarily accepted by SARA (COSEWIC 2011).

The Government of the Northwest Territories' (GNWT) Department of Environment and Natural Resources (ENR) has established an assessment program for species found within the NWT (GNWT, ENR 2011a). Since 1999, the GNWT has been collecting information on species and has developed the NWT General Status Ranking Program to be used as a tool for conservation management. Under this program, species ranks must be reviewed every five years. Species may be ranked as "at risk" (have been assessed in detail or ranked by COSEWIC as "threatened" or "endangered"), "may be at risk" (may be at risk of extinction or extirpation; the highest rank for species under GNWT General Status Ranking system), "sensitive" (may require protection to keep from becoming at risk), "secure" (not at risk or sensitive), "undetermined" (insufficient information to determine status), "not assessed" (not assessed under program), "alien" (introduced through human activities), "extirpated / extinct" (no longer found in the NWT / world), "vagrant" (infrequent and / or unpredictable occurrences, outside normal distribution range) and "presence expected" (species not yet recorded but expected to occur in the NWT).

In 2009, the GNWT passed the *Species at Risk (NWT) Act* to fulfill the NWT's commitment to effective legal protection of the territory's flora and fauna (GNWT, ENR 2010). It also describes the processes to assess, list, protect and recover species at risk specifically for the NWT. The *Species at Risk (NWT) Act* applies to any wild animal or plant species managed by the GNWT on public and private lands, including private lands owned under a land claims agreement. The act was designed to complement SARA and other legislation, and assessments follow the same procedure as described above for SARA (GNWT, ENR 2010). Species occurring in the NWT listed under SARA and / or COSEWIC are considered as well in the *Species at Risk (NWT) Act.*

10.1 REGIONAL SETTING

The Caribou Hills are located adjacent to the MacKenzie Delta, paralleling the East Channel of the Mackenzie River. The rolling, hilly terrain is composed dominantly of glacial till. The hills lie in the Southern Arctic Terrestrial Ecozone. Typically, the Southern Arctic Ecozone terrain consists largely of strongly rolling lowland and plains. Much of it is mantled by glacial moraines. Throughout the ecozone, there are exposures of bedrock; most of the outcrops belong to the Precambrian Shield group. Lakes are very common (Canadian Heritage 2000).

The Southern Arctic Ecozone represents a major area of vegetation transition, as most ecozones that lie to the south are treed. This zone contains trees but also major shrublands and tundra. The size of shrubs decreases rapidly towards the north, with very low and flattened plants being most characteristic of the northern and central locales. Typical shrubs include dwarf birch (*Betula glandulosa*), willows (*Salix spp.*) and ericaceous species; these are commonly mixed with various herbs and lichen. Wetlands are common in low-lying areas, mainly supporting sedge-moss covers (Canadian Heritage 2000).

10.2 WEATHER AND CLIMATE

Long, cold winters and short, warm summers characterize the region. Daylight hours vary significantly during the year due to the high latitude. Darkness prevails between the beginning of December and early January, and January is normally the coldest month of the year. Mean daily temperatures in the area range from a low of -29.4°C to a high of 13.3°C (Canadian heritage 2000).

Persistent temperature inversions are a feature of the region, particularly in winter. Fog occurrences are common on the Delta in spring, and again in September-October. Ice fog occurs at Inuvik and elsewhere on cold, calm winter days (Golder 1997a).

In the Project area, prevalent strong winds are from the northwest and southeast, often baring upland ridges and creating drifts in the lees of hills (Slaney 1974).

It normally rains in this area during the period May to late September with peak rainfall occurring during July and August. Although snowfall occurs only on rare occasions during June, July and August, it may occur in any month of the year. Most snow tends to fall beginning in late September through early November, with a secondary maximum snowfall occurring in March

and April. Continuous snow cover generally lasts from mid November through to the end of April (Golder 1997a).

10.3 TERRAIN AND SOILS

The Project region is composed of distinctive Delta landforms. These landforms include wetlands, active alluvial channels and estuarine deposits which have been deposited to form thick Deltaic sediment overlying bedrock beneath. Regosolic static cryosols and gleysolic static cryosols are the dominant soils in the active Delta portion of the area, but organic and turbic cryosols may be found in the area as well (Canadian Heritage 2000). Cryosols are composed of either minerals or organic material and they are characterized as having permafrost within 1 to 2 m of depth. They are the characteristic soil types in permafrost environments and are circumpolar in distribution (Tarnocai 2005). In the eastern portions of the Project area, the Caribou Hills are composed primarily of thin Quaternary sediments and gravels, sands and glacial tills (Indian and Northern Affairs Canada [INAC] 2005).

Sensitive surficial terrain areas encountered within the Project area include the eroded banks of the Mackenzie River and associated channels of the Delta.

Permafrost is rock and soil that remains below 0^{o}C for at least 2 years. The greater part of the Project area is likely underlain by discontinuous permafrost (50-90% permafrost; NRCan 2003) with the eastern portions of the Project area laying on continuous permafrost (90-100% permafrost). Areas of discontinuous permafrost are typified by soils with low to medium ice content and occasional ice wedges (Natural resources Canada [NRCan] 2003).

Overlying the permafrost is an active layer, the portion of the surface soil subject to seasonal freezing and thawing. The thickness of the active layer is dependent on numerous variables including type and extent of the vegetation cover, thickness of the surface organic matter, the moisture content, topographic characteristics and insulating effects of snow cover (Tarnocai 2004).

The proposed Project is located in rolling glaciated upland adjacent to the Caribou Hills escarpment. The escarpment colluvium is rated as “sensitive terrain” (Category 7), while the adjacent upland lies within the next lower sensitive category (Category 6; Environmental-Social Committee 1975). Retrogressive thaw flow slides can occur on vegetated colluvial slopes after disturbance.

The upland area round the well sites is overlain with morainal overburden and thus is topographically irregular. Crests of the Caribou Hills are comprised of reasonably well-drained deposits with a thin active layer and little ice. Depressions between the crests have poor drainage and may contain lakes, wet meadows and polygonal terrain. Peats and organic silts occupy lower slopes and topographic lows, often containing sheets or lenses of ground ice within polygons. Intermediate levels, including lower hill tops, feature silty till with pockets of sands and gravels and may also contain ground ice (Golder 1997c).

10.4 VEGETATION

10.4.1 Vegetation Communities

The Project is located north of the treeline. The upland area of the Caribou Hills in the vicinity of the Project features a dwarf shrub-heath vegetation type on small knolls, tussocks or hummocks, with lichens dominant on well-drained areas and sedges on poorly drained areas. Cottongrass or sedges are common in low areas, with low shrubs along drainages and around some water bodies. Polygonal patterns have been observed in surface deposits of sedge peat. The existing K-35 Ikhil well site supports a high, dense growth of domestic grasses resulting from previous restoration activities (Golder 1997b; IMG-Golder 2010).

A 1997 vegetation survey along the entire Ikhil Gas Project area describes the vegetation communities and their key species composition. The upland area (including the west escarpment of the Caribou Hills) where the proposed Project will be located was described to be composed of the following vegetation communities:

- tundra tussock;
- marsh / lake edge;
- sedge meadow;
- riparian complexes;
- low shrub; and
- tall shrub (Golder 1997b).

Tussock Tundra

Tussock tundra in the area was dominated by clumps of cottongrass (*Eriophorum vaginatum* and *Eriophorum angustifolium*). The tussocks were firmly rooted to the ground. They were associated with intensive frost action and therefore often occur with frost boils or ice wedges. The interstices were filled with water or wet sphagnum moss. The vegetation surrounding those tussocks was dominated by low shrub vegetation communities.

The tussock zones were often located on the edges of sedge meadows. They were generally composed of cottongrass that forms “tussocks,” or tight clumps of related plants growing from the same individual root system. Several tussock sedge species and cottongrasses intermingled with other grasses were found. Often tussocks are invaded by low shrub species and sphagnum moss (Golder 1997b).

Marsh / Lake Edge

Marsh is distinguished from other wetland forms by the lack of tree or shrub cover. Unlike open, graminoid-dominated fens, marshes require frequent flooding and are associated with fluctuating water levels (Vitt *et al.* 1996). In the Project area, marshes were often associated with shallow open water. For example, marsh communities were evident at the base of the lake

near the Ikhil K-35 well site. The marsh vegetation here and throughout the area was dominated by emergent sedges (*Carex* spp.), cottongrass (*Eriophorum* spp.), rushes *(Scirpus* spp.) and marsh cinquefoil (*Potentilla palustris*). This vegetation community type graded into a sedge meadow community in low-lying areas (Golder 1997b).

Sedge Meadow

Sedge meadows were assessed to be very common in the Project area. Sedge associations develop on nearly level slopes, shallow depressions or adjacent to creeks. The edge of the sedge meadows is drier and is often bordered by low shrub communities. This community type varied according to the moisture regime. Stagnant, ephemeral or permanent flowing water microhabitat conditions cause slight shifts in species dominance. However, for the purpose of this report all wet sedge dominated communities, except for marshes, were classified as sedge meadows.

Sedge meadows were composed of a mixture of plants belonging to the sedge family (Cyperaceae) and related plants that grow in wet areas. Different species of sedges and cottongrasses are the most dominant species. Both sedge and cottongrass occurred along the drainage north of the Ikhil Production Facility. Sedges observed in the project area were dominated by three main species namely, *Carex scirpidea*, *Carex aenea* and *Carex atrofuca* (Golder 1997b).

Riparian Complexes

The riparian complexes that occurred along ephemeral drainages were dominated by riparian willows and alder (*Alnus crispa*) that followed the small ephemeral streams that drain spring runoff into lakes or the Mackenzie River valley from the surrounding upland. Generally, the willows and alder became progressively lower in growth as the streams became smaller. The heads of the streams merged with the overall tundra and low willow shrubs spread out and graded into the surrounding tundra tussocks. The result in the transition area was determined to be a vegetation community that is a hybrid between riparian willow and tussock tundra (Golder 1997b).

Low Shrub

The low shrub community in the area was interspersed with cottongrass tussocks. The shrub vegetation is dominated by dwarf birch, net-veined willow (*Salix reticulata*), Labrador tea (*Ledum groenlandicum*), bell heather (*Cassiope tetragona*), alpine bearberry (*Arctostaphylos alpina*), tundra bilberry (*Vaccinium uliginosum*) and red bilberry (*Vaccinium vitis-idaea*; Golder 1997b). Cloudberry (*Rhubus chamaemorus*), arrow-leaved coltsfoot (*Petasites sagittatus*) and herbaceous forbs were often associated with this community, as were fruticose or shrubby lichens such as reindeer “moss” (*Cladina rangiferina* and *Dactylina sp.*).

Over time, tussock clumps are invaded by low shrub species that succeed to mounds. These mounds or “hummocks” are typically composed of smaller amounts of cottongrass, sphagnum moss, bog rosemary, Labrador tea, blueberry, lingonberry and cloudberry. In drier areas,

hummocks also supported bearberry (*Arctostaphylos uva-ursi*), crowberry (*Empetrum nigrum*) and Labrador lousewort (*Pedicularis Labradorica;* Golder 1997b).

Tall Shrub

The tall shrub community that was evident in northern area reaching the western escarpments of the Caribou Hills was willow dominated and composed of *Salix bebbiana* and *Salix glandulosa.* Characteristic herbs growing in thickets are fireweed (*Epilobium angustifolium*), horsetail (*Equisetum arvense*), buttercup (*Rununculus* spp.), coltsfoot (*Petasites frigidus*), groundsel (*Senecio lugens*) and a number of sedges and grasses (Golder 1997b).

10.4.2 Species with Special Conservation Status and Rare Plants

There are currently no species of vascular plants, lichens, or mosses that occur in the NWT that are listed on Schedule 1, 2 or 3 of SARA (2011). Similarly, COSEWIC does not list any vascular plants, mosses or lichens in the NWT (COSEWIC 2011).

The NWT General Status Ranking Program (GNWT, ENR 2011a) identifies species with status rankings within both the Taiga Plains and Southern Arctic ecozones. Within the Taiga Plains, 136 plant species are considered "sensitive", 85 species "may be at risk", no species are "at risk", 15 species are considered "exotic / alien", and no species have become "extinct / extirpated. Within the Southern Arctic ecozone, 43 plant species are considered "sensitive", 21 "may be at risk", none are "at risk", 1 is considered "exotic / alien", and no species have become "extinct / extirpated". No mosses or lichen in either ecozone are ranked (GNWT, ENR 2011a).

A list of rare plants of the NWT, compiled by McJannet *et al.* (1995), identifies approximately 206 rare species. Rare plants include widespread species that are rare throughout their range, species with only small populations occurring within the NWT, disjunct species with widely spread localities and geographically restricted endemic species. There are potentially six plant species that are considered rare which may occur within the Project area (McJannet *et al.* 1995; Table 10.1). These six species therefore require special attention in terms of mitigation. Most of these species however, potentially occur on the west-facing escarpment to the Mackenzie River, which is to the west of the proposed Project.

Table 10.1 Rare Plants Potentially Occurring in the Project Area *

Family	*Scientific Name*	*Common Name*	*Phyto-geography*	*Habitat*[1]	*Description*
Asteraceae (Asters)	*Erigeron yukonensis*	Yukon fleabane	Boreal	1	Early flowering, white, lilac, pink or purplish flowers.
Brassicaceae (Mustard)	*Smelowskia calycina var. media*	Alpine smelowskia, fern leaf, false candytuft	Arctic-alpine	1,3	White or purple flowers.
Poaceae (Grass)	*Puccinellia poacea*	Floodplain alkali grass	Arctic	3	Goose grass, usually near seashore.
Primulaceae (Primrose)	*Douglasia arctica*	Mackenzie River dwarf	Arctic-alpine	1	Pink or purple flowers.

Family	Scientific Name	Common Name	Phyto-geography	Habitat[1]	Description
		primrose			
Salicaceae (Willow)	*Salix ovalifolia var arctolitoralis*	Arctic seashore willow	Arctic	3	Reddish-brown twigs.
Scrophulariaceae (Figwort)	*Castilleja yukonis*	Indian paintbrush	Boreal	2,3,4,6	Pink or purple upright flowers.

* Source: McJannet et al. 1995.

[1] Classification of habitat: 1-rocky slopes or ridges, sand banks; 2-turfy or heathy slopes; 3-river banks, floodplains, tidal flats, lakeshore; 4-marsh, treed bog, moist areas; 5-meadow, open woods; 6-forest, spruce woods.

No rare plants were observed during a vegetation survey of the entire Ikhil Gas Project area in 1997 (Golder 1997b). Habitat known to support rare plants was more intensively surveyed and samples were collected for subsequent identification. The lack of rare plants was expected since the Project avoided slumped or unstable slopes associated with the escarpment which constitutes terrain where most rare plants have been recorded previously.

10.5 WILDLIFE

The Caribou Hills and the western escarpments are rich in wildlife. Mammals and birds are important in the maintenance of diverse and healthy ecosystems in the region and also are an important cultural resource for harvesting activities by people in the nearby communities of Inuvik, Aklavik and Tuktoyaktuk (Community of Inuvik *et al.* 2008; Community of Aklavik *et al.* 2008; Community of Tuktoyaktuk *et al.* 2008).

10.5.1 Mammals

Mammals considered important to local people have been identified in the Inuvik ICCP (Community of Inuvik *et al.* 2000; 2008) and by IEG (2002) when they conducted habitat suitability modeling for species within the Mackenzie Delta region.

Barrenground caribou (*Rangifer tarandus groenlandicus)* of the Cape Bathurst and Bluenose-West herds and semi-domestic reindeer (*Rangifer tarrandus tarrandus*) may be found in or adjacent to the Project area. Moose (*Alces alces),* grizzly bear (*Ursus arctos)*, black bear (*Ursus americanus*), wolf (*Canis lupus)*, lynx (*Lynx canadensis lynx*), wolverine (*Gulo gulo)*, red fox (*Vulpes vulpes)*, arctic fox (*Vulpes lagopus*), mink (*Mustela vison*), beaver (*Castor canadensis*), muskrat (*Ondata zibethica)*, snowshoe hare (*Lepus americanus*), and brown and collared lemmings (*Lemmus sibiricus* and *Discrostonyx torquatus)* may also be found in or near the Project area (Community of Inuvik *et al.* 2008).

Caribou - None of the barrenground caribou herds in the region are known to currently use the proposed Project area as calving or summer range. The summer forage of primarily cottongrass species and lichen is more readily available on Richards Island, the Tuktoyaktuk Peninsula and other locations north of the Project area. Only the eastern portion of the Caribou Hills is considered to provide suitable summer habitat (IEG 2002).

Animals from the Bluenose-West and possibly the Cape Bathurst herds may come through the Project area during their migrations or in winter (Community of Inuvik *et al.* 2008; Geomatics 2002; GNWT, ENR 2011b). Winter habitat for caribou in the Caribou Hills is considered "suitable" to "optimal" (IEG 2002).

Both herds are reported to have declined in numbers during the last decade (GNWT, ENR 2011b; c). Table 10.2 provides a summary of the Bluenose-West caribou population surveys as determined by the GNWT, ENR (2011b).

Table 10.2 Population Estimates for the Bluenose-West Caribou Herd *

Year	*Estimated Numbers of Adult Animals*	*Range (95% confidence interval)*
1987	106,887	102,233 - 111,542
1992	112,360	86,794 - 137,926
2000	76,376	62,029 - 90,723
2005	20,800	18,760 - 22,840
2006	18,050	17,523 - 18,578
2009	17,897	16,587 - 19,207

* Source: GNWT, ENR 2011b.

Table 10.3 provides a summary of the Cape Bathurst caribou population surveys as determined by the GNWT, ENR (2011c).

Table 10.3 Population Estimates for the Bluenose-West Caribou Herd *

Year	*Estimated Numbers of Adult Animals*	*Range (95% confidence interval)*
1987	12,512	9,012 - 16, 020
1992	19,278	13,881 - 24,675
2000	11,089	9,333 - 12,845
2005	2,434	2,178 - 2,691
2006	1,821	1,672 - 1,971
2009	1,934	1,585 - 2,283

* Source: GNWT, ENR 2011c.

Reindeer - Abundant at the turn of the century, barrenground caribou became scarce in the area in the 1920s. A managed reindeer herd was brought into the region in 1935 as a replacement food source, and a Reindeer Reserve established for them. The size of this semi-domesticated herd has been as large as 13,000 animals (around 1980) but in 2003 was down to 4,000 animals. It is estimated that there were 3000 animals in the herd in 2009 (Maisonneuve 2009). The Reindeer Reserve includes Project area east of the East Channel; these areas also encompass the animals' winter range (DFO 2002). This herd is regularly being harvested (L. Binder, pers. comm. 2007).

Moose - Populations of moose in the Delta are suspected to be limited, with higher concentrations in valleys and riparian areas with abundant willow and growth providing browse

and cover (Community of Inuvik *et. al.* 2008). Riparian zones in the general area have been rated as "optimal" habitat (IEG 2002). Although less abundant than caribou, moose are used as a food resource by the Inuvialuit, both in the communities and while out on the land (Clarkson and Liepens 1989). Moose and their sign were observed in the Project area during a wildlife survey in summer 1997 (Golder 1997b).

Grizzly Bear - Grizzly bears occur year round in low densities throughout the ISR, including the Delta and upland areas (Community of Inuvik *et. al.* 2008). Grizzly bears in the western arctic are known to reproduce slowly due to poor habitat and weather conditions. The majority of known grizzly bear dens in the Mackenzie Delta occur on Richards Island to the north of the Project area, but there may be available denning habitat along the escarpment or in nearby upland soils (Webb and McDougall 1996). The bears den in areas with topographic relief such as lake and channel banks in either tundra areas or within the treeline (GNWT, ENR 20011d). Dens are usually found on south-facing slopes in sandy soils (McLoughlin *et al.* 1999) but they may also be dug into north-facing slopes with deeper snow depths. Dens are typically used from October or November to the end of April or early May. Females give birth in their dens in January or February, with an average litter size of two cubs (GNWT, ENR 2011d).

It is common that dens collapse during the spring breakup period, just after the bears have left their dens. The absence of trees with tall roots (which usually hold the dens in place) and the sandy nature of the substrate in combination with heavy, wet snow are the cause for the observed collapse. Most bears are therefore forced to dig new dens every fall.

ENR, in conjunction with the University of Alberta, started a grizzly bear radio-collaring program in 2003. More than 20 satellite and GPS collars were placed on grizzly bears in the northern region of the Delta and coastal areas during 2003 and 2004. All radio collars were programmed to stop sending signals between November 1 and April 1 each year while the bears are denning (to increase the lifetime of the collars). In many cases, dens cannot be confirmed due to the lack of signals during that period.

All those information sources indicated that there is potential for grizzly bear denning in the general area. All observations had in common, that if there was an obvious change in relief and ground conditions that were stable enough, grizzly bears will den in the area. If bear dens are encountered during the Project activities, they will be avoided by 300 m.

Black Bear - The density of black bears in the ISR is unknown but their habitat preference is typically forested areas. Denning occurs from October to May, with 2 to 3 cubs per litter born in January or February. They are believed to be common and are known to use the Delta including forested areas such as creeks and river valleys (Community of Inuvik *et al.* 2008).

Wolf - Wolves are considered to have an important role in the area (Clarkson and Liepins 1989) and den sites have been located throughout the Caribou Hills, potentially within the Project area. Although wolves have been seen at their dens in late March and early April, they do not typically have pups until late May. Wolves are more common in areas that are regularly used by the animals they prey on, such as caribou, reindeer, and moose, as well as small mammals and birds (Community of Inuvik *et al.* 2008). A wolf research program was undertaken by the

Department of Renewable Resources (now ENR) from 1987-1993 because wolves play a major role in ecosystem function on Inuvialuit land and are an important resource for the Inuvialuit. Caribou are the main prey species for the wolves. Study results have revealed that the wolves use one of two range use patterns. Some wolf packs continue to use relatively small areas and have not undertaken large seasonal migrations with the caribou, while other packs travel in an east and west direction with the caribou. Den sites have been located throughout the Caribou Hills (Clarkson and Liepins 1992). Wolves were observed on the pipeline ROW south of the Caribou Hills (IMG-Golder 2010).

Lynx – Lynx are known to occur throughout the Mackenzie Delta and associated river valleys. Their numbers fluctuate over the years as they cycle with populations of snowshoe hares (Community of Inuvik *et al.* 2008). A lynx was observed on the pipeline ROW south of the Caribou Hills (IMG-Golder 2009).

Wolverine - Wolverine occur at low densities throughout their range, where they periodically roam over large areas in search of prey. Although they are known to occur in the Mackenzie Delta and the Caribou Hills, their density is believed to be low (Community of Inuvik *et al.* 2008). Suitable caves, rock crevices, fallen logs, or snow holes and burrows may be used for shelter wherever they are found, potentially including areas around the Project area (Community of Inuvik *et al.* 2008; IEG 2002).

Arctic fox – Arctic foxes have a circumpolar distribution in North America, Europe and Asia. They mainly inhabit areas north of the treeline such as tundra and pack ice, but have been observed in forested areas (Feldhamer *et al.* 2003). They are likely to use the upland areas of the Caribou Hills and travel along the frozen river channels in the winter.

Red fox - These foxes are found throughout the Delta and other areas within the treeline. Population densities are variable and the animals feed primarily on small mammals such as rodents, birds and carrion. It is highly probable that red foxes occur within the Project area, including slopes in the Caribou Hills area where dens may be excavated and in shrubby areas where prey such as ptarmigan and hares are found (Community of Inuvik *et al.* 2008; IEG 2002).

Beaver - Habitat preferences for beaver are slow moving streams and rivers, ponds and small lakes. They build lodges and dens for protection and raising their young and feed primarily on willow, alder, birch and aspen as well as aquatic vegetation. Within the Project area the habitat suitability for beavers is scattered, with areas in the Caribou Hills having been recorded as poor habitat quality (IEG 2002). Considered to play an important role within the health of the Delta ecosystem through habitat maintenance and subsequent distributions of fish and other animals, beaver can be expected within the general area in streams, river channels and lakes where shores and bottoms are muddy and easily burrowed (Community of Inuvik *et al.* 2008).

Muskrat - The Mackenzie Delta is considered important habitat for muskrat where they feed on aquatic weeds found in river channels and other water bodies. Their numbers cycle naturally, although trapping may have contributed to density changes and possibly population health

throughout the years. They appear to be common today and can be expected to occur across the Delta (Community of Inuvik *et al.* 2008).

Snowshoe hare - Common throughout forested areas of the Mackenzie Delta, snowshoe hare population cycle over approximate 10-year periods. They are important within ecosystems as prey for a variety of mammalian and avian species such as foxes, lynx and eagles. Food sources include shrubby plant species such as willow, but shelter is also a key habitat component (Community of Inuvik *et al.* 2008; IEG 2002).

Brown and collared lemmings - The two species of lemmings that may be found in the region have different vegetation (food) and moisture (habitat) requirements and appear to have distinct habitat associations. Brown lemmings occur throughout the Delta and are typically found in wet areas with suitable vegetation. Collared lemmings are usually found in more northern areas of the Delta (Community of Inuvik *et al.* 2008; IEG 2002).

Additional mammals which may be found within the Project area are listed in Table 10.4. The list does not include any marine mammals (other than the polar bear, *Ursus maritimus*) because it is assumed that they will not migrate up the Mackenzie Delta during the winter as far as the Project area.

Table 10.4 Additional Mammals Potentially Occurring within the Project Area *

Common Name	*Scientific Name*	*Common Name*	*Scientific Name*
Alaska vole	*Microtus abbreviatus*	Muskox[1]	*Ovibos moschatus*
Coyote[1]	*Canis latrans*	Polar bear[1]	*Ursus maritimus*
Hoary marmot	*Marmota caligata*	Porcupine	*Erethizon dorsatum*
Least Weasel	*Mustela nivalis*	River otter	*Lontra Canadensis*
Long-tailed weasel	*Mustela frenata*	Tundra redback vole	*Clethrionomys rutilus*
Meadow vole	*Microtus pennsylvanicos*	Tundra vole	*Microtus oeconomus*
Mink	*Mustela vison*	Yellow-cheeked vole	*Microtus xanthognathus*

* Source: Community of Inuvik *et al.* 2008.

[1] Species unlikely to be found within Project area, but because of expanding and shifting species ranges, or rare sightings of individuals, may possibly occur within the Project area.

10.5.1.1 Mammal Species with Special Conservation Status

Several mammals potentially occurring within the Project area are considered species with special conservation status. Although in April 2005, grizzly bears were removed from Schedule 3 of SARA (SARA 2011) where they were ranked as “special concern”, they are still ranked as “special concern” with COSEWIC (COSEWIC 2011). The western population of the wolverine is listed by COSEWIC as “special concern”.

Mammals listed in the NWT Status Ranking Program include both of the barrenground caribou herds found in the region (the Bluenose-West and Cape Bathurst herds), the grizzly bear and the wolverine; these species are all considered “sensitive” (GNWT, ENR 2011a).

Barrenground caribou - The monitoring of the barrenground caribou herds, including the Bluenose West and Cape Bathurst herds, has resulted in the confirmation of decreasing population sizes since the 1980s (GNWT, ENR 2011b, c).

Mitigation strategies that have been implemented to slow these dramatic population declines include closing hunts for resident, non-resident and commercial hunters (Cape Bathurst herd) and restricting resident hunter and outfitting tags (Bluenose-West herd) and limiting hunts to bulls (GNWT, ENR 2011b, c).

Grizzly bear - Current populations in the NWT are believed to be stable with an estimated 3,500 - 4,000 bears in the territory. Slow reproduction rates, limited suitable habitat such as den sites, and human activities such as harvesting and habitat disturbance may affect grizzly bear populations. The hunting of grizzly bears by non-Aboriginal people is limited or illegal throughout much of the country but is allowed in the ISR. Twenty tags are allocated to HTCs throughout the ISR each year for non-Aboriginal hunters (GNWT, ENR 2011d).

The actual presence of grizzly bears cannot properly be confirmed in or near the Project area without a reconnaissance survey in the fall or early winter when they dig their dens and tracks are visible in the snow.

Wolverine - Although believed to have stable populations within the region, wolverine are considered sensitive to development activities such as the development of roads and seismic lines (Dauphiné 1989; Mulders 1999). Vulnerabilities to human activities such as oil and gas exploration may be confounded by reduced caribou herd sizes in the area, an important prey source as well as increased sport hunting (Dauphiné 1989; Mulders 1999). There are currently no specific management strategies for the wolverine in the Project area.

10.5.2 Birds

Few species of birds overwinter in the Mackenzie Delta. The majority migrate to or through the area during spring (April / May) to nest, raise young and moult. At the end of the breeding season (August / September), they migrate south again. The Delta is important as a spring and fall staging and moulting area for migrating waterfowl and a variety of different shorebirds breed in the area. Most waterfowl species and shorebirds arrive in the area by mid June and leave by late September, depending on weather conditions, with the Middle Channel of the Mackenzie River in particular acting as important habitat for many bird species (Aurora Research Institute [ARI] 2002).

Birds considered important to local people have been identified in the Inuvik ICCP (Community of Inuvik *et. al.* 2008) and by IEG (2002). These particular species are considered in this section, as well as one additional owl species which may be found in the area and is listed as a species with a special conservation status (SARA 2011). Migratory bird species will not be affected directly by Project activities. Several species are listed here because the use the area in the summer and the Project may impact summer habitat (e.g., nesting).

During summer the following waterfowl species may use the Project area: king eider (*Somateria spectabili),*; common eider (*Somateria mollissima*), mallard (*Anas platyrhynchos),* scoter

(*Melanitta* spp.), wigeon (baldplate duck; *Anas Americana),* long-tailed duck (oldsquaw; *Clangula hyemalis),* northern pintail (*Anas acuta*), Canada goose (*Branta Canadensis),* snow goose (*Chen caerulescens),* white-fronted goose (*Anser albifrons frontalis),* brant (*Branta bernicla*), tundra swan (*Cygnus columbianus*), common loon (*Gavia immer*), yellow-billed loon (*Gavia adamsii*), Pacific loon (*Gavia pacifica*), and red-throated loon (*Gavia stellata*).

Additionally, sandhill cranes (Grus Canadensis), rock ptarmigan (Lagopus mutus; year-round resident), willow ptarmigan (Lagopus lagopus; year-round resident), bald eagle (Haliaeetus leucocephalus), golden eagle (Aquila chrysaetos), Osprey (Pandion haliaetus), peregrine falcon (Falco peregrinus); gyrfalcon (Falco rusticolus; year-round resident), great grey owl (Strix nebulosa), snowy owl (Nyctea scandiaca; year-round resident), short-eared owl (Asio flammeus) and rough legged hawk (Buteo lagopus) are potentially using the area during the summer months (Community of Inuvik et al. 2008; ARI 2002). It is possible, although highly unlikely, that the Eskimo curlew (Numenius borealis) may also occur in the summer (ARI 2002). Birds that may overwinter in the Project area include the gyrfalcon, snowy owl, and rock and willow ptarmigan (ARI 2002).

Ducks - Ducks do not generally arrive on the ponds and lakes of the Mackenzie Delta until May and leave the area by early September. Recent knowledge of duck population trends are conflicting, with populations in the region possibly decreasing overall with the exception of the wigeon (Community of Inuvik *et al.* 2008; IEG 2002). Habitat preferences vary for different ducks, but it may be assumed that suitable summer habitat exists within the Project area for important duck species.

Geese - The arrival of geese to their summer habitat is associated with the timing of ice break-up, usually in May. Geese feed on terrestrial and aquatic vegetation including seeds and grass. Habitat preferences vary with species but typically include mud banks and flats. They generally leave the Delta by September. Populations of important species appear to be stable or increasing. It is possible that any species of goose may occur within the Project area, although they are more likely found elsewhere (Community of Inuvik *et al.* 2008; IEG 2002).

Tundra swans - Tundra swans use the Mackenzie Delta extensively from mid-May until September and their populations are believed to be increasing in the area (Community of Inuvik *et al.* 2008; IEG 2002). It is probable that tundra swans could be found in marshy areas with aquatic vegetation within the Project area. During the 2010 annual environmental inspection, several tundra swans were observed on lakes in the vicinity of the Ikhil production facility (IMG-Golder 2010).

Loons - Typically arriving by May and leaving by September, loon populations appear to be stable or increasing within the Delta with the exception of the yellow-billed loon which may be less abundant now than it once was. Different species may utilize the same habitats, with small fish as their dominant diet (Community of Inuvik *et al.* 2008).

Ptarmigan - Both the rock and willow ptarmigan remain in the Delta throughout the year. The rock ptarmigan feeds primarily on birch, and the willow ptarmigan primarily on willow. The rock ptarmigan is likely to be found more outside of the treeline and in rocky places such as the

Caribou Hills area of the Project, and suitable habitat was found to exist east of the East Channel (IEG 2002). The willow ptarmigan is common in muskeg areas and sheltered valleys throughout the Delta and may use the Project area (Community of Inuvik *et al.* 2008; IEG 2002). During the 2009 annual environmental inspection, a willow ptarmigan was encountered sitting on the roof of well K-35 (IMG-Golder 2009).

Sandhill cranes - Sandhill cranes arrive in the area in late April or May and leave by early September. They feed primarily on insects, lemmings, aquatic plants and seeds and may exist in upland and foothill areas around the Project area (Community of Inuvik *et al.* 2008).

Eagles - Bald eagles are common throughout the Delta, one of the few places in the arctic where they are regularly found during the summer season (ARI 2002). It is one of the first birds to arrive in the region in spring (late April) and nests in trees and feeds on fish. The golden eagle is more likely to be found near cliffs but it also nests in trees. Both begin nesting in the area in April or May and leave by fall. The Mackenzie Delta is considered important habitat for both eagle species and they may occur within the Project area (Community of Inuvik *et al.* 2008).

Falcons – The anatum subspecies of the peregrine falcon breeds mainly in the forested areas and the tundrius subspecies mainly in tundra habitat. A third falcon, the gyre falcon occurs north of the teeline. All three falcons feed on birds and small mammals such as ground squirrels, lemmings and hares (Community of Inuvik *et al.* 2008). It is possible that nests of either bird may exist in the cliff areas of the Caribou Hills, with gyrfalcons potentially being year-round residents.

Rough legged hawks - The rough-legged hawk nests in cliffs and feeds primarily on ground-squirrels and lemmings (Community of Inuvik *et al.* 2008). These birds may nest in the Caribou Hills area.

Owls - Great grey owls reach the northern limit of their range in the Mackenzie Delta. They require large trees or snags for nesting sites and feed primarily on small mammals and birds (ARI 2002). They have been sited near Reindeer Station and it is possible that they may nest in or near the Project area. Habitat suitability values for the great grey owl are high, particularly in the Project area (IEG 2002). The snowy owl occurs in low numbers in the region and individuals may remain throughout the winter, feeding on small mammals, birds and fish. They prefer coastal habitats but may possibly occur in the Project area (Community of Inuvik *et al.* 2008). The short-eared owl exists throughout the Delta, preferring open areas and marshes, and it nests on the ground (National Geographic 1999).

Eskimo curlew - These scarce birds are very unlikely to occur within the Project area. Once very common, this species was believed to be extinct at the beginning of the last century and only sporadic observations have been recorded across the arctic during the last few decades (ARI 2002). This species formerly bred in the forest tundra transition zone of the Delta and did not overwinter in the area. If it occurs, its presence would be limited to transient periods of migration.

10.5.2.1 Bird Species with Special Conservation Status

Three species of birds that may occur within the Project area for at least part of the year are listed on Schedule 1 of SARA (2011). The peregrine falcon (anatum and tundrius subspecies are considered as one complex) is listed as "special concern", the Eskimo curlew is considered "endangered", and the short-eared owl is considered of "special concern". COSEWIC also considers the Eskimo curlew to be "endangered" and the short-eared owl to be of "special concern" (COSEWIC 2011).

According to the NWT Status Ranking Program, several of the birds that may be found within the Project area and are considered important by the communities have special conservation status. The northern pintail, brant, long-tailed duck (oldsquaw), the white-wing, black and surf scoters (*Melanitta fusca* and *Melanitta nigra*), the king and common eider, wigeon, the anatum peregrine falcon, and the short-eared owl are considered "sensitive", while the Eskimo curlew is considered "at risk" (GNWT, ENR 2011a).

A summary of the breeding seasons and habitat preferences of bird species with special conservations status that may be found within the Project area is provided in Table 10.5.

Table 10.5 Summer Information for Bird Species with Special Conservation Status *

Bird Species	*Breeding Season*	*Habitat Preferences*	*Status*
Northern pintail	Arrival mid-May	Nest in open areas with low vegetation, average site 40 m from water	NWT: Sensitive
Brant	Arrival late May, early June Nesting mid June to late July	Nest close to water	NWT: Sensitive
Long-tailed duck (oldsquaw)	Arrival late May, early June	Nest on small islands or upland areas near tundra ponds, average site less than 10 m from water	NWT: Sensitive
Scoters (white-wing, black, surf)	Arrival late May, early June	Nest in dense cover such as forested or thick bush areas, average site 30-100 m from water	NWT: Sensitive
Eiders (king and common)	Arrival early June	Nest close to sea, also near tundra ponds in inland areas	NWT: Sensitive
Wigeon	Arrival mid-May	Nest in clumps of brush, average site 36 m from water	NWT: Sensitive
Tundra / anatum peregrine falcon	Nesting May, early June	Nest in cliffs	SARA: No Status COSEWIC: Special Concern NWT: Sensitive
Short-eared owl	Nesting April to August (dependent on food)	Nest on the ground	SARA: Special Concern COSEWIC: Special Concern NWT: Sensitive
Eskimo curlew	Nesting mid to late June Eggs hatch mid-July	Thought to nest in tundra or transitional tundra-forest areas	SARA: Endangered COSEWIC: Endangered NWT: At Risk
Rusty blackbird	Arrive April and May	Nest in wet areas such as edges of ponds and wetlands	SARA: Special Concern COSEWIC: Special

Bird Species	Breeding Season	Habitat Preferences	Status
			Concern NWT: Sensitive

* Compiled from Community of Inuvik *et al.* 2008; SARA 2011; COSEWIC 2011; GNWT, ENR 2011.

10.6 AQUATIC RESOURCES

The Mackenzie Delta is an estuarine Delta with poorly developed levees, formed largely from sediments transported by the Mackenzie River over the last 13,000 years. The Delta is a complex, flat area with a network of river channels and is dominated by an estimated 25,000 shallow floodplain lakes, some of which are recharged through spring flooding, but it also contains land varying from stable forested areas to tidal flats (Mackenzie River Basin Committee (MRBC) 1981).

10.6.1 Hydrology

To describe the Mackenzie Delta's hydrologic regime, a combination of factors must be considered, including topography, permafrost, climate, and vegetation characteristics (Kokelj 2001). Consideration must also be given to the interactions between the Delta region and the Beaufort Sea, the Delta's surrounding uplands and lowlands, the Tuktoyaktuk Peninsula, the Husky Lakes estuary and the Peel and Mackenzie rivers (MRBC 1981).

The Mackenzie Delta comprises an estimated 25,000 lakes with freshwater lakes covering up to half of the Delta's area (Marsh and Hey 1989). These lakes, the channels of the Mackenzie River, as well as numerous other distributary channels, are important features of the Delta's hydrologic system. The Mackenzie River has the most significant influence on the hydrologic regime, delivering massive amounts of water, energy and sediments into the Delta system (Carson *et al.* 1998; Kokelj 2001).

Ice covers the waters of the Mackenzie Delta for six to seven months of the year, and can be up to 2.5 m thick in the Middle and East Channel of the Mackenzie River. Most lakes and channels of the Delta rarely exceed 3 m in depth (Mackay 1963) and, therefore, are expected to be largely bottom-fast for most of the winter. Ice break-up in the Delta typically begins in April, and ice movement occurs approximately one week before peak spring water levels. The basic hydrology of the Delta is a complex interaction of aggrading and degrading forces, with spring break-up as the major hydrological event each year (MRBC 1981). Freeze-up starts typically in late October.

The East Channel at Inuvik carries 0.5 to 2% of the total Mackenzie River flow (Golder 1997b). Escarpment creeks run intermittently, with flows mainly at peak runoff periods. In the escarpment valley used for winter access from the East Channel to the Ikhil facility and well sites, there is a minor channelled drainage-way with no winter flows and no significant Delta at its confluence with the East Channel, indicating no high flow rates (Golder 1997b; Figure 2).

10.6.2 Water Quality

Delta lakes and channels vary in their chemical composition. Lake water chemistry is affected by a number of factors, but most significantly by the flooding regime. Lakes are generally divided into three categories (Marsh and Hey 1988): No-closure lakes are defined as those that open to, are joined with, or are crossed by river channels. Lakes that are flooded often and have large sediment inputs are low-closure lakes. They have been found to be mineral-rich as opposed to lakes that are often disconnected from flood events (high-closure lakes) and subsequently become mineral and nutrient-poor over time (Gill 1974; Lesack *et al.* 1998). There is no specific pattern for the distribution of these different lakes across the Mackenzie Delta. No-closure lakes are less common than low-closure and high-closure lakes; their water quality generally reflects Mackenzie River water quality.

10.6.3 Fish and Fish Habitat

Fish species that potentially occur in the Project area and that are considered important to the communities for subsistence harvesting and their spiritual and cultural values are summarized below (Community of Inuvik *et al.* 2008; Community of Aklavik *et al.* 2008). A fish habitat survey was conducted by Golder in 1997 (Golder 1997b). Based on this survey and the Inuvik ICPP, the following list of species that are potentially present in the Project area was established:

Arctic charr (*Salvelinus alpinus*) - This fish is occasionally found near Inuvik when it travels through the Mackenzie River but its primary habitat is composed of the lakes and rivers to the east of the Mackenzie River. Its population appears to be stable and it may potentially be found within the Project area (Community of Inuvik *et al.* 2008).

Arctic Cisco (*Coregonus autumnalis*) - The arctic cisco may be found in the Mackenzie Delta throughout the summer utilizing rivers and lakes as habitat and the river including its tributaries as spawning areas. It currently appears to have an abundant population and will likely be found within the Project area (Community of Inuvik *et al.* 2008).

Arctic grayling (*Thymallus arcticus*) - Preferring clear water, the arctic grayling is not often found in the turbid waters of the Mackenzie Delta, but it may be found in streams along the Delta's edge including potentially those that run off of the Caribou Hills. Its population appears to be stable (Community of Inuvik *et al.* 2008).

Blue / Pacific herring (*Clupea pallasi*) - This herring utilizes marine ecosystems as wintering habitat but will travel into the Mackenzie River, its tributaries and Delta lakes for spawning. There are abundant blue herring within the region and they may be found within the Project area during the summer season (Community of Inuvik *et al.* 2008).

Broad whitefish (*Coregonus nasus*) - The broad whitefish is considered to have both anadromous and non-migratory stocks within the Mackenzie Delta. Overwintering areas include the East Channel and there is a good possibility that it could be found within the Project area. It is considered to be locally abundant (Community of Inuvik *et al.* 2008).

Burbot / loche (*Lota lota*) - Important spawning areas for the burbot include shallow lakes and rivers in mid-winter under the ice. These fish then move into river tributaries during late winter or early spring and into deeper water during summer. They are common fish and it is possible that these fish are located within the Project area (Community of Inuvik *et al.* 2008).

Dolly Varden (*Salvelinus malma*) - Although sometimes caught in the Mackenzie River near Inuvik, the dolly varden is generally found to the west of the Mackenzie River. It spawns in mountain streams but spends its life traveling between marine and freshwater habitats, overwintering in lakes. Generally, dolly varden populations appear stable although there are localized areas where their numbers are declining. It is possible that these charr may be found within the Project area (Community of Inuvik *et al.* 2008).

Inconnu / coney (*Stenodus leucicthys*) - Generally considered anadromous fish, inconnu live in coastal areas as they mature and during winters, then migrate throughout the Delta to spawn in fast-moving streams with gravel bottoms. They are considered locally abundant and may be found in the Project area (Community of Inuvik *et al.* 2008).

Northern pike / jackfish (*Esox lucius*) - Jackfish are typically found in the main channels of the Mackenzie River or areas of slow water movement such as the tributaries, creeks and shallow lakes of the Mackenzie Delta. It is an abundant fish and is likely to occur within the Project area (Community of Inuvik *et al.* 2008).

Lake trout (*Salvelinus namaycush*) - Important habitat for lake trout include large, deep lakes but they are also found within brackish water and large rivers. Their populations appear to be stable and they may be found in suitable habitats within the Project area (Community of Inuvik *et al.* 2008). Peter Lake, north of the Project area is known to have a viable stock of lake trout (Webb and MacDougall 1996).

Lake whitefish / crooked back (*Coregonus cluepeaformis*) - There are both lake-dwelling and anadromous stock of lake whitefish, but both utilize habitat within the Mackenzie Delta. They are considered locally abundant and may be found within the Project area (Community of Inuvik *et al.* 2008).

Least cisco / big-eyed herring (*Coregonus sardinella*) - The least cisco is abundant throughout the lower Delta with habitat including Mackenzie River tributaries and inland lakes. They may occur within the Project area (Community of Inuvik *et al.* 2008).

Additional fish, including freshwater as well as marine species which may sometimes enter the Delta and may be found in lakes and watercourses within the Project area, are listed in Table 10.6.

Table 10.6 Additional Fish Species Potentially Occurring within the Project Area *

Common Name	*Scientific Name*	*Common Name*	*Scientific Name*
Chum salmon	*Oncorhynchus keta*	Pond smelt	*Hypomesus olidus*
Pink salmon	*Onchorhynchus gorbuscha*	Rainbow smelt	*Osmerus mordax*

Finscale dace	*Phoxinus neogaeus*	Round whitefish	*Prosopium cylindraceum*
Flathead chub	*Platygobio gracilis*	Slimy sculpin	*Cottus cognatus*
Lake chub	*Couesius plumbeus*	Spoonhead sculpin	*Cottus ricei*
Longnose dace	*Rhinichthys cataractae*	Trout perch	*Percopsis omiscomaycus*
Longnose sucker	*Catostomus catostomus*	Walleye	*Stizostedion vitreum*
Nine-spine stickleback	*Pungitius pungitius*	White sucker	*Catostomus commersoni*

* Source: Community of Inuvik *et al.* 2008; Golder 1997b.

10.6.3.1 Fish Species with Special Conservation Status

Of the species considered important within the Project area, the GNWT has identified the arctic cisco, arctic grayling, dolly varden and inconnu (lower Mackenzie River and Mackenzie Delta populations) as "sensitive" (GNWT, ENR 2011a). None of these species currently have any protection status.

Among federal agencies, dolly varden have been listed as a species of "special concern" by COSEWIC (2011). SARA (2011) has not listed any species potentially occurring in the Project area.

Concerns for sensitive species that may be found within the Project area are limited to those species that may overwinter in those areas. Fish species have differing demands with regards to overwintering habitat, but generally, this is the limiting factor of many fish populations in the arctic. The overwintering capability of aquatic habitats in the region is dependent on depth, temperature, salinity and dissolved oxygen.

10.7 CULTURAL AND HERITAGE RESOURCES

There are no cabins or camps in the vicinity of the Project area (Golder 1997b). Reindeer Station, on the shore of the Mackenzie River East Channel is an important site to people of the region and is considered an archaeological site. Fence posts likely associated with the reindeer program were found adjacent to the Ikhil ROW in a 1997 survey (Golder 1997b).

Regional work for the Archaeological Survey of Canada, which included the general area, revealed five additional sites in the broader vicinity of the Ikhil Gas Project (Golder 1997b):

- a single prehistoric lithic artefact;
- a prehistoric scraper;
- a 19th century multiple grave site, destroyed by erosion and looting;
- prehistoric flakes; and
- a recent (1970) grave, plus prehistoric tools.

None of these sites were located within the Ikhil Gas Project area including a 500 m buffer to all sides (Golder 1997b). The following provides a brief description of the five sites:

NdTs-1 - Archaeological site NdTs-1 is a disturbed 19th century Inuvialuit burial site located on the east bank of Oniak Channel, immediately north of its confluence with Bombardier Channel. Arnold (1983) first observed the site in 1982 and noted that it was eroding out of a river bank. Arnold revisited the site in June 1983 and found that it had almost completely eroded. Later, by August of the same year, it had been completely destroyed by looting. When intact, the site consisted of a multiple burial, containing the remains of at least three persons covered by logs (Golder 1997b).

NeTs-1 - This site is located on a gravel ridge roughly 1.1 km east of the East Channel of the Mackenzie River and approximately 6.5 km north (linear) of Reindeer Station. The site consists of a single isolated lithic artifact–an amorphous end scraper made of grey chert (Golder 1997b).

NeTs-2 - Archaeological site NeTs-2 is located in the Caribou Hills on an exposed sandy ridge that overlooks the East Channel of the Mackenzie River. It measures 200 m by 200 m and contains an eroding prehistoric component as well as a disturbed Inuvialuit grave, dating to the historic period. The site form for NeTs-2 indicates that the burial is a log feature of some kind; suggestive of a log cribbing or fenced enclosure. Yorga and Gordon (1972) describe the burial as “Christian,” with a collapsed fence enclosure, and collected two beige chert artifacts from the site – a small amorphous core fragment and a flake end scraper (Golder 1997b).

NeTs-3 - This site is located on a low but prominent knoll in the Caribou Hills, overlooking the East Channel of the Mackenzie River, roughly 4.5 km (linear) north of Reindeer Station and was first recorded by LeBlanc (1986). The site measures 100 m by 100 m and includes both an historic and prehistoric component. The historic component consists of a grave with a headboard dated 1970. The prehistoric component is described as extensive and includes quartzite flakes, a ground and retouched quartzite tool, and fire-cracked rock (Golder 1997b).

NeTs-4 - Archaeological site NeTs-4 is located at the north end of Peter Lake on top of an ice thrust moraine situated just east of the outlet stream. This location was considered as a potential source of gravel aggregate for the original Ikhil Gas Project Development. The site measures 200 m by 200 m and consists of a stone feature and associated lithic artifacts. The artifacts include quartzite flakes, spalls and cobble cores collected from within the feature limits and in the surrounding area to the east, south and west (Golder 1997b).

During an archaeological survey in 1997, no new archaeological sites were found within the Ikhil Gas Project area. However, two archaeological sites (NeTs-2 and NeTs-4) were revisited and one historic campsite was identified by a lake in the vicinity of the study area, but clear of any Project components and 500 m buffer to all sides (Golder 1997b).

The first archaeological site to be revisited was NeTs-2, located on an exposed sandy ridge that overlooks the East Channel of the Mackenzie River immediately south of an old winter access trail. Numerous surface exposures were examined along the ridge for evidence of cultural material including the disturbed grave feature. No evidence of the Inuvialuit grave was located

nor were artifacts observed on the surface. It is possible that the grave feature was situated farther south of the winter access route (Golder 1997b).

The second site to be revisited was NeTs-4, located at the north end of Peter Lake. NeTs-4 is well outside of the Project area but the ice thrust moraine on which the site is situated was considered as a potential source of gravel aggregate for the foundation pads of the Ikhil Production Facility. The site was subjected to an intensive surface inspection to locate artifacts and rock features. No artifacts were identified but two rock-enclosed hearth features containing fire cracked rock were observed on the bench above Peter Lake east of the outlet stream. Some historic debris was noted in the same area (rusted juice and cream tins). These features do not appear to be of great antiquity. Debris associated with previous seismic exploration of the area was noted along the top of the moraine feature (Golder 1997b).

The remains of what appears to be an historic campsite were located during the survey of the pipeline ROW. The site is off the ROW on the shore of a small unnamed lake. The site consists of two areas. The first area is a small terrace roughly 3 m above the lake at its eastern end (Golder 1997b). A log measuring 185 cm in length was located on the surface of the terrace. The function served by this log is not known but it may be related to a reindeer fence (Golder 1997b)

The second area of the site is a flat bench adjacent to the lake immediately northwest of the terrace with the log feature. This area was determined to be a campsite area based on the presence of wormwood (*Artemisia tilesii*), which is associated with disturbed landforms. No artifacts were found in shovel tests but a 10 cm long fragment of a sawn wooden pole, perhaps belonging to a tent frame or a rack of some form, was located on the surface (Golder 1997b).

11 ANTICIPATED IMPACTS AND PROPOSED MITIGATION

To complete the Environmental Impact Assessment (EIA) for the Project, Valued Components (VCs) are rationalized and selected, and the potential impacts and corresponding mitigation measures are described. Residual effects, or those environmental impacts that are expected to remain after mitigation, are then assessed, and their significance is predicted. The significance of the predicted residual effects is assessed using a qualitative approach, which uses best professional judgment of experienced environmental assessment specialists, supplemented by available data from regulatory agencies and community knowledge.

The significance of the various impacts of Project work is based upon the aerial extent of disturbances, their magnitude, their duration and their reversibility over a certain time frame (Appendix D).

11.1 SELECTION OF VALUED COMPONENTS

VCs are environmental, cultural, and / or social attributes that are considered to be important in Project decisions (Duinker and Doyon 2000). VCs were chosen for each environmental or social component, as listed in Table 11.1, to assist in the analysis of the potential environmental

impacts. Rationales for the selected VCs are provided during the impact assessment of each component.

Table 11.1 Project Environmental and Social Components and Corresponding Valued Components

Environmental or Social Component	*Valued Components*
Air and Noise	Air quality Noise levels
Soils and Terrain	Sensitive terrain Permafrost Soil quality
Vegetation	Vegetation communities Sensitive species and rare plants
Wildlife	Barrenground caribou Semi-domestic reindeer Grizzly bear
Aquatic Resources	Water quality Fish and fish habitat
Cultural and Heritage Resources	Archaeology sites
Socio-Economics	Employment and services Social conflicts

This section is formatted to describe the anticipated environmental impacts on VCs within the Project area and proposed mitigation strategies. These impacts and mitigation measures are typical for development Projects completed throughout the Mackenzie Delta. After summarizing the potential impacts and proposed mitigation, residual effects will be predicted. These are those effects that are believed to remain after mitigation measures have been implemented. Finally, the significance of the effects is predicted, based on the predicted residual effects. Appendix C provides Assessment Criteria for Residual Effects.

It is expected that the use of the proposed mitigation measures, including completion of the Project under winter conditions and meeting or exceeding government guidelines and community expectations, will result in residual environmental, cultural and social impacts that are predicted to be not significant.

The proposed Project will be completed entirely during the winter months, and within a well defined and previously disturbed area. Therefore, the duration is considered to be short and the geographic scope is local / sub-regional (Appendix D).

Project activities potentially affecting the environment and cultural resources include the camp, waste management, vehicular traffic, and construction and installation of facilities associated with the drilling and operation of the new well.

11.2 AIR AND NOISE

The VCs for the air and noise component were selected based on their sensitivity to impact through Project activities. For the purpose of this assessment, the two VCs, air quality and noise levels were chosen.

Emissions generated during the Project include carbon monoxide (CO) and nitrogen oxides (NO_x) from:

- vehicle emissions;
- diesel emissions from large construction equipment and generators;
- storage and dispensing of fuels;
- flaring; and
- drilling operations.

During windless conditions and periods of ice fog (during extremely cold days), Project-related emissions may be detectable at distance from the source. Flaring will only be for short periods of time to test the new well and, therefore, is not predicted to have an impact on air quality.

Primary sources of noise during the Project activities are expected to be from equipment, such as heavy machinery, the drill rig, and diesel generators. Noise will be restricted to the immediate vicinity of the work in progress.

The highest noise levels will likely occur from drilling and flaring of gas. Noise from drilling has been measured as 115 dBA at the source to above 55 dBA at distances 550 to 1,000 m from the well (Tribal Energy and Environmental Information Clearinghouse [TEEIC] 2011). Drilling noise will occur continuously for 24 hours per day for a period of one to two weeks depending on the depth of the formation. It is anticipated that this new well will continue to generate noise during the production phase. However, the new well is replacing the old, not-producing well K-35 and will not add to the noise disturbance at the site.

Residual effects will be negative and short-term. Effects will be local, of low magnitude and can be reversed in the short-term at the end of the Project. Residual effects on air and noise can be predicted with high confidence and are predicted to be not significant (Appendix D).

11.3 SOILS AND TERRAIN

The VCs for the soil and terrain component were selected based on their sensitivity to disturbance from Project activities. For the purpose of this impact assessment, soils and terrain are represented by three VCs:

- sensitive terrain;
- permafrost; and

- soil quality.

Disturbed soils on sensitive terrain features, such as the steep slopes of the western escarpments of the Caribou Hills may erode during spring runoff and flood events. Potential disturbance to permafrost can result in melting, causing slumping and erosion. In either case, soil erosion reduces the available habitat for vegetation, and may contribute to siltation and sedimentation of nearby water bodies.

There is some potential for surface disturbance during the drilling of the new well and its subsequent operation as well as during construction and operation of the winter access. Tundra vegetation and ice-rich soils are sensitive. Damage on slopes could lead to erosion, and disturbance of polygonal terrain can induce ponding. However, effects will be minimized through construction during winter months and the use of the Mackenzie River East Channel and the previously established winter access (Alternative Route) to the Project area. In addition, a 100 m by 160 m ice pad will be built up around the well site to protect the underlying vegetation and soils. This procedure has been successfully applied in the past (UGFI 2011; Appendix B). Additionally, a gravel pad will be constructed on which the shed and associated equipment including the methanol tank will rest. Timber mats will be placed on the ice pad to accommodate any necessary piping and auxiliary equipment.

Drip trays will be used under all equipment and machinery. Refuelling will occur in specially designated areas, equipped with spill kits.

Residual effects on soils and terrain will be negative; however, they will be local, low in magnitude and can be reversed in the short- or medium-term. Residual effects can be predicted with high confidence and are predicted to be not significant (Appendix D).

11.3.1 Sensitive Terrain

The following additional mitigation measures are expected to further limit the potential for impacts to sensitive soil and terrain:

- sensitive terrain features will be avoided during Project work;
- overland access will follow the previously established winter access route; and
- equipment operators will maintain minimum average snow and ice cover of 20 cm and avoid steep slopes to minimize potential ground disturbance.

Proposed winter activity and the implementation of proven mitigation measures are expected to minimize potential disturbance to sensitive terrain features. The residual impacts to sensitive soil and terrain features are predicted to be not significant.

11.3.2 Permafrost

Completing the Project under frozen ground conditions, while maintaining a minimum average snow cover, is expected to mitigate potential effects on permafrost. The potential residual impacts of site-specific melting of permafrost are predicted to be not significant.

11.3.3 Soil Quality

Soil quality can be impacted as a result of accidental spills of fuel or hazardous materials. Both, an Emergency Response Plan and Spill Contingency Plan will be in place for the Project are discussed in Section 13, and are provided in Appendix B and Appendix D, respectively. Proposed Project clean-up, reclamation, and disposal methods, which are designed to prevent and mitigate the impacts of inadvertent spills are provided in Section 14. As a result, no residual effects to soil quality are predicted due to spills.

11.4 VEGETATION

Selection of VCs for the vegetation component was based on ecosystem function and process, including soil protection, local and regional biodiversity, and provision of wildlife habitat. Particular vegetation species also provide value as a harvested resource. For the purpose of this impact analysis, vegetation is represented by two VCs:

- vegetation communities; and
- sensitive species and rare plants.

11.4.1 Vegetation Communities

The vegetation within the Project area is comprised of primarily tussock tundra and some tall shrub vegetation in the western escarpments of the Caribou Hills.

The Project will be completed on frozen ground conditions, which will minimize impacts to vegetation, particularly low-lying vegetation.

Vehicle access to the Project components will be via ice road along river channel to limit the potential for impact to terrestrial vegetation communities. The overland access to the Project site will follow an established winter access (the Alternative Route; Figure 2).

To reduce the Project footprint, which reduces the potential for disturbance to vegetation, both the staging and temporary camp sites (on an ice and gravel pad around the new wellsite) will be minimized within the limits of safety and applicable regulations, and as operationally feasible.

Proposed winter activity, during plant dormancy, and the implementation of proven mitigation measures is predicted to result in, at most, crushing or compacting of plant material that is above the frozen layer. These residual impacts to vegetation communities are predicted to be not significant.

11.4.2 Sensitive Species and Rare Plants

There are currently no species of vascular plants, lichen or moss that occur in the NWT which are listed by SARA or COSEWIC; however, a variety of plant species potentially occurring in the Project area are listed by the NWT as "sensitive" (Section 10.4.2).

No rare plants were found during vegetation surveys in the area (Golder 1997b), so no specific mitigation measures are proposed with regard to rare plants.

Since the site-specific abundance and distribution of sensitive or rare plants within the proposed Project area is not known, avoidance is not practical. However, the mitigation techniques described above for vegetation communities are expected to minimize the potential for impact to sensitive and rare plants, particularly as the proposed Project activity will coincide with the dormant period for herbaceous plants. The risk of impact to sensitive and rare plants is considered to be low and any site-specific residual effects to these species are predicted to be not significant.

Overall, residual effects on vegetation will be negative; however, they will be local, low in magnitude and can be reversed in the short- or medium-term. Residual effects can be predicted with high confidence and are predicted to be not significant (Appendix D).

11.5 WILDLIFE

The Project will occur during winter months, when the many of the wildlife species are not typically present in the region, and direct disturbance to wildlife is expected to be minimal and primarily concerned with overwintering or hibernating species. Project activity is scheduled to be completed prior to the arrival of most migratory species and prior to breeding or calving of resident species.

Impacts to wildlife present in the region during the winter will be restricted to the proposed drilling work and the winter access, and is expected to be of short duration. The use of frozen channels and a previously established overland route will limit the amount of access on terrestrial areas, which in turn is expected to limit the potential for disturbance to wildlife habitat. Vegetation regeneration during the following growing season is expected to assist in mitigating disturbances to wildlife habitat in the Project area. Other mitigation efforts used to limit the effects to wildlife in the area include:

- local Environmental and Wildlife Monitors will be employed as required to assess the proposed Project area in advance of the crews, and to advise on wildlife concerns in the Project area;
- crews will be instructed to not feed or harass wildlife, and workers will not be allowed to hunt, trap or have dogs on the Project; and
- any unscheduled Project related air traffic will follow the recommendations for air traffic in the ISR.

Three wildlife VCs were selected for the detailed Project impact analysis based on community importance and conservation status:

- barrenground caribou;
- semi-domestic reindeer; and
- grizzly bear.

11.5.1 Barrenground Caribou

The traditional winter range of the Bluenose-West and possibly Bathurst barrenground caribou herds may overlap with the Project area. It is well documented that human activities cause disturbances to caribou and may contribute to increased predation risks, increased intraspecific forage competition and decreased herd productivity (IEG 2002).

It is anticipated that caribou will not come near drilling activities during the winter Project work but will, if in the vicinity, move elsewhere due to sensory disturbances such as noise. If any caribou are seen, all work will cease until the animals have moved away from the work site.

Any disturbances to caribou habitat, such as alteration to vegetation, will be minimized through the mitigation measures described in 12.4. Caribou sightings will be documented (e.g., by Wildlife Monitors) and reported to the appropriate authorities (e.g., HTC; ENR).

11.5.2 Reindeer

The local reindeer herd typically spends the winter around the Jimmy Lakes area, southeast of the Project area and north of Inuvik (L. Binder, pers. comm. 2007). They remain in their winter range area from around December until April, and then are moved north. Their migration route leads along the Caribou Hills and may cross the Project area. The timing of this migration, early April, may overlap with Project activities if the Project should be delayed (in 2007, they were moved from the Caribou Hills across the East Channel to Richards Island on April 8; L. Binder, pers. comm. 2007).

It is anticipated that reindeer will not come near drilling activities during the winter Project work. At the time of the year when they may be in the vicinity (i.e., during their northern migration), they will be actively herded. It is expected that the herdsman will drive the herd to the east of the Project area (L. Binder, pers. comm. 2007). If any reindeer are seen, all work will cease until the reindeer herder has herded the animal(s) away from the work site.

Any disturbances to reindeer habitat, such as alteration to vegetation, will be minimized through the mitigation measures described in 12.4. Reindeer sightings will be documented (e.g., by Wildlife Monitors) and reported to the appropriate authorities.

11.5.3 Grizzly Bear

Potential effects on grizzly bears resulting from the Project include sensory disturbance that may result in early den abandonment, habitat avoidance, habitat loss, reduced reproductive success, and mortality.

Grizzly bears generally seem to tolerate human activity within 1 to 2 km distance of a den (Linnell *et al.* 2000). The response to activity in closer proximity to the den varies individually, ranging from no response to den abandonment (Linnell *et al.* 2000). Disturbance effects can occur within 1 km of a den site, and are most pronounced when they occur within 200 m of the den (Linnell *et al.* 2000). If denning bears (especially females with cubs) are disturbed, they may leave their dens too early and will not return (Linnell *et al.* 2000). This added stress can reduce their survival probability and impact the local grizzly bear population.

Project activities are scheduled to overlap with the denning period for grizzly bears. In order to decrease either direct or indirect negative effects on grizzly bears, the following mitigation measures are proposed:

- Wildlife and Environmental Monitors will attempt to identify and monitor bear den sites during Project activity, and a 300 m buffer of restricted Project activity will be established around known den locations;
- camps and work areas will be kept clean, with waste kept in bear-proof containers, and fuel will be properly stored;
- disturbance to grizzly bears from loss of habitat vegetation or food sources as a result of the Project will be minimized;
- all personnel will have bear safety training and will follow the bear encounter procedures in place;
- ice roads along river channels will maintain a maximum distance from the banks (as safety allows) where suitable bear habitat has been identified; and
- should any dens or denning bears be inadvertently disturbed during Project activities, or should any problems bears be encountered, the local office of ENR will be immediately notified.

The implementation of the above mitigation measures is expected to result in only distant, low-level disturbance to grizzly bears and their den sites. These residual impacts to grizzly bears are predicted to be not significant.

Overall, the presence of vehicles and heavy equipment during construction carries some potential for wildlife harassment in winter. The identified VC's caribou, semi-domestic reindeer and grizzly bears might be impacted either directly or through habitat alteration. Birds would only be impacted indirectly through impacts on nesting habitat as Project activities are scheduled to be completed prior to the arrival of waterfowl and other migratory bird species.

Residual effects will be negative and short-term, local in extent, of low magnitude and can be reversed in the short-term at the end of the Project. Residual effects on wildlife can be predicted with high confidence and are predicted to be not significant (Appendix D).

11.6 AQUATIC RESOURCES

Selection of the VCs for aquatic resources was based on ecosystem function and process, and local and regional biodiversity. Aquatic resources, namely fish, also provide value as a harvested resource. For the purpose of this impact analysis, aquatic resources are represented by two VCs:

- water quality; and
- fish and fish habitat.

Without appropriate mitigation, impacts to aquatic resources, particularly fish and fish habitat, may occur as a result of Project activities, including water withdrawal, use of the ice road, and the potential of spills. Because the two VC's are interrelated, the impact assessment is organized around the Project activity seen as the primary cause of the potential impact (e.g., water withdrawal) rather than the VC (e.g., fish and fish habitat).

All tanks for fuel and chemical storage will be installed with spill containment trays or berms. Spills of fuel or stored methanol constitute a potential hazard to surface waters and aquatic organisms. A spill contingency plan that takes local environmental values into account is provided in Appendix E.

No drilling wastes will remain on-site, all waste products will be trucked first to Inuvik and from there to appropriate disposal sites. No sumps will be constructed.

11.6.1 Water Withdrawal

Water for the Project will be taken from the East Channel of the Mackenzie River; no water will be withdrawn from lakes or inland streams. Water levels in the channel will not be affected by the small quantity of water to be withdrawn, compared to the channel volumes.

Fish can be injured or killed if drawn into intake hoses used to withdraw water. Intakes used for withdrawing water will be screened according to the current DFO regulations (DFO 2005) to avoid impingement or entrainment of fish. The NWT Operational Statement for the construction of Ice bridges and snow Fills (DFO 2010) will be followed.

The implementation of the above mitigation measures regarding water withdrawal is predicted to result in negligible effects to water levels from the channel where water is withdrawn. Residual impacts to aquatic resources from water withdrawal are therefore predicted to be not significant.

11.6.2 Winter Access

Effects that may arise from the construction and use of the ice road (on the frozen river channel) and the overland winter access include introduction of deleterious substances and erosion of banks where the ice road meets land. Only snow and water will be used for ice road and winter access construction. An Emergency Response Plan and a Spill Contingency Plan are described in Section 13, and provided in Appendix B and D, respectively. Equipment will be well maintained, and free of external fluid leaks, grease, and oil. Equipment will be refuelled and serviced at staging sites only. Drip pans, absorbent materials and other means of spill containment will be kept on-site and with each vehicle. Ice thickness and strength will be monitored frequently to ensure safe operations. Extra ice padding will occur at sites were the ice road meets land, to provide protection to the banks. Should bank disturbance inadvertently occur, matting will be placed on-site to re-insulate the soil.

The implementation of the above mitigation measures for the construction and use of the ice road and overland winter access is predicted to result in minimal impacts to aquatic habitats. These residual impacts are predicted to be not significant.

11.6.3 Spills

Water quality and fish habitat can be impacted as a result of accidental spills of fuel or hazardous materials. The Spill Contingency Plan is provided as part of the Emergency Response Plan which is described in Section 13, and provided in Appendix E. Proposed Project clean-up, reclamation, and disposal methods are provided in Section 14, which are designed to prevent and mitigate the impacts of any potential accidental spills. Equipment will be well maintained, and free of external fluid leaks, grease, oil and mud. Equipment will be refuelled and serviced at designated areas only. Drip pans, absorbent materials and other means of spill containment will be kept on-site and with each vehicle; additionally, spill kits will be available at the designated refuelling area. Staff will be trained in safe refuelling operations and Environmental Monitors will be encouraged to report on any concerns or inappropriate practices.

The implementation of spill prevention and mitigation measures is predicted to result in no residual impacts to aquatic resources.

In summary, residual effects on aquatic resources will be neutral, they can be predicted with high confidence and are predicted to be not significant (Appendix D).

11.7 CULTURAL AND HERITAGE RESOURCES

Cultural resources that may be adversely affected by Project activities include culturally sensitive areas. For the purpose of this assessment, one VC represents the cultural resources in and around the Project area: archaeology sites. There are no cabins in the direct vicinity of the Project area. No archaeological or historic sites were found during the 1997 survey near the Ikhil Gas Project and no further archaeological work was recommended (Golder 1997b). Archaeological site NeTs-4 was visited at the north end of Peter Lake, as it was in an area being

considered as a potential quarry for well site pad gravel. It was recommended that this area should not be used as a source of gravel aggregate.

In the unlikely event that additional unrecorded archaeology sites are discovered within the Project area, the sites will be immediately reported to the appropriate organizations (Prince of Wales Northern Heritage Centre [PWNHC]) and a 100 m buffer will be maintained between the site locations and any land-based activity associated with the Project. With the scheduling of the Project to be conducted under winter conditions (i.e., snow cover and frozen ground), no disturbances are expected to the existing ground surface. Impacts to any unrecorded or unknown sites are anticipated to be negligible, including for sites that occur below or at ground surface such as low stone features and material scatter sites. Residual effects on archaeological sites will be neutral; they can be predicted with high confidence and are predicted to be not significant (Appendix D).

11.8 SOCIO-ECONOMICS

With respect to socio-economic aspects of the Project, two VCs are chosen to reflect concerns of communities with regards to Project work:

- employment and services; and
- social conflicts.

11.8.1 Employment and Services

Benefits for the region are expected to be realized by local service, supply and contracting companies that are hired by UGFI to assist with the Project. These may include ice road and winter access construction and maintenance, camp services, fuel supply and environmental and wildlife monitoring. In addition, particularly in Inuvik, services such as transportation companies, hotels, gas stations and restaurants are expected to benefit from increased levels of activity related to the Project. On a regional scale, this economic impact is predicted to be not significant.

As part of the 1997/1998/1999 development, construction and start-up activities of the Ikhil Gas Project, there were Access and Participation Agreements specifying the employment, training and contracting provisions with the ILA.

Similarly, for ongoing operations and maintenance work, there is an Access and Participation Agreement for the Ikhil wells, production facilities and pipeline with the ILA specifying the employment, training and contracting provisions on an ongoing basis.

For the Project, UGFI will follow the existing Access and Participation Agreement with the ILA which outlines employment, training and contracting provisions.

11.8.2 Social Conflicts

Potential conflicts with traditional and other land uses, as identified in the Inuvik ICCP (Community of Inuvik *et al.* 2008) with relation to land development activities within the ISR, are expected to be negligible due to the scheduling of the Project during the winter and the mitigation plans to be employed. As in the past, UGFI is committed to working closely with local HTC to identify and mitigate any potential conflicts with traditional land use. The use of a temporary, remote camp provides the opportunity for separation of the crews from the communities, which is expected to minimize the potential for social conflicts (e.g., alcohol and drug use). Procedures and policies outlined in the CPE HSE Manual (Appendix F) will be followed throughout the duration of the Project. The potential for impacts related to social concerns are expected to be minimized.

Through careful Project planning, ongoing communications with affected communities, enforcing a Drug and Alcohol Policy, and the remote location and short-term duration of the Project, no significant effects are expected to important areas of social concern such as:

- continued accessibility to resources for traditional economic and land use activity;
- retention of traditional skills and values;
- the potential for area population increases;
- health and safety of Project workforces;
- community wellness; and
- the potential for impacts on social service and infrastructure.

11.9 MITIGATION IMPLEMENTATION

Through acknowledging the value of local knowledge, UGFI is able to plan its Project work in the most environmentally and culturally responsible manner. Important sources of local knowledge include, but are not limited to, the knowledge of Environmental and Wildlife Monitors and community knowledge shared through consultations and ongoing communications.

11.9.1 Wildlife and Environmental Monitors

UGFI will use Environmental Monitors and Wildlife Monitors throughout the duration of Project activities. The monitors will be familiar with the environmental and cultural concerns and the proposed mitigation measures, and they will be encouraged to communicate local concerns and solutions to Project crews. The monitors will have the appropriate training and experience as well as local knowledge of the Project area. Environmental Monitors will be encouraged to bring environmental concerns (such as e.g., leaking equipment) to UGFI's attention. Daily reports will be prepared that describe the activities observed during their shift, including any concerns and recommended steps to resolve them. Monitor observations will be submitted to the appropriate organization as required.

11.9.2 Communications

Effective communication is considered to be critical for the successful completion of the Project in an environmentally, culturally and socially responsible manner. UGFI will establish communication links at the start of the Project, and continue these efforts through the life of the Project. This will ensure that all Project personnel are educated with respect to their responsibilities related to safety, the environment and cultural considerations. The following procedures will be completed to facilitate communication:

- a Project start-up meeting will be conducted with UGFI representatives, construction and advance crews (e.g., winter access and camp construction), camp staff, drill crew and Environmental and Wildlife Monitors. The meeting will present the environmental, cultural and social sensitivities identified and outline the mitigation measures that UGFI has proposed;
- ongoing communication (e.g., use of radios) will occur between the monitors and the crews so that identified issues can be addressed in a timely manner;
- crew managers will highlight the commitment to environmental protection on an ongoing basis (e.g., at daily safety meetings) to make sure that crews understand this commitment and its importance; and
- Environmental and Wildlife Monitors will be encouraged to participate and report at the daily meetings.

11.9.3 Impact and Mitigation Summary

The proposed Project will be completed entirely during the winter months, and within a small, well defined and previously disturbed area. Therefore, the duration is considered to be short and the geographic scope is local / sub-regional (Appendix D).

Table 11.1 summarizes the potential impacts, proposed mitigation, and residual effects that are predicted to remain after mitigation. The significance is then predicted, based on the predicted residual effects.

It is expected that the use of the proposed mitigation measures, including completion of the Project under winter conditions and meeting or exceeding government guidelines and community expectations, will result in residual environmental, cultural and social impacts that are predicted to be not significant.

Table 11.1 Summary of Potential Impacts, Proposed Mitigation, Predicted Residual Effects, and Predicted Significance

Potential Impact	*Mitigation Measures*	*Predicted Residual Effect and Significance*
Air and Noise		
Project activities can impact air quality	• Flaring will only be for short periods of time.	Site-specific reduced air quality may occur.

Potential Impact	*Mitigation Measures*	*Predicted Residual Effect and Significance*
	• Number of vehicles, heavy equipment and diesel generators will be limited.	*Not Significant*
Project activities can increase noise level in the area	• Noise will be restricted to the immediate vicinity of the work in progress. • The highest noise levels will likely occur from drilling and flaring of gas, which will occur during a short time frame only in a localized area.	Site-specific increased noise levels may occur. *Not Significant*
Terrain and Soils		
Disturbance to sensitive terrain features (i.e., steep terrain)	• Project will be completed under stable, frozen ground conditions. • Winter access on the river channel and use of previously established overland access (Alternate Route) will be used for access to the Project area. • Ramp of snow and ice will be built where ice road meets the land. • Final inspection and clean-up will focus on ice pad around new well site	Site-specific disturbance to steep terrain may occur if adequate snow / ice thickness is not maintained. *Not Significant*
Access route, staging area and temporary camp may alter surface insulation and permafrost	• The Project will be completed under frozen ground conditions. • Winter access follows previously established route. • Equipment will be staged on an ice pad with matting on top. • Temporary camp will be located on an ice pad.	Site-specific melting of permafrost may occur. Not Significant
Spills can affect soil quality.	• A Spill Contingency Plan is in place to handle spills of fuel or hazardous materials. • An Emergence Response Plan is in place. • Storage areas will include secondary containment so that spills or ruptures remain contained on site. • Staged equipment, drill rig and camp will be located on an ice pad with matting on top, creating a barrier which is expected to prevent spills from reaching the vegetation and soil, and allow easier clean-up.	None predicted when clean-up is complete. *Not Significant*
Vegetation		
Disturbance to vegetation communities	• A minimum 20 cm ice / snow cover will be maintained on the overland access route. • Frozen ground and snow cover will allow travel over most vegetation without damage to the root systems. • Final site inspection and clean-up will be conducted with site-specific clean-up conducted on foot to avoid disturbance to vegetation.	Plant material above the snow / ice cover is expected to be crushed or compacted by vehicles and equipment. *Not Significant*
Potential disturbance to sensitive or rare plant species	• Drilling will occur in winter, which will coincide with the dormant period for herbaceous plants. • Winter access follows previously established route along the western escarpment of the Caribou Hills. • Minimum snow / ice cover of 20 cm will help to mitigate possible effects to low-lying vegetation. • Natural revegetation will be promoted by avoiding disturbance of the root zone.	Site-specific disturbance to sensitive or rare plants may occur. *Not Significant*
Wildlife		
Disturbance of barrenground caribou and / or semi-domestic reindeer in their respective wintering ranges	• Wildlife Monitors will scout ahead of equipment to avoid disturbing any observed caribou and / or reindeer. • If any animals are observed, work will cease until the animals leave the area.	Site-specific disturbance to habitat vegetation may occur. Distant, low-level sensory disturbance may occur. *Not Significant*
Encroachment on grizzly bear habitat and / or den sites	• Wildlife Monitors will scout ahead of equipment to avoid potential bear dens and / or conflicts with bears. • Newly identified den sites will be avoided by at least 300 m.	Distant, low-level sensory disturbance may occur.

Potential Impact	*Mitigation Measures*	*Predicted Residual Effect and Significance*
		Not Significant
Attraction of bears to camps and work areas can lead to bear-human conflict	• Camp will be kept clean, with use of bear-proof containers. • Wildlife Monitors will communicate bear sightings. • Personnel will have bear safety training.	None predicted. *Not Significant*
Encroachment on waterfowl habitat and / or nesting sites	• Winter access follows previously established route. • Minimum snow cover requirements will help to mitigate possible effects to low-lying vegetation. • Camp will be constructed on ice pad. • Ice pad will be build up around new wellsite and serve as staging area.	Limited disturbance to above-ground vegetation habitat may occur. *Not Significant*
Aquatic Resources		
Wastewater disposal can affect receiving water bodies and with this, fish and fish habitat	• All wastewater will be collected and transported to the Town of Inuvik or further south for appropriate disposal. • All drilling waste will be collected and transported to the Town of Inuvik or further south for appropriate disposal.	No effects to water quality are predicted. *Not Significant*
Spills can impact water quality	• A Spill Contingency Plan is in place to address spills of fuel or hazardous materials. • Sites for storage of fuels, lubricating oils, chemicals, or other hazardous materials will be located a minimum of 100 m away from water bodies, and surface drainages. • Storage areas will include secondary containment so that spills or ruptures remain contained on-site. • Hazardous materials transportation operators will be licensed and adhere to approved emergency response and spill response plans.	None expected when clean-up is complete. *Not Significant*
Cultural and Heritage Resources		
Loss or damage of cultural resources including archaeology sites	• Known archaeology sites have been identified in the region surrounding the Project area and will be avoided by at least 100 m. • In the event that previously unknown archaeology sites are discovered during drilling work, work will cease at that location and the PWNHC and the communities will be notified and consulted for advice on mitigation.	None expected. *Not Significant*
Socio Economics		
Employment and community services will be affected	• Equal opportunity will be given to local employment and service, supply and contracting services by using the IRC Business List to source required services.	None expected. *Not Significant*
Social conflict in regional communities stemming from cultural separation and alcohol and / or drug abuse	• Procedures and policies in the CPE HSE Manual will be followed.	None expected. *Not Significant*

12 CUMULATIVE EFFECTS

Cumulative effects refer to the effect on the environment as it results from a development activity when combined with those of other past, existing and reasonably foreseeable programs and activities. When individual activities or disturbances interact spatially or temporally, their combined effects can result in environmental impacts that may differ in nature or extent from the effects from individual activities. To assess potential cumulative effects from the proposed Project, any past, present and reasonably foreseeable human activities in and surrounding the proposed Project area must be considered as well.

The Cumulative Effects Assessment (CEA) for the Project follows the guide for proponents developed for CEA in the ISR (Kavik-Axys 2002). Four steps have to be followed in order to evaluate possible cumulative impacts, which are described below:

1. Negative effects on VCs need to be determined. This step is based on the assessment of the anticipated environmental impacts and proposed mitigation, which included a prediction of the significance of the residual effects, as well as an assessment of the environmental or cultural consequence (Section 11).

2. Determine whether these residual effects act cumulatively with the effects of other activities. For the Project effects to act cumulatively there must be other human activities affecting the same VC. Both the temporal and spatial scope of the activities need to be considered. Typically, activities that interact in either scope are considered in a CEA.

3. Determine how the Project-specific effects contribute to the cumulative effects. This involves an analysis of the relevance of the interactions between activities.

4. Assess the need for further mitigation measures if the cumulative effects are anticipated to be significant.

Potential Project-specific effects assessed on the selected VCs for the Project, as discussed in Section 11, completes Step 1 of the CEA. When considered individually, residual effects of this Project on each VC are predicted to be not significant. However, the identification of a residual effect indicates some possibility that negative effects may occur. The CEA must therefore consider these and potential effects from past, current, and reasonably foreseeable activities that may interact with the Project.

12.1 PAST, CURRENT AND REASONABLY FORESEEABLE ACTIVITIES

For the purpose of this CEA, past activities include those that have occurred; current activities include those that are occurring or have been approved; and reasonably foreseeable activities include those that are proposed or that are expected to occur.

The spatial scope considered by the CEA is the Mackenzie Delta. Activities within the Delta that may be expected to interact cumulatively with the Project include:

Traditional activities - Hunting and fishing are activities that have occurred historically throughout the Project area and are expected to continue to occur in the Delta. Since the majority of these activities is not controlled or predictable, and is considered to have only minimal impact on wildlife and fish populations, hunting and fishing activities are not included in this CEA.

Research activities - Helicopter traffic, as transportation used for the completion of environmental assessments and other studies in the Project area, may contribute to cumulative effects in the Delta. Several research studies have been conducted in the Delta, or are

ongoing, each of which involves potential impacts on wildlife, most notably from helicopter traffic and associated sensory disturbances:

- numerous CWS bird surveys in the Mackenzie Delta and KIBS (e.g., several multi-year studies);
- environmental impact assessment baseline studies for the Mackenzie Gas Project (until April 2005);
- CWS polar bear research along the Mackenzie Delta / Beaufort Sea coast (conducted during several years; each year in April);
- University of Alberta and ENR grizzly bear study (capture and GPS collaring) in the Richards Island area (conducted during several years; each year in May);
- DFO research in Mackenzie Delta / Beaufort Sea (e.g., lake surveys);
- University of Victoria study of 66 lakes between Inuvik and Richards Island (March - October 2007);
- University of Victoria study of ice jams and deep scour holes including East Channel (March to October 2007);
- Carleton University study on ground temperatures in spruce forests in the Mackenzie Delta, including near Reindeer Station (April 2007);
- Carleton University study on snow, ground temperatures and ground ice in the Kendall Island Bird Sanctuary (ongoing year-round since 2006);
- ongoing summer reconnaissance work (e.g., soil sampling, archaeological surveys, vegetation surveys, fish habitat assessments) associated with permits and licenses granted to the Department of Transportation in preparation for the construction of the Inuvik to Tuktoyaktuk Highway; and
- baseline data collection by and oil and gas companies.

Some of the research activities may overlap spatially with the Project area directly or with components of the Project such as transportation routes. Temporal overlap of the Project with research activities may also occur.

Development activities - The scope of this CEA considers known oil and gas exploration and proposed or potential projects located in the Delta. According to the most recent Oil and Gas Disposition for the Mackenzie Delta and Beaufort Sea area (as of July 2011) there were 11 Exploration Licenses (ELs), 2 Production Licenses (PLs) and 65 Significant Discovery Licenses (SDLs) issued by Aboriginal nd Northern Development Canada (AANDC; 2011).

Past, current, and reasonably foreseeable oil and gas activities considered by this CEA, in addition to the Project, are listed in Table 13.1.

Past, current and future development associated with the Ikhil Gas Project, such as seismic surveys, drilling of wells, pipeline construction, operation and maintenance could contribute to cumulative effects.

Table 13.1 Past, Current and Reasonably Foreseeable Hydrocarbon Related Activities Considered for the Cumulative Effects Assessment *

Project	*Spatial scope*	*Activity*	*Temporal Scope*	*Status*
Past Activity				
Ikhil Gas Project	Caribou Hills and ROW to Inuvik	3 wells,1 gas production Facility, pipeline	Pipe completion 1999	Gas flowing
Ikhil Gas Project	Caribou Hills and ROW to Inuvik	Annual environmental inspections and maintenance work	2000 - ongoing	Ongoing
PC Anderson Kurk M-15 well	EL 419	1 well re-entry	Winter 2001/2002	Completed
Devon PC Kugpik L-46	EL 419	1 well	Winter 2001/2002	Completed
Esso Mallik L-38	Mackenzie Delta	Test drilling	Winter 2001/2002	Completed
Devon PC Tuk B-02	Tuk Peninsula	1 well	Winter 2001/2002	Completed
Devon PC Tuk M-18	Tuk Peninsula	1 well	Winter 2001/2002	Completed
Petro-Canada Mackenzie Delta Seismic Program	Mackenzie Delta (EL395, EL396)	2-3D seismic, 3-2D seismic	Winter 1999/2000	Completed
PC Devon Nuna I-30	EL 406	1 well	Winter 2002/2003	Completed
Chevron Langley Drilling Program	Langley Island (EL394)	1 well	Winter 2002/2003	Completed
EnCana Kugmallit 2D Seismic Program	Richards Island (EL384)	2D seismic	Winter 2002/2003	Completed
Chevron Taktuk 3D Seismic Program	Ellice Island (EL417, EL404)	3D seismic	Winter 2003/2004	Completed
Chevron Ellice I-48 Drilling Program	Ellice Island (EL404)	1 well	Winter 2003/2004	Completed
EnCana et al Umiak N-16 Drilling Program	Richards Island (EL384)	1 well	Winter 2003/2004	Completed
EnCana et al Umiak N-05	EL 384	1 well	Winter 2004/2005	Completed
Chevron Garry 3D Seismic Program	Gary Island / Niglintak Island (EL394)	3D seismic	Winter 2004/2005	Completed
Chevron Ellice Drilling Program H-01, 2H-01, 3H-01	Ellice Island (EL427-422)	3 wells	Winter 2004/2005	Completed
Encana Corporation	Mackenzie Delta	2D seismic	Winter 2004/2005	Completed
Devon Canada Corporation	Mackenzie Delta	Geological field survey	Summer 2005	Completed
Husky Oil Operations Ltd.	Summit Creek / M. Delta	Aerogravity survey	Fall 2005	Completed
Devon Offshore Paktoa C-60	Beaufort Sea (EL 420)	1 well	Winter 2005/2006	Completed
Chevron Arvoknar 3D	Mackenzie Delta (EL 427)	3D seismic	Winter 2005/2006	Completed
GX Technology Canada	Beaufort Sea	2D	Summer / Fall 2006	Completed
Chevron et al. Kumak I-25	Mackenzie Delta (EL 394)	1 well	Winter 2006/2007	Completed
Chevron et al. Unipkat M-45	Mackenzie Delta (EL 394)	1 well	Winter 2006/2007	Completed
Aurora / JOGMEC / NRCan 3L-38, 4L-38, 5L-38	Mackenzie Delta (Mallik)	2006-2008 JOGMEC-NRCan Mallik Gas Hydrate Research and Development Project	Winter 2006/2007	Completed
MGM et al.	Langley	3 wells	Winter 2007/2008	Completed

Project	*Spatial scope*	*Activity*	*Temporal Scope*	*Status*
Aurora / JOGMEC / NRCan 3L-38, 4L-38, 5L-38	Mackenzie Delta 3 locations (Mallik)	2008-2009 JOGMEC-NRCan Mallik Gas Hydrate Research and Development Project	Winter 2008/2009	Completed
MGM et al.	North Ellice	3 wells	Winter 2008/2009	Completed
Tuktoyaktuk to Source 177 all-weather road	Mackenzie Delta	23 km long all-weather road between Tuktoyaktuk and Source 177	Summer 2009	Completed
Inuvik to Tuktoyaktuk Highway	Mackenzie Delta	Spring Aquatic Assessment for all-weather road	Spring 2010	Completed
Present Activity				
Inuvik to Tuktoyaktuk Highway	Mackenzie Delta	Fisheries and Archaeological assessments for all-weather road	2010 - 2011	Ongoing
Ikhil Gas Project	Caribou Hills and ROW to Inuvik	Annual environmental inspections and maintenance work	2000 - ongoing	Ongoing
Reasonably Foreseeable Activities				
Ikhil Gas Project	Caribou Hills and ROW to Inuvik	Annual environmental inspections and maintenance work	2000 - ongoing	Ongoing
Mackenzie Gas Project	Mackenzie Delta	Development of 3 gas fields, gathering station, pipeline construction	Unknown, construction expected within next several years if approved	Preparations for approvals
Inuvik to Tuktoyaktuk Highway	Mackenzie Delta	Road construction	Unknown, construction expected within next several years if approved	Preparations for approvals

* This table has been created by compiling the best available knowledge: This list may be inadvertently incomplete because of missing and / or inaccessible information (e.g., exact locations of some activities). Several sources were used, including NEB (2011; with exclusion of Beaufort Sea offshore projects).

12.2 POTENTIAL INTERACTIONS OF PROJECT ACTIVITIES

Step 2 of the CEA, the determination of the possible interaction of activities in the Delta and the potential for cumulative effects, is determined by comparing the spatial and temporal scope of the known activities. The relevance of this interaction is assessed using a qualitative approach, which uses best professional judgment of experienced environmental assessment specialists, supplemented by available data and community knowledge.

Spatial interaction is indicated by any activities that overlap or are adjacent. Generally, the zone of influence (the distance from an activity in which an effect on a VC is measurable) of oil and gas activities in the Delta, given regulatory requirements and guidelines, and industry best practices, is in close proximity to the Project boundaries. Figure 4 provides an overview of some past oil and gas activities.

The analysis of temporal interactions of other current and reasonably foreseeable activity in the Delta considers the effects conservatively. This approach assumes that, if logical, the current and reasonably foreseeable activities are considered to interact temporally.

12.2.1 Spatial Interactions

There are numerous projects and associated activities that interact spatially with the Project area (Table 13.1; Figure 4) including past, current and future research projects, the existing Ikhil Gas Project, completed seismic programs, numerous previous well drilling sites (completed and abandoned) and the proposed all-weather road from Inuvik to Tuktoyaktuk. Additional seismic and drilling projects throughout the Delta and off-shore (not listed in Table 13.1) have also interacted spatially through the use of shared transportation routes (e.g., ice roads, air traffic routes) and will likely continue to do so. Local travelers also use the ice roads in and around the Project area.

Throughout the Delta, many historic seismic lines and well sites exist, some of them in and close to the Project area (Figure 4). Some of these seismic lines date back to the early 1970's. There may have been impacts to vegetation from many of these past seismic programs, but data are rare on long-term impacts on arctic vegetation due to winter disturbance. It is expected that the most apparent impacts to vegetation communities will result from disturbances to their habitat (e.g., exposed soil and increased thaw depth).

Due to effective mitigation practices described earlier (e.g., minimum snow / ice cover on the overland access route, construction of an ice pad for staging, operations and camp facilities), the proposed Project is not expected to result in significant effects to vegetation. Therefore, interaction between the Project and past activities is not expected to contribute significantly to cumulative effects.

Vehicle traffic along the ice roads on the East Channel and Middle Channel of the Mackenzie River allow access to other research and development projects in the region as well as access to the communities of Tuktoyaktuk and Aklavik during winter months (Figure 1). The proposed Project will rely on the established ice roads and construct additional access routes to the Project sites. Traffic volume in the area will increase temporarily, which may affect the quality of the ice roads and may contribute to increased noise pollution and disturbance. Vehicle and equipment operations during the Project are expected to increase the level of emissions from vehicles used within the Delta. These increased emissions are expected to be of low magnitude and due to the short duration of the Project, any cumulative effects are predicted to be not significant.

Offshore development activities have not been considered in this CEA, because access to these offshore areas typically occurs through chartered aircraft from Yellowknife to Kugluktuk and Sachs Harbour, well outside the Mackenzie Delta.

Two potential future projects which would contribute much traffic and activity to the Project area are the Mackenzie Gas Project and the Inuvik to Tuktoyaktuk Highway. Residual effects due to the proposed Project are expected to be minimal, and likely not measurable by the time the Mackenzie Gas Project and / or the highway are realized; therefore, spatial overlap and subsequent cumulative effects due to the Mackenzie Gas Project and the Inuvik to Tuktoyaktuk Highway are expected to be negligible and are not considered in this CEA.

12.2.2 Temporal Interactions

Activities which may interact temporally with the Project activities may include various research projects. Currently, it is unknown whether any oil and gas development programs will be conducted in the Delta during the proposed Project's scheduled timeframe. There may be some offshore work in the Beaufort Sea, however, these activities have not been considered in this CEA, due to unlikely spatial overlap.

12.3 POTENTIAL CUMULATIVE EFFECTS

The determination of the potential cumulative effects, comprising Step 3 of the CEA, involves an analysis of the Project-specific effects using the VCs to assess the significance of any cumulative effects. Project VCs are organized according to the environmental, cultural or social components described in Section 11, Anticipated Impacts and Proposed Mitigation.

12.3.1 Air and Noise

Vehicles, heavy equipment, generators and short-term flaring will contribute both to reduced air quality and increased noise levels. Project activities are estimated to continue over a period of approximately three months and likely will overlap with regular vehicle traffic on the Inuvik to Aklavik and the Inuvik to Tuktoyaktuk ice roads. Due to the localized nature and short duration of the Project, potential impacts to air and noise from the Project are expected to result in cumulative effects that are not significant.

12.3.2 Soil and Terrain

The proposed winter access is composed of an ice road section, which follows the river channel, avoiding sensitive terrain and soil, and an overland access, which follows an established route along a creek valley. These spatial interactions are not considered to contribute to significant cumulative effects on terrain and soil.

Site specific disturbance to terrain and soils in the Project area as a result of the ice road and overland access construction and travel is predicted to be isolated. Potential impacts to terrain and soils from the Project are expected to result in cumulative effects that are not significant.

12.3.3 Vegetation

Cumulative effects to vegetation are not predicted as a result of the proposed ice road because the route follows the river channel, avoiding vegetation communities and potential listed plant habitat.

Vegetation communities are predicted to be disturbed in localized areas along the proposed overland winter access and the ice pad, constructed around the new well site. Required snow / ice thickness will be maintained to protect ground vegetation and roots, and regeneration of disturbed vegetation is expected within the next few growing seasons. Because terrain and soil are not significantly impacted, only above ground vegetation will potentially be disturbed.

Therefore, impacts from the proposed Project are expected to result in cumulative effects to vegetation communities and listed plants that are predicted to be not significant.

12.3.4 Wildlife

Barrenground caribou and semi-domestic reindeer could be disturbed through the residual effects of Project activities near their winter ranges. It is expected that the specific mitigative measures identified for this Project (Section 11) will result in no significant cumulative impacts to caribou and reindeer as the result of direct disturbance.

Denning grizzly bears could be negatively impacted where the winter access could come close to potential den sites, particularly along channel banks and other suitable den sites. A residual effect is predicted for grizzly bears from disturbance due to Project activities. Other programs have been identified to overlap spacially and could potentially contribute to these effects. However, given the mitigative measures for this Project, the use of Wildlife Monitors and industry best practices, no significant cumulative impacts are predicted to bears as a result of disturbance.

12.3.5 Aquatic Resources

Water withdrawal for the Project is expected to come from the Mackenzie River East Channel. No water withdrawal from lakes or other watercourses is anticipated; therefore, the Project is not expected to contribute to any cumulative impact to lakes and watercourses as a result of water withdrawal. Withdrawal from the river channel is not expected to result in lower river water levels. Isolated, minimal increases in sedimentation and temporary disruption of surface water flows from Project activities are predicted to result in negligible effects to fish and fish habitat. Mitigation measures in place for the proposed Project are expected to result in minimal effects to hydrology and water quality. Cumulative effects are predicted to be not significant.

Increased vehicle traffic along the frozen river channels increases the risk of an accidental spill or the occurrence of other incidents that may impact water quality. However, considering the winter schedule and the spill mitigation methods, the possibility of an incident of such magnitude that would contribute to cumulative effects is considered low.

Finally, no wastewater or drill wastes will be released to the environment or stored in a sump. All waste products will be transported off-site for appropriate disposal. It is anticipated that the proposed Project will not contribute to cumulative effects on fish or fish habitat.

12.3.6 Cultural and Heritage Resources

The cumulative effects of the Project work on traditional harvesting areas are expected to be minimal. Communications between UGFI and Inuvik's HTC is ongoing and UGFI will inform local land users of work scheduling to minimize conflicts between Project work and traditional harvesting activities. No residual effects to known cultural resource sites such as cabins or archaeology sites as a result of the Project are predicted due to site avoidance. Therefore, cumulative effects are predicted to be not significant.

12.3.7 Socio-Economics

The Ikhil Gas Project is ongoing since 1999 and has provided employment for a variety of local residents (including Inuvialuit). No social concerns have arisen during the years of operation (Kavik Axys 2007). Compared to the size of the existing project, the proposed Project is small in temporal and spatial scale. Cumulative effects to employment, income, traditional land use, and traditional resources use are expected to be short-term in duration and predicted to be not significant. Due to the remoteness of the location, potential cumulative effects to areas of social concern (e.g., community wellness, social service and infrastructure) are expected to be not significant.

12.4 MITIGATION OF CUMULATIVE EFFECTS

No potential significant cumulative effects of regular Project work were identified. If residual effects of the Project are later considered to be contributing to cumulative effects, monitoring and adaptive management may be applied. These initiatives would be coordinated with regulators and communities, as applicable.

12.5 SUMMARY OF CUMULATIVE EFFECTS

Table 13.2 summarizes the assessed cumulative effects of the proposed Project and their predicted significance. Incremental environmental and cultural disturbance effects may occur in the Delta as a result of the interaction of individual activities. However, the mitigation of potential impacts within the Project area is predicted to result in low to negligible effects. The predicted limited impact of the proposed Project, in combination with past, current and reasonably foreseeable activities, is predicted to result in no significant cumulative effects.

Table 13.2 Summary of Assessed Project Cumulative Effects and Predicted Significance

CEA Steps:	STEP 1		STEP 2		STEP 3		STEP 4
Valued Component	Project-specific effects		Possible interaction with other activity		Potential Cumulative Effects		Additional Mitigation
	Predicted residual effects	Predicted significance	Spatial	Temporal	Predicted residual effects	Predicted significance	
Air and Noise							
Air quality	Emissions from Project equipment	Not significant	Not expected	Not expected	None	Not significant	None
Noise levels	Increased noise levels	Not significant	Not expected	Not expected	None	Not significant	None
Soils and Terrain							
Sensitive terrain	Disturbance to steep slopes	Not significant	Not expected	Not expected	None	Not significant	None
Permafrost	Melting of permafrost	Not significant	Not expected	Not expected	None	Not significant	None
Soil quality	None expected	None	Not expected	Not expected	None	Not significant	None
Vegetation							
Vegetation communities	Crushed or compacted vegetation material above snow/ice layer	Not significant	Not expected	Not expected	None	Not significant	None
Listed plants	Disturbance to plants	Not significant	Not expected	Not expected	None	Not significant	None
Wildlife							
Barrenground caribou and semi-domestic reindeer	Low-level sensory disturbance	Not significant	Possible with potential activities at Reindeer Station and with Inuvik to Tuktoyaktuk Highway	Not expected	None	Not significant	None
Grizzly bear	Low-level sensory disturbance	Not significant	Possible; den sites not known	Not expected	Sensory disturbance	Not significant	None
Aquatic Resources							
Water quality	Reduced chemical and physical quality	Not significant	Possible during equipment and fuel transportation	Possible during equipment and fuel transportation	None	Not significant	None
Fish and fish habitat	Reduced habitat quality	Not significant	Not expected	Not expected	None	Not significant	None
Cultural and Heritage Resources							
Archaeology sites	None expected	Not significant	Not expected	Not expected	None	Not significant	None

CEA Steps:	STEP 1		STEP 2		STEP 3		STEP 4
Valued Component	Project-specific effects		Possible interaction with other activity		Potential Cumulative Effects		Additional Mitigation
	Predicted residual effects	Predicted significance	Spatial	Temporal	Predicted residual effects	Predicted significance	
Socio-Economics							
Employment and services	None expected	Not significant	Not expected	Not expected	None	Not significant	None
Social conflict	None expected	Not significant	Not expected	Not expected	None	Not significant	None

13 EMERGENCY RESPONSE PLAN

During the Project, appropriate regulatory agencies will be contacted immediately in the event of an emergency. In the event of a fuel spill, the updated Project-specific Spill Contingency Plan (included in Appendix E) will be followed, and the Northwest Territories 24-Hour Spill Report Line (867-920-8130) will be contacted. Other safety, contingency and emergency response procedures will be followed, as outlined in the applicable comprehensive documents provided in the appendices of this PD (Emergency Response Plan [Appendix E] and HSE Manual [Appendix F]).

14 CLEAN-UP, RECLAMATION, DISPOSAL AND / OR DECOMMISSIONING PLAN

All equipment, materials, and any debris will be removed from the Project area prior to spring breakup and taken to Inuvik (and further south as applicable) for appropriate disposal. Any waste fluids generated, and excess fuel containers will also be removed from the Project area and disposed of appropriately. Spill containment kits will be available at camps and staging sites, and carried on vehicles to properly contain accidental spills. Spills will be cleaned up and impacted materials remediated through excavation and disposal. An updated Spill Contingency Plan is provided as part of te Emergency response Plan in Appendix E. Any disturbed areas will be covered with snow and / or ice to maintain protection of vegetation, soil, and water, as appropriate.

The Project area will be re-inspected by helicopter in the summer following Project completion and any remaining debris or other materials will be cleaned up and removed from the area.

15 OTHER ENVIRONMENTAL ASSESSMENTS

In 1997, Golder produced a PD for submission to the EISC, an archaeological and ecological assessment report and an Environmental Impact Assessment for the Ikhil Gas Project (1997a; b; c, respectively) which described soils and terrain, vegetation, wildlife and wildlife habitat, fisheries and archaeology resources for the area. IMG-Golder Corporation (IMG-Golder)

produced several PD reports for a variety of 2D and 3D seismic surveys in the Mackenzie Delta, including one seismic project in the Caribou Hills.

Since 2009 and ongoing, Kiggiak EBA and IMG-Golder carried out several studies and completed reports for the proposed Inuvik to Tuktoyaktuk Highway, which is routed to the east of the Project area. Within the Mackenzie Delta, a number of other oil and gas program assessments have been completed, and other studies have occurred over the years. Examples of these are listed in Table 15.1. This list is not exhaustive and does not include all assessments and studies that have occurred in the area. Examples are provided as a general indication of the intensity of research on various environmental, cultural and social subjects in the region.

Table 15.1 Examples of Past Environmental Assessments and Studies of General Relevance to the Project

Assessment / Study	*Period*	*Sources*
Spring 2010 Aquatik Field program Results	2010	Kiggiak (2010a)
Submission to the EISC Inuvik to Tuktoyaktuk Highway / Spring – Summer 2010 Field Stream Crossing Assessment	2010	Kiggiak EBA (2010b) on behalf of GNWT, DOT
Submission to the EISC Construction of the Inuvik to Tuktoyaktuk Highway, NWT	2010	Kiggiak EBA (2010c) on Behalf of GNWT, DOT
Archaeological and Fisheries assessment of the Tuktoyaktuk to Source 177 Road	2009	IMG-Golder (2009)
Submission to the EISC MGm Energy Corp. Ogruknang 2D Seismic Program, 2007/2008, 2008/2009 and 2009/2010	2007	IMG-Golder Corp. (2007) on behalf of MGM
Review of the Ikhil gas development and pipeline regulatory and environmental process: Lessons learned (Environmental Studies research Fund)	2007	Kavik Axys (2007)
Inuvik Gas Pipeline Lessons Learned. Prepared by North of 60 engineering Ltd. (Imperial Oil resources Ltd.)	2004	McDougal (2004)
Annual Environmental Inspection Reports of the Ikhil Gas project	2003-0ngoing	AltaGas / IMG-Golder Corp.
GNWT, ENR and DFO	Ongoing	Wildlife management surveys and studies; aquatic studies
Submission to the EISC: Chevron North Ellice and Olivier 3D Seismic Programs	2005	IMG-Golder prepared for Chevron Canada Resources
Submission to NEB: EIS for Mackenzie Gas Program	2004	Imperial Oil et al. (2004)
Submission to NEB: Comprehensive Study Report, Devon Beaufort Sea Exploration Drilling Program	2004	Devon Canada Corporation (2004)
Submission to the EISC: Chevron Arvoknar, Farewell and Ya Ya 3D Seismic Programs	2004	IMG-Golder. (2004), prepared for Chevron on behalf of the MDJV
Submission to the EISC: Chevron Garry 3D Seismic Program	2004	Kavik-Axys Inc. (2004), prepared for Chevron on behalf of the MDJV.
Submission to the EISC: Chevron Taktuk 3D Seismic Program	2003	Kavik-Axys Inc. (2003), prepared for Chevron on behalf of the MDJV
Mackenzie Gas Project Reconnaissance and Impact Assessment	2003	Mackenzie Project Environmental Group (2003)
Vegetation Classification and Wildlife Habitat Suitability Modeling in the Mackenzie Delta Region	2002	Inuvialuit Environmental and Geotechnical Inc. (2002), prepared for The Operators and the

Assessment / Study	*Period*	*Sources*
		Wildlife Management Advisory Council in the Mackenzie Delta Region, NWT
Mackenzie River Delta Heritage and Biophysical Resource Surveys	2001	Inuvialuit Environmental and Geotechnical (2001)
Napoiak Seismic Program and Napartok Gravity Survey	2001	Inuvialuit Environmental and Geotechnical (2001)
Mackenzie Delta Inuvik Block 1 & 2 Winter Seismic Program	2000/2001	Inuvialuit Environmental Inc. (2000) prepared for Chevron
Mackenzie River Delta Winter 2001 Regional Seismic Acquisition Program	2001	Inuvialuit Environmental Inc. (2000) prepared for Explor Data Ltd.
Mackenzie Delta Winter 2000/2001 Napartok Seismic Program	2000	Inuvialuit Environmental Inc. (2000) prepared for Petro-Canada
Submission to the EISC Ikhil Gas Development to Supply Natural Gas to the Town of Inuvik.	1997	Golder (1997a)
Technical Report: An ecological and archaeological survey of the Ikhil gas development study area	1997	Golder (1997b)
Environmental impact assessment for the Ikhil gas development to supply natural gas to the town of Inuvik (NEB)	1997	Golder (1997c)
Town of Inuvik gas supply environmental overview: A report submitted to the Inuvialuit Petroleum Corporation	1996	Webb and McDougall (1996)
Beaufort Region Environmental Assessment and Monitoring Program (BREAM)	1986 to 1994	BREAM analysis reports
Mackenzie Environmental Monitoring Program (MEMP)	1985 to 1994	Government and industry reports
Inuvialuit Organizations (Joint Secretariat, FJMC, Wildlife Management Advisory Council (NWT), Inuvialuit Game Council, HTC, ILA)	1984 to present	Surveys, management plans, harvest studies, etc.
Northern Oil and Gas Action Program (NOGAP)	1982 to 1992	NOGAP bibliographies and reports
Oil and gas exploration and development (CAGSL; Parsons Lake)	1970's to 1990's (onshore peak in 1970's)	Government and company reports; consultant studies
Berger Commission Hearings (pipeline)	1977	Transcripts and reports by various groups
IBP Site evaluation	1970 to 1975	Panel and government lists and reports; Eng and Green (1989)
Reindeer Grazing Reserve evaluation and management	1935 to 1970's	CWS publications and reports; Canadian Field-Naturalist and botanical journals
Aquatic furbearer studies - Delta	1950's to 1960's	CWS publications
U.B.C. Deltaic process studies (terrain, vegetation, hydrology)	1950's to present	MacKay (1963); Gill (1971) and various scientific journals

16 CLOSURE

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

Respectfully,

INSERT SIGNATURE

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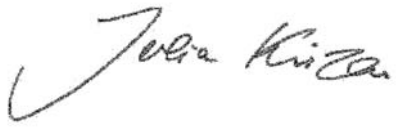

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National Energy Board

PROJECT SUMMARY FOR OPERATIONS AUTHORIZATION APPLICATION FOR THE UGFI ET AL IKHIL 2 / J-35 GAS WELL DRILLING, COMPLETION AND TIE-IN PROGRAM IKHIL, NWT

October 21, 2011

EXECUTIVE SUMMARY

PROJECT DESCRIPTION

Utility Group Facilities Inc. (UGFI) is reviewing plans to drill and complete a new well offsetting the Ikhil J-35 well as part of the existing Inuvik Gas Project in the Mackenzie Delta. The Project may commence as early as the winter of 2011/2012 or as late as the winter of 2013/2014. This well (UGFI IKHIL 2 / J-35) will provide a redundant source of gas to supply the Northwest Territories Power Corporation (NWTPC; for power generation) and the Town of Inuvik for heating and domestic appliance use for the community.

The new well will replace the K-35 well which is no longer capable of production. The activity associated with this Project will include the building of a winter access to the Ikhil well sites, construction of a snow / ice pad, mobilization of an Akita Equtak Drilling Ltd. (Akita Equtak) drill rig from southern Canada to the location, the drilling of one well, including completion and tie-in activities on the well, and then subsequent demobilization of all equipment back to Inuvik and southern Canada. An on-site temporary camp will be established to accommodate up to 60 personnel. The camp will be equipped with a heated water storage and a heated wastewater storage system that is capable of handling all of the wastes created in the camp. All wastewater will be taken to Inuvik for disposal / treatment. Likewise, all solid wastes will be removed and taken to appropriate disposal sites. The intent is to leave no waste on-site and no sumps will be constructed.

LOCATION

The Ikhil reservoir is located in the Caribou Hills approximately 50 kilometres (km) north-west of the Town of Inuvik. The Ikhil K-35 well, drilled in 1986, is centrally located in Production License (PL)-06, which covers a subsurface area of approximately 25 square kilometres (km^2). In 1998, two additional wells were drilled into the reservoir, Ikhil J-35 and Ikhil N-26. The Ikhil J-35 well is still producing but the N-26 well was abandoned as non-productive in 1998.

The Ikhil well sites and production facility are located on Inuvialuit private lands as described under Section 7(1) (a) of the *Inuvialuit Final Agreement* (IFA) of 1984. Both surface and subsurface rights are held, with the lands administered by the Inuvialuit Land Administration (ILA).

PROJECT TIMETABLE FOR A 2011/2012 COMMENCEMENT

Activity	***Approximate Date***
Submit PD to EISC	October 3, 2011
Submit EIS to NEB	Mid-October
Submit water license application to NWT Water Board	Early November
Submit land use permit application to ILA	Early November
Submit permit application to DOT	Early November
EISC decision	Mid-November, 2011

Activity	*Approximate Date*
Submit drilling application to NEB	Mid-November, 2011
Commence ice road construction	Mid-December 2011
Commence well site construction	Mid-January 2012
Mobilize rig and well consumables to Inuvik	Mid-January 2012
Mobilize rig and camp to Project location	3rd week of January, 2012
Spud well	February 1, 2012
Well completed	March 1, 2012
Facilities moved and well tied in	Mid-March, 2012
All equipment demobilized, location cleared	3rd week March, 2012

REGULATORY APPROVALS

This Project Summary is submitted to the National Energy Board (NEB) to assist the NEB with reviewing of the Operations Authorization (OA) Application for this Project. A Project Description was submitted to the Environmental Impact Screening Committee (EISC) October 3, 2011 for screening under the IFA. An Environmental Impact Assessment (EIA) was submitted to the NEB October 14, 2011. To adhere to all legislation that is relevant to the Project, a number of permits will be applied for. These permits include:

Regulator	*Required Approval*
Inuvialuit Land Administration (ILA)	Land Use Permit and Temporary Right of Way Permit
Northwest Territories Water Board	Class B Water License
National Energy Board (NEB)	Environmental screening; Operations Authorization; Authorization to Drill a Well
Department of Transportation (DOT)	Permit for Temporary Access to a Public Highway

EMERGENCY RESPONSE PLAN

A detailed Emergency Response Plan (ERP) has been prepared specific for this Project and is attached in Appendix B. It includes a Spill Contingency Plan.

HEALTH, SAFETY, AND ENVIRONMENTAL MANUAL

A detailed Health and Safety Manual (HSE) has been prepared specific for this Project and is attached in Appendix C.

ENVIRONMENTAL PROTECTION PLAN

An Environmental Protection Plan (EPP) has been completed to summarize all mitigation measures identified for the different Project components and is attached in Appendix D.

WASTE MANAGEMENT PLAN

A Waste Management Plan (WMP) has been prepared specific for this Project and is attached in Appendix E.

CLEAN-UP, RECLAMATION, DISPOSAL AND / OR DECOMMISSIONING

All equipment, materials and waste products associated with this drilling program will be removed from the site immediately following Project completion and transported to the appropriate locations and facilities. A Project–specific Waste Management Plan was developed and will be distributed to Project crews. Two thorough inspections will be conducted: one commencing immediately after demobilization of all equipment and machinery and another one in the snow free season following the drilling program.

At the end of the Ikhil Gas Project lifetime, all wells will be abandoned and decommissioned as per NEB requirements.

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1 DEVELOPMENT SUMMARY

Project Description

Utility Group Facilities Inc. (UGFI) is submitting this Project Summary to the National Energy Board (NEB) to assist in its review of the Operations Authorization Application for this Project. UGFI is reviewing plans to drill and complete a new well offsetting the Ikhil J-35 well as part of the existing Inuvik Gas Project in the Mackenzie Delta (Figure 1; Appendix A), commencing as early as the winter of 2011/2012 or as late as the winter of 2013/2014. If a decision to proceed with drilling an offset well at Ikhil is made, a separate Application to Drill a well (ADW) wil be filed.This well (UGFI 02 / J-35) will provide a redundant source of gas to supply the Northwest Territories Power Corporation (NWTPC; for power generation) and the Town of Inuvik for heating and domestic appliance use for the community. The new well will replace the K-35 well which is no longer capable of production. Figures 2 and 3 (Appendix A) show the old and new well locations.

The Ikhil Gas Development Plan (Submission 06-97-03) was initially proposed by the Inuvialuit Petroleum Corporation (IPC) as Operator of the Ikhil Gas Project at that time. The project was reviewed by the EISC during meetings held July 28 to 31, 1997 and was approved. It was determined by the EISC that "the development will have no significant negative impact on the environment or Inuvialuit harvesting in the Inuvialuit Settlement Region (*Inuvialuit Final Agreement* [IFA] Section 11(13)(a))." The Ikhil Gas Development Plan was subsequently submitted to the National Energy Board (NEB) on August 29, 1997 and approval received on December 24, 1997. In the Development Plan, IPC planned to use the K-35 well and to drill two additional wells to provide a secure supply of gas for the Town of Inuvik.

The additional two wells were drilled in 1998; however, one of those wells (N-26) was dry and abandoned and was not a viable source well. Since late 2010, the K-35 well is unable to produce due to water inflow and is currently shut-in. It is used as an observation well to monitor pressure and gas-water contact changes in the Ikhil gas pool.

J-35 is currently the only supply source for gas from the Ikhil gas pool which has supplied gas to the Town of Inuvik since start-up in May of 1999. UGFI is now the operator of the field and facility and plans to drill a new well approximately 100 m (down hole) offset to J-35 possibly this upcoming winter as part of the ongoing field development of the Ikhil Gas Project. The surface location of the proposed well is generally governed by the geometry of the gas reservoir. The specific siting of the proposed well can be adjusted by directionally drilling into the reservoir in the best location to intersect the gas sands that are believed to be present while allowing the surface location to be sited near the J-35 well.

Drilling Program

The activity associated with this Project will include the building of a winter access to the Ikhil well sites (Figure 2), construction of a snow / ice pad, mobilization of an Akita Equtak Drilling

Ltd. (Akita Equtak) drilling rig from southern Canada to the location, the drilling of one well including completion and tie-in activities on the well, and then subsequent demobilization of all equipment back to Inuvik and southern Canada.

The winter access to the new well site will branch off the Inuvik to Tuktoyaktuk ice road to the base of Blueberry Hill following what is known as the “Alternate Route”, which is the same route used for initial well drilling and production facility construction in 1997/1998/1999, in 2009 and 2011 when work-over operations were conducted on the Ikhil K-35 well and from time-to-time for replenishment of operating supplies, diesel and gravel. The winter access is approximately 8 km in length and will be built to accommodate all the heavy loads associated with construction and the rig mobilization. The winter access consists of an ice road, following the Mackenzie River East Channel and an existing overland access. Water for the access and location construction (including the ice pad) will be withdrawn only from the Mackenzie River.

Akita Equtak will supply a drilling rig for the Project and a camp to accommodate up to 60 personnel on-site. The camp will be equipped with a heated water storage and a heated wastewater storage system that is capable of handling all of the wastes generated in the camp. Sewage will be taken to Inuvik for disposal / treatment. Likewise, all solid wastes will be removed and taken to appropriate disposal sites. The intent is to leave no wastes on site.

UGFI intends to site the new well as close as possible to the J-35 well to minimize tie-in costs, work activity and any surface disturbance in the immediate area (Figure 3). This new well will provide a second well to back-up the J-35 well in the event of an operational failure. The new well may be drilled directionally to reduce the overall foot print and the length of tie-in. Two additional sands above and below the main Ikhil sand are prospective in the new well to provide additional gas reserves.

The land area required for the new well location is small and will have minimal impact on the surface landscape at the site. The new well site will be located within 100 metres (m) of the J-35 well site, and an area no more than 100 m by 160 m (1.6 hectares [ha]) will be required for the ice pad to conduct the drilling, stage the equipment and facilitate the camp. The permanent gravel pad required for the well head equipment and connection to the above ground gathering line will be similar to the K-35 and J-35 gravel pads and utilize approximately 0.03 ha (equivalent to 10 m by 30 m) of surface area.

The well site will be constructed with a small teardrop centre area of gravel which will house the permanent well site production equipment once the well is drilled. The remaining well site area required to support the drill rig and camp will be constructed with a snow/ice pad surrounded by a snow/ice containment berm. The rig and camp will be placed on rig matting on top of the ice pad. This procedure, which has been used successfully in the past, will protect the ice pad from melting during the drilling program and from contamination. No sumps will be excavated, all waste will be collected in aboveground tanks and trucked off-site for appropriate disposal.

In order to minimize any ground effects, all stationary fuel tanks on location will be double walled or will be located within a self berm skid. Refuelling of vehicles will be conducted following a strict refuelling procedure and using approved conventional fuel transfer equipment.

As mentioned previously the camp will be self-contained with sanitary wastes stored and transported off-site for disposal in an approved manner. The drilling program will also be self–contained and conducted in a zero discharge manner.

Drilling fluids will be treated and recycled to the greatest extent possible and waste fluids remaining at the end of the Project will be transported off-site and disposed of at a proper facility. All drill cuttings will also be trucked off-site for disposal at an appropriate site.

The well depth for the new well will be approximately 1,200 m total vertical depth (TVD), similar to the J-35 and K-35 well depths. The drilling operation is expected to be completed in approximately 14 days. The completion program for the new well will be similar to the J-35 completion, although other minor changes will be evaluated in the design stage of the well programming. Once this well is completed, the surface equipment and above ground gathering line from K-35 will be relocated to the new well site and a pipeline tie-in completed to the Ikhil production facilities.

Project Location

All drilling activities will take place within the existing Production Licence PL-06 on Inuvialuit lands where both surface and subsurface rights are held by the Inuvialuit. The PL-06 is 2,506 ha in size encompassing sections 25, 26, 34, 35, 36, 44, 45, and 46. The J-35 and K-35 well sites, gathering lines and production facilities are located centrally within the PL-06 and cover approximately 0.7 ha in total. The new well, facilities and tie-in pipeline will add less than 0.1 ha of surface disturbance to the existing Ikhil Gas Project (Figure 3).

1.1 WINTER ACCESS

The proposed winter access is composed of two sections (Figure 2):

1. An ice road on the Mackenzie River East Channel connecting eastward from the Inuvik to Tuktoyaktuk ice road to the bottom of Blueberry Hill. The entire ice road from Inuvik to this location is approximately 58 kilometres (km) in length, with approximately 50 km of the route using the official Inuvik to Tuktoyaktuk ice road. The final section of ice road will lead eastward from the ice road on the East Channel (Figure 2). This ice road will lead approximately 4 km eastward to the bottom of Blueberry Hill.

The Government of the Northwest Territories (GNWT) Department of Transport (DOT) will be contacted with a request that the ice road be constructed after freeze-up in December and January so that UGFI is able to commence drilling operations early in February.

2. From the bottom of Blueberry Hill, an established overland access leads up a seasonal drainage valley to the Ikhil wells and production facility (this access is called the “Alternate Route”). UGFI is proposing to use this existing access to construct the overland portion of the winter access. This route was used for initial well drilling and production facility construction in 1997/1998/1999, in 2009 and 2011 when work-over operations were conducted on the Ikhil K-35 well and from time-to-time for replenishment of operating supplies, diesel and gravel.

The ice road and overland access will be built to accommodate all of the heavy loads associated with construction and the rig mobilization. Water for the entire winter access will be taken exclusively from the Mackenzie River.

Operations to establish the ice road include ice profiling, flooding of thin ice sections and the initial snow ploughing required for opening the road. Snow and ice will be piled up to form ramps for crossing onto the land. No banks will be cut to access the land. Maintenance snow ploughing of the road will take place to enable vehicle access for the duration of the Project.

The overland access route will be constructed using proven Arctic construction practices. A snow cat will be used to pack the snow cover and then a low-ground pressure vehicle (LGPV) will begin flooding the access. After a base has been established, water trucks with balloon tires will build the snow / ice thickness to achieve a thickness of at least 20 centimetres (cm; 8 inches). Regular water trucks will be used to move water from the Mackenzie River to the LGPVs. A local contractor will be tasked with the development and construction of the entire winter access.

There are several weeks of contingency within the planned schedule to accommodate a delayed freeze-up date and other unforeseen weather events.

1.2 WELL SITE PREPARATION

For a commencement in the 2011/2012 season, the well location will be prepared after freeze-up in mid-January 2012 to meet a scheduled spud date of February 1, 2012. The well site will be covered with a 20 cm thick snow / ice pad measuring approximately 100 m by 160 m and will be surrounded by a snow / ice containment berm. The water will be trucked from the Mackenzie River. Snow blades on construction equipment at the well site will be fitted with mushroom shoes to limit potential for damage to the vegetation and soil cover during construction.

A small teardrop gravel pad measuring approximately 10 by 30 m will be placed immediately around the well site area on a liner mat. The first 20 cm of gravel will be placed on the ground prior to constructing the ice pad. The ice pad will then be built around and level with the gravel pad. After the well has been completed and prior to demobilizing the equipment, the gravel pad thickness will be increased to a thickness to 1 m or more.

1.3 DRILLING RIG

A small conventional oilfield drilling rig supplied by Akita Equtak, with a rated capacity of 1,400 m, will be used to conduct the drilling. The drilling rig, well consumables and well service equipment will be trucked from southern Canada to Inuvik in mid-January and staged at Akita Equtak's property in Inuvik. Construction equipment and rig mobilization equipment will be sourced in Inuvik from Inuvialuit companies wherever possible.

The rig will be mobilized from the staging area to the well site, using the winter access, in late January 2012. The rig will be placed on rig matting on top of the snow / ice pad. This procedure, which has been used in the past, will protect the ice pad from melting.

All stationary fuel tanks will be double walled or will be located within a self-berm skid. Refuelling of vehicles will take place using approved conventional fuel transfer equipment. The staging and drilling facilities will be located at a minimum of 100 m away from any existing water body.

To support local businesses, construction and support equipment, supplies, and fuel will be procured locally, to the greatest extent possible.

1.4 CAMP

A 60 person rated camp will be sourced from Akita Equtak as that camp is already in Inuvik. The camp will be mobilized from the staging area in Inuvik to the well site using the winter access in late January 2012. The temporary camp will be placed on rig matting on top of the snow / ice pad. This procedure, which has been used in the past, will protect the ice pad from melting. Additionally, the camp will be located at least 100 m away from any existing water body.

To support local businesses, construction and support equipment, catering services, supplies, potable water and fuel will be procured locally, to the greatest extent possible, and transported from Inuvik to the Project site using the winter access.

The camp will be a standard winterized Atco Structures site camp that will be hauled to the site by trucks (an estimated 21 loads for the camp structure, 2 loads for the generators, one load for the sewage tank and 3 loads for rig matting). The units will be installed on rig matting when they arrive at the lease.

The camp consists of the following units:

- Unit #1 (12 feet [ft] x 54 ft) - 8 man bed unit;
- Unit #2 (12 ft x 54 ft) - 4 man bed and dry stores unit;
- Unit #3 (12 ft x 54 ft) - 1 man bed, freezers, washroom unit;
- Unit #4 (12 ft x 54 ft) - 3 man bed, kitchen unit;
- Unit #5 (12 ft x 54 ft) - 3 man bed, dining room unit;
- Unit #6 (12 ft x 54 ft) - 3 man bed, dining room unit;
- Unit #7 (12 ft x 54 ft - 3 man bed, washroom unit;
- Unit #8 (12 ft x 54 ft) - 8 man bed unit;
- Unit #9 (12 ft x 54 ft) - 7 man bed unit;

- Unit #10 (12 ft x 54 ft) - 3 man bed, washroom unit;
- Unit #11 (12 ft x 54 ft) - 3 man bed, lounge unit;
- Unit #12 (12 ft x 54 ft) - 3 man bed, lounge unit;
- Unit #13 (12 ft x 54 ft) - 3 man bed, recreation room unit;
- Unit #14 (12 ft x 54 ft) - 8 man bed unit;
- Unit #15 (12 ft x 60 ft) - office unit;
- Unit #16 (12 ft x 60 ft) - office unit;
- Unit #17 (12 ft x 60 ft) - office and first aid unit;
- Unit #18 (14 ft x 30 ft) - mud room unit;
- Unit #19 (14 ft x 30 ft) - laundry unit;
- Unit #20 (12 ft x 48 ft) - water treatment and storage unit; and
- Unit #21 (12 ft x 48 ft) - water treatment and storage unit.

Two generators will be used; they measure 12 ft x 40 ft and are each equipped with a double walled 19,000 Litre (l) fuel tank. The estimated consumption of the units is 2,700 l per day. Fuel will be resupplied on a weekly basis using fuel trucks from Inuvik.

During camp operations, all wastewater will be stored in a 400 barrel heated sewage storage tank (12 ft diameter and 20 ft high). On average, there will be one vacuum truck per day scheduled to remove sewage from the tank and transport it to Inuvik for disposal.

Water from the Mackenzie River will be stored and treated to potable water quality standards in the water treatment modules. Alternatively, potable water may be trucked from Inuvik.

All garbage will be collected, sorted and stored in wildlife proof containers. All waste will be transported off-site and disposed of at appropriate facilities (Waste Management Plan; Appendix B).

1.5 PIPELINE TIE-IN TO NEW WELL

The K-35 wellsite production equipment and flow line will be purged, dismantled, and inspected for its suitability for reuse on the new well. It is anticipated that all of the K-35 production equipment will be reused. The new pipeline connecting the new UGFI IKHIL ET AL 2 / J-35 well with the production facility will be aligned with the existing J-35 pipeline to the greatest extent possible (see Figure 4).

1.6 DRILLING PROGRAM

Conductor, Rat Hole and Mouse Hole

An auger rig will be brought to location to construct a cellar of 2 m in diameter and set a cellar cribbing, then drill and set 20 m of 508 millimetres (mm) by 339.7 mm insulated conductor pipe, this conductor pipe will be cemented using permafrost cement.

The rig will then drill both the rat hole and mouse hole prior to departing from the location. The conductor hole, mouse hole and rat hole will be drilled dry.

Move In and Rig Up the Drilling Rig

The rig will be moved in and fully rigged in, fully winterized and a rig inspection will be conducted jointly by the rig manager and the company supervisor, prior to undertaking any drilling activity. Rig up will include rigging in a 339.7 diverter system for drilling the surface hole.

Drilling the Well

Upon completing the rig inspection, the rig manager and company supervisor will conduct a safety meeting and review the drilling plan with the rig crews and the service company representatives prior to undertaking the drilling activity.

The well will be spudded with a 311 mm bit; drilling will proceed to surface casing setting depth which will be approximately 420 m Kelly Bushing (KB). The casing shoe will be set a minimum of 20 m below the unconsolidated Alluvial Plain into the more consolidated Delta Plain. Wiper trips will be conducted as necessary while drilling the surface to ensure good well cleaning. Prior to reaching casing setting depth (no less than 10 m and no greater than 15 m above the estimated casing setting depth), the drilling tools will be pulled from the well and all tools will be double measured to confirm actual drilled depth.

Note that this well may be deviated and may be directionally drilled prior to setting the surface casing.

Drilling fluid will be cooled for this section of the well, temperature will be maintained between minus 2 and plus 2 degrees Celsius (^{0}C) to the greatest extent possible.

Upon reaching the casing setting depth, the well and drilling fluid will be conditioned to run casing. While conditioning the well, the drill string will be reciprocated; a short trip of a minimum of 20 singles will be conducted. After the “dummy trip” has been completed, the well will be circulated for a minimum of two bottoms up time or until the shale shakers have minimal cuttings observed to be coming from the well.

After the well and drilling fluids have been conditioned, “pull out of hole” (POH) will follow to run casing.

While drilling the surface hole, crews will prepare and visually inspect the 244.5 mm casing prior to running the casing into the well, also all casing running tools will be prepared and inspected to ensure “rig to run casing time” required is kept to a minimum.

Rig to Run 244.5 mm Surface Casing

All casing will have been cleaned, visually inspected and drifted with a proper sized rabbit to ensure the casing has not sustained any damage while in transit.

The casing will be spaced to be within 1 m off of the bottom of the well drilled depth, with the top casing collar to be within a minimum of 0.5 m and a maximum 1.5 m above the rotary table. This is to ensure that all of the handling of cementing heads can be conducted safely.

The circulating head will be made up and the well will be reciprocated and circulated to condition the well and drilling fluid until the well returns are clean at the shale shaker and the well drag, if any, has been removed.

Upon completing well conditioning operations, the casing will be set as low as possible at the rotary table and the casing cementing head will be made up to conduct the first stage of the cementing program.

After the cementing head has been made up and the cement lines have been attached, management and supervisors will conduct a pre-cement safety meeting. After the job safety meeting has been conducted, the first stage of the detailed cementing program will be carried out.

The casing will be reciprocated while cementing and the casing will be set as close to the bottom as possible.

Samples will be caught throughout the cement mixing sequence and placed in a water bath with a temperature range between plus 5^0C and minus 5^0C to monitor the cement setting progress.

After the first-stage cementing program has been completed, the following processes will occur:

- the float will be bumped and confirmed to be holding;
- the casing cement stage tool will be opened; and
- the upper portion of the well will be circulated until the first stage cement has achieved an initial set that is able to support the upper cement column.

After the initial set has been achieved on the first stage lower cement, circulating equipment can be rigged out and preparations for conducting the second-stage of the cementing program can proceed.

The second-stage cementing will be conducted using a drill pipe (DP) inner cementing string, install base of the cementing head to top casing collar and pick up DP cementing string as per the detailed cementing program including the following steps:

- run the cementing string to approximately 10 m above the opening ports of the casing cement stage tool;
- make up the upper cementing head assembly and establish circulation;

- pump a minimum of 2 times bottoms up to ensure annulus is free and clean prior to undertaking cementing operations;
- make up surface cementing head, conduct pre-cementing safety meeting as per the first stage and undertake cementing program;
- conduct pressure test for leaks, and cement casing as per detailed cementing program;
- catch samples of the cement mix throughout the cementing activity, place samples in a water bath of approximately 1^0C and monitor the cement setting progress;
- continue mixing and pumping cement until cement returns have arrived at surface;
- when cement returns are observed at the surface, the cement mixing will be stopped and the plug launcher released. The stage tool will be closed as per service company representative instructions;
- after stage tool has been closed bleed back running string and measure volume of flow back, flow back should not exceed 0.5 m^3;
- monitor the conductor and casing annulus, to ensure that the cement does not drop back;
- while waiting on cement (at least 24 hours), weld on the casing bowl;
- prepare to and rig up the blow-out-preventers (BOP);
- after BOP rig up has been completed, pressure test BOP, kill and choke manifold, Kelly cock, and all of the auxiliary well control equipment;
- when pressure testing the blind rams also pressure test the casing to 14,000 kilo pascal (kpa); and
- log and record all pressure tests.

Main Hole Section

Upon drilling out the casing shoe, a new hole at a maximum of 5 m below the casing setting depth will be drilled. The well will be circulated to a uniform mud weight and a pressure integrity test (PIT) casing shoe test conducted.

After the casing shoe test has been completed, the well will be drilled and directionally steered to the bottom well coordinates that will be determined. The well will be drilled to within 10 to 15 m above the top of the projected productive sand.

The drilling tools will be tripped out of the well and the directional tools will be taken out of the drilling assembly.

When the drilling fluid parameters, as determined in the drilling fluid program, have been achieved, the drill ahead to total depth will commence and the drilling fluids returns monitored closely.

Upon reaching the total depth, the following procedures will apply:

- the well and drilling fluid will be conditioned by circulating and reciprocating the drill string for a minimum of three bottom ups time has been achieved;
- after circulating and conditioning the well, make a wiper trip to the casing shoe and ensure pulling and running pipe speeds do not cause excessive hydraulic surges;
- when back on bottom continue to circulate and reciprocate the drill string and condition the well to run electric logs;
- pull out of the well to log, double strap the drill string to confirm final depth;
- rig to and run logs;
- after the logging program has been completed, run into the well with a short bottom hole assembly to condition the well for casing;
- while circulating and conditioning the well and the drilling fluid to run casing, reciprocate the drill string slowly and monitor the returns for both fluid losses and volume of cuttings that are coming over the shale shakers;
- after the well and drilling fluid have been conditioned, pull out of the well to run casing;
- rig to and run casing as per the detailed casing and cementing program, care must be taken to torque all of the casing connectors to the manufactures specification;
- run the production casing string and cement the casing using a two stage cementing program; and
- while logging the well, crews will prepare and inspect the casing string, the casing will be numbered and double measured, all casing will be drifted with a full size rabbit, to ensure it meets manufacturer's specified drift clearances.

1.7 COMPLETION PROGRAM

The main objective of the completion / testing program is to gain direct pressure and flow characteristics of Upper and Lower Aklak gas sands at 1,050 m TVD and 1,150 m TVD (estimated), respectively. The final depths and zones to be looked at will be confirmed post open hole logging of the well bore.

The planned testing program is as follows:

- tests during the drilling may be done to measure initial flows and pressures from the potential gas sands, these tests will be done during the drilling phase;
- after post drilling evaluation, the well will be cased if there are indications of commercial natural gas in the wellbore;

- the completion will commence after appropriate time intervals to allow for Production casing cement to cure and reconfiguration of on-site equipment for the pending flow tests;
- potential zones will be perforated and flowed to contained systems that will allow for the measurement of gas rate, temperatures and pressures; the produced natural gas will be flared to atmosphere; down hole pressure data will be gathered;
- it is anticipated that gas flared volumes will reflect the anticipated reserves being investigated and will be specified by the NEB re testing and flare volumes;
- flare volumes will be kept to a minimum that will allow for the establishment of the reserve potential being tested;
- the surface equipment that will be utilized will be sized and of a suitable pressure rating for the service intended;
- gas, liquid samples and flows will be gathered, analyzed and data made available to regulators;
- all liquids produced will be gathered on site, retained in tanks and transported to an appropriate disposal system;
- the zones are expected to produce sweet natural gas with no associated H_2S; reserve potential has been identified but it is not possible to quantify numbers until this testing is completed; and
- the testing program is expected to take 10 days.

1.8 EQUIPMENT

Table 1.1 provides a preliminary list of equipment that will be required to complete the Project.

Table 1.1 Preliminary Equipment List for the Project

Equipment	*Quantity*
Akita Rig 14	1
60 person camp (including associated equipment)	1
Truck shop	1
Double walled fuel tank, 50,000 litres	1
Loader	2
Snow plough	1
Caterpillar	1
Water truck	1
Vacuum truck	1
Drilling Supervisor pickup	1

Equipment	*Quantity*
Rig Manager pickup	1
Ambulance	1
Service company pickup	3

1.9 PERSONNEL

Table 1.2 outlines the approximate number of personnel required for completion of the Project. The table outlines the total number of personnel required for the Project; however, there will be a maximum of 60 people on-site at any given moment during the Project.

Table 1.2 Personnel Required for the Project

Position	*Drilling Well*	*Testing Well*
Drilling crew	15	15
Rig manager	1	1
Drilling supervisor	2	2
UGFI observer	1	2
Logistics supervisor	1	1
Water / vacuum truck operator	3	2
Loader operator	2	2
Roustabout	4	4
Catering service	6	6
Wildlife Monitor	2	2
Environmental Monitor	2	2
Medic	1	1
Mud service	1	1
Cementing	2	1
Mud logger	2	-
Mud cooler / watcher	2	-
Power tong operator	2	2
Electric wireline logging	3	3
Slick line truck and operator	-	2
Perforators	-	2
Packers / down hole tool operator	-	1
Capilary string operator	-	1
N2 truck and operator	-	2
Coil tubing truck and operator	-	2
Pressure tank testing supervisor	-	2
Pressure tank crew	-	4
Well service supervisor	-	1
Testing supervisor	-	1

Position	*Drilling Well*	*Testing Well*
Wellhead technician	-	1
DTS cable monitoring	3	1
Total	**55**	**67**

1.10 WATER NEEDS AND SOURCES

Water that will be used for construction of the entire winter access, the snow / ice pad and for camp use, if required, will be obtained from the Mackenzie River channels. The intake hoses will be screened according to current regulations to avoid fish entrainment (DFO 2005). The NWT Operational Statement for the construction of Ice bridges and snow fills (DFO 2010) will be followed.

No water will be taken from a land-locked water body where drawdown and related fisheries concerns may be an issue. Potable water will be provided to the camp either by treating river water or by truck from Inuvik.

It is estimated that daily water needs will be above 100 cubic metres (m^3) during winter access construction. A Class B water licence from the NWT Water Board will be applied for.

1.11 WASTE MANAGEMENT

UGFI is responsible for all waste products generated from Project activities and will manage the waste materials to minimize any potential threat to the environment or to public health. UGFI will ensure that waste handling and disposal procedures are carried out in accordance with all applicable legislation including NEB waste treatment guidelines, GNWT waste management and disposal guidelines, DOT rules and regulations, and others. All waste generated during the Project will be transported off-site. An integrated waste management system will be used to ensure that wastes generated by the proposed Project are disposed of in a manner that does not adversely affect the environment, public health, or safety. A Project-specific Waste Management Plan (WMP) is provided in Appendix E.

The disposal of all waste generated by the Project, whether they are disposed of in Inuvik or at another site (outside of the territory), will be manifested. This will provide a record of the volume / mass of waste produced and disposed of and where and when the disposal took place. All information generated on waste treatment and disposal will be maintained in a UGFI database to allow for easy and rapid report generation.

1.11.1 Garbage and Solid Wastes

Solid waste material will be segregated into non-hazardous waste matter, hazardous wastes, recyclable beverage containers and recyclable metal / machinery types (outlined in more detail in the WMP, Appendix E). The waste materials will be collected, compacted, and stored in suitable wildlife proof containers and shipped for disposal at an authorized waste facility. Non-hazardous waste will be disposed of at the Inuvik dump site. Recyclable metals or machinery

will be trucked south to a site where they can be sold or disposed of. Recyclable beverage containers will be recycled through the NWT *Cash in your Trash* program in Inuvik. Hazardous wastes will be trucked to applicable disposal sites (Section 1.11.4).

1.11.2 Sanitary Wastes

All wastewater will be confined in a separate lined and heated tank (Section 1.4) and regularly trucked to Inuvik for disposal. The sewage truck will be used only for transportation of raw sewage to the Inuvik sewage facility.

1.11.3 Hydrocarbons

Accidental spills on-site will be segregated and cleaned up using absorbent material which will then be transported off-site. Areas potentially subject to small spills or oil leaks (such as the refuelling area) will have berms and drip pans in place to provide containment, and then any contaminated material or liquid waste will be drained into an oily waste holding tank. The wastes will then be placed in drums for appropriate disposal off-site.

1.11.4 Drilling Wastes

During the drilling process solid and liquid drilling fluid components will be separated on-site (WMP; Appendix E). To the greatest extent possible, the fluid portion will be reused in the drilling activities. At the conclusion of the Project, both solids and liquids will be transported to Fort Nelson British Columbia, the Swan Hills Treatment Centre (SHTC) in Alberta or another approved disposal site. No drilling waste sumps or pits will be constructed on-site.

1.12 DEVELOPMENT TIME TABLE

The proposed schedule for carrying out all of the work associated with the drilling and tie-in of the proposed well in 2011/2012 is provided in Table 1.3.

Table 1.3 Proposed Drilling and Completions Schedule for a 2011/2012 Commencement

Activity	*Approximate Date*
Submit PD to EISC	October 3, 2011
Submit EIS to NEB	Mid-October
Submit water license application to NWT Water Board	Early November
Submit land use permit application to ILA	Early November
Submit permit application to DOT	Early November
EISC decision	Mid-November, 2011
Submit drilling application to NEB	Mid-November, 2011
Commence ice road construction	Mid-December 2011
Commence well site construction	Mid-January 2012
Mobilize rig and well consumables to Inuvik	Mid-January 2012
Mobilize rig and camp to Project location	3rd week of January, 2012

Activity	*Approximate Date*
Spud well	February 1, 2012
Well completed	March 1, 2012
Facilities moved and well tied in	Mid-March, 2012
All equipment demobilized, location cleared	3rd week March, 2012

2 PROJECT LOCATION

The Ikhil reservoir is located in the Caribou Hills approximately 50 km north-west of the Town of Inuvik in the Northwest Territories (NWT). The Ikhil K-35 well, drilled in 1986, is centrally located in PL-06, which covers a subsurface area of approximately 25 square kilometres (km^2). In 1998, two additional wells were drilled into the reservoir, Ikhil J-35 and Ikhil N-26. The Ikhil J-35 well is still producing but the N-26 well was abandoned as non-productive in 1998.

The geographical location of the existing Ikhil J-35 well is:

Latitude: 68° 44' 35.582" N

Longitude: 134° 08' 34.928" W

Grid: Unit J Section 35

The Universal Transverse Mercator (UTM) coordinates for the well site are:

7,625,791.58N, 534,673.64 E

Ground elevation at the location is approximately 150 m above sea level.

The existing pipeline, which delivers gas from the production facility, located between the Ikhil K-35 and J-35 wells to the town of Inuvik, follows the top of the Caribou Hills until it drops down into the surrounding Delta landscape after crossing Douglas Creek (the only above ground section of the pipeline). The pipeline right-of-way (ROW) is 10 m wide and approximately 50 km in length. The locations of the pipeline, wells and production facility are shown in Figure 1.

The Ikhil well sites and production facility are located on Inuvialuit private lands as described under Section 7(1) (a) of the IFA of 1984. Both surface and subsurface rights are held, with the lands administered by the ILA.

For the purposes of this OA, the following definitions are used:

The ***Ikhil Gas Project*** (also referred to as Inuvik Gas Project) includes the existing Ikhil well sites, gathering pipelines, production facility, and pipeline right-of-way (ROW) to Inuvik (as shown in Figure 1).

The ***Project*** refers to the work proposed in this Project Summary; that is the development of a new well (UGFI ET AL IKHIL 2 / J-35) and associated structures as described in Section 1 (and as shown in Figures 2 and 3).

The ***Project area*** refers to the general area of Caribou Hills potentially affected by the drilling and tie-in program proposed in this Project Summary. It includes the winter access, new well-pad area and new tie-in line to the existing production facility.

3 REGULATORY APPROVALS

The proposed Project (Figure 1 and Figure 2) is located on Inuvialuit 7(1)(a) lands in the Mackenzie Delta within the Inuvialuit Settlement Region (ISR) of the NWT. The proposed Project requires approval under the IFA. The EISC will be responsible for carrying out a screening of the Project under the IFA. Required permits and approvals, and the federal and territorial agencies responsible for Project approvals, are listed in Table 3.1.

UGFI will contact the appropriate regulatory agencies as listed in Table 3.1 and submit the required permit and license applications.

Table 3.1 Approvals Required for the Proposed Project

Agency and Contact Person	*Required Approval*
Patrice Stuart Land Use Applications Manager Inuvialuit Land Administration (ILA) P.O. Box 290 Tuktoyaktuk, NT X0E 1C0	Land Use Permit and Temporary Right-of-Way Permit *Inuvialuit Final Agreement*
Christine Inglangasuk Environmental Impact Screening Coordinator Environmental Impact Screening Committee (EISC) P.O. Box 2120 Inuvik, NT X0E 0T0	Approval of the Project Description *Inuvialuit Final Agreement*
John McCarthy Chief Conservation Officer National Energy Board (NEB) 444 – 7th Ave S.W. Calgary, AB T2P 0X8	Environmental screening under the *Canadian Environmental Assessment Act*; Operations Authorization and Authorization to Drill a Well under the *Canada Oil and Gas Operations Act*
Eddie T. Dillon (Chair) NWT Water Board PO Box 2531 125 Mackenzie Road Suite 302, Professional Building Inuvik, NT X0E 0T0	Class B Water License *NWT Waters Act* *NWT Water Regulations*
Gurdev Jagpal Regional Superintendent Inuvik Region 1st Floor Mack Travel Building 149 Mackenzie Road Inuvik, NT X0E 0T0	Permit for Temporary Access to a Public Highway *Public Highways Act*

A Project Description report was submitted to the EISC for screening on October 3rd, 2011. The EISC will hold their next screening meeting mid-November and UGFI will inform the NEB about the screening submission (i.e., will forward the decision letter).

The NEB is the "governmental authority competent to authorize the development" within the meaning of the IFA. The NEB is also required to conduct an environmental screening of the Project pursuant to the *Canadian Environmental Assessment Act* (CEAA), and to consider environmental impacts under its jurisdiction to approve the facilities and development under the *Canadian Oil and Gas Operations Act* (COGOA) and its applicable regulations. The environmental information to be filed with the NEB is set out in Filing Manual - Guide A - Facilities Applications and the 2011 Conclusion of Filing Manual Revision (NEB 2011). The Environmental Impact Assessment (EIA) for this project was submitted October 14, 2011.

4 NEW TECHNOLOGY

Use of existing, proven technology is planned for the Project. The Project technology has been selected because of its simplicity, safety and proven track record in the North. New technologies will be evaluated as they arise.

5 ALTERNATIVES

This Project will be completed on previously disturbed land. No sumps will be constructed and winter access follows established routes. No alternatives to this low-impact method have been identified.

6 ANTICIPATED IMPACTS AND PROPOSED MITIGATION

6.1 IMPACT AND MITIGATION SUMMARY

The proposed Project will be completed entirely during the winter months, and within a small, well defined and previously disturbed area. Therefore, the duration is considered to be short and the geographic scope is local / sub-regional

Table 6.1 summarizes the potential impacts, proposed mitigation, and residual effects that are predicted to remain after mitigation. The significance is then predicted, based on the predicted residual effects.

It is expected that the use of the proposed mitigation measures, including completion of the Project under winter conditions and meeting or exceeding government guidelines and community expectations, will result in residual environmental, cultural and social impacts that are predicted to be not significant.

Table 6.1 Summary of Potential Impacts, Proposed Mitigation, Predicted Residual Effects, and Predicted Significance

Potential Impact	*Mitigation Measures*	*Predicted Residual Effect and Significance*
Air and Noise		
Project activities can impact air quality	• Flaring will only be for short periods of time. • Number of vehicles, heavy equipment and diesel generators will be limited.	Site-specific reduced air quality may occur. *Not Significant*
Project activities can increase noise level in the area	• Noise will be restricted to the immediate vicinity of the work in progress. • The highest noise levels will likely occur from drilling and flaring of gas, which will occur during a short time frame only in a localized area.	Site-specific increased noise levels may occur. *Not Significant*
Terrain and Soils		
Disturbance to sensitive terrain features (i.e., steep terrain)	• Project will be completed under stable, frozen ground conditions. • Winter access on the river channel and use of previously established overland access (Alternate Route) will be used for access to the Project area. • Ramp of snow and ice will be built where ice road meets the land. • Final inspection and clean-up will focus on ice pad around new well site	Site-specific disturbance to steep terrain may occur if adequate snow / ice thickness is not maintained. *Not Significant*
Access route, staging area and temporary camp may alter surface insulation and permafrost	• The Project will be completed under frozen ground conditions. • Winter access follows previously established route. • Equipment will be staged on an ice pad with matting on top. • Temporary camp will be located on an ice pad.	Site-specific melting of permafrost may occur. Not Significant
Spills can affect soil quality.	• A Spill Contingency Plan is in place to handle spills of fuel or hazardous materials. • An Emergence Response Plan is in place. • Storage areas will include secondary containment so that spills or ruptures remain contained on site. • Staged equipment, drill rig and camp will be located on an ice pad with matting on top, creating a barrier which is expected to prevent spills from reaching the vegetation and soil, and allow easier clean-up.	None predicted when clean-up is complete. *Not Significant*
Vegetation		
Disturbance to vegetation communities	• A minimum 20 cm ice / snow cover will be maintained on the overland access route. • Frozen ground and snow cover will allow travel over most vegetation without damage to the root systems. • Final site inspection and clean-up will be conducted with site-specific clean-up conducted on foot to avoid disturbance to vegetation.	Plant material above the snow / ice cover is expected to be crushed or compacted by vehicles and equipment. *Not Significant*
Potential disturbance to sensitive or rare plant species	• Drilling will occur in winter, which will coincide with the dormant period for herbaceous plants. • Winter access follows previously established route along the western escarpment of the Caribou Hills. • Minimum snow / ice cover of 20 cm will help to mitigate possible effects to low-lying vegetation. • Natural revegetation will be promoted by avoiding disturbance of the root zone.	Site-specific disturbance to sensitive or rare plants may occur. *Not Significant*
Wildlife		
Disturbance of barrenground caribou and / or semi-domestic reindeer in their respective	• Wildlife Monitors will scout ahead of equipment to avoid disturbing any observed caribou and / or reindeer. • If any animals are observed, work will cease until the animals leave the area.	Site-specific disturbance to habitat vegetation may occur. Distant, low-level

Potential Impact	*Mitigation Measures*	*Predicted Residual Effect and Significance*
wintering ranges		sensory disturbance may occur. *Not Significant*
Encroachment on grizzly bear habitat and / or den sites	• Wildlife Monitors will scout ahead of equipment to avoid potential bear dens and / or conflicts with bears. • Newly identified den sites will be avoided by at least 300 m.	Distant, low-level sensory disturbance may occur. *Not Significant*
Attraction of bears to camps and work areas can lead to bear-human conflict	• Camp will be kept clean, with use of bear-proof containers. • Wildlife Monitors will communicate bear sightings. • Personnel will have bear safety training.	None predicted. *Not Significant*
Encroachment on waterfowl habitat and / or nesting sites	• Winter access follows previously established route. • Minimum snow cover requirements will help to mitigate possible effects to low-lying vegetation. • Camp will be constructed on ice pad. • Ice pad will be build up around new well site and serve as staging area.	Limited disturbance to above-ground vegetation habitat may occur. *Not Significant*
Aquatic Resources		
Wastewater disposal can affect receiving water bodies and with this, fish and fish habitat	• All wastewater will be collected and transported to the Town of Inuvik or further south for appropriate disposal. • All drilling waste will be collected and transported to the Town of Inuvik or further south for appropriate disposal.	No effects to water quality are predicted. *Not Significant*
Spills can impact water quality	• A Spill Contingency Plan is in place to address spills of fuel or hazardous materials. • Sites for storage of fuels, lubricating oils, chemicals, or other hazardous materials will be located a minimum of 100 m away from water bodies, and surface drainages. • Storage areas will include secondary containment so that spills or ruptures remain contained on-site. • Hazardous materials transportation operators will be licensed and adhere to approved emergency response and spill response plans.	None expected when clean-up is complete. *Not Significant*
Cultural and Heritage Resources		
Loss or damage of cultural resources including archaeology sites	• Known archaeology sites have been identified in the region surrounding the Project area and will be avoided by at least 100 m. • In the event that previously unknown archaeology sites are discovered during drilling work, work will cease at that location and the PWNHC and the communities will be notified and consulted for advice on mitigation.	None expected. *Not Significant*
Socio Economics		
Employment and community services will be affected	• Equal opportunity will be given to local employment and service, supply and contracting services by using the IRC Business List to source required services.	None expected. *Not Significant*
Social conflict in regional communities stemming from cultural separation and alcohol and / or drug abuse	• Procedures and policies in the CPE HSE Manual will be followed.	None expected. *Not Significant*

6.2 WINTER ACCESS

Effects that may arise from the construction and use of the ice road (on the frozen river channel) and the overland winter access include introduction of deleterious substances and erosion of

banks where the ice road meets land. Only snow and water will be used for ice road and winter access construction. An Emergency Response Plan including a Spill Contingency Plan are described in Section 11, and provided in Appendix B. Equipment will be well maintained, and free of external fluid leaks, grease, and oil. Equipment will be refuelled and serviced at staging sites only. Drip pans, absorbent materials and other means of spill containment will be kept on-site and with each vehicle. Ice thickness and strength will be monitored frequently to ensure safe operations. Extra ice padding will occur at sites were the ice road meets land, to provide protection to the banks. Should bank disturbance inadvertently occur, matting will be placed on-site to re-insulate the soil.

The implementation of the above mitigation measures for the construction and use of the ice road and overland winter access is predicted to result in minimal impacts to aquatic habitats. These residual impacts are predicted to be not significant.

6.3 SPILLS

Water quality and fish habitat can be impacted as a result of accidental spills of fuel or hazardous materials. The Spill Contingency Plan is provided as part of the Emergency Response Plan which is described in Section 11 and provided in Appendix B. Proposed Project clean-up, reclamation, and disposal methods are provided in Section 12, which are designed to prevent and mitigate the impacts of any potential accidental spills. Equipment will be well maintained, and free of external fluid leaks, grease, oil and mud. Equipment will be refuelled and serviced at designated areas only. Drip pans, absorbent materials and other means of spill containment will be kept on-site and with each vehicle; additionally, spill kits will be available at the designated refuelling area. Staff will be trained in safe refuelling operations and Environmental Monitors will be encouraged to report on any concerns or inappropriate practices.

The implementation of spill prevention and mitigation measures is predicted to result in no residual impacts to aquatic resources.

6.4 EFFECTS OF ACCIDENTS AND MALFUNCTIONS

During the Project, equipment accidents and malfunctions can create potentially hazardous situations. Accidents and malfunctions may negatively affect the environment; therefore, strict adherence to environmental and health and safety manuals will be enforced to reduce their likelihood. Should an incident occur, response procedures and reporting guidelines in the ERP (including Spill Contingency Plan) and HSE Manual will be followed (Appendix B and Appendix C, respectively).

All incidents will be reported to the appropriate agencies and each incident report will be reviewed to identify measures to avoid future similar incidents and improve mitigation measures. Significant incidents and near-misses will be formally investigated by trained staff.

Equipment will be well maintained and inspected on a regular basis to prevent potential malfunctions, and operators will be instructed to remain vigilant and work.

Accidents and malfunctions that may occur during the Project include hydraulic oil leaks, spills, and well kicks and blowouts.

6.4.1 Hydraulic Oil Leaks

Hydraulic systems are commonly used on transportation equipment and drill rigs. There is the potential that a hose or fitting may crack or leak, and fluid could spill onto the ice cover of the winter access or snow / ice pad at the new well site.

Preventative maintenance and regular equipment inspections will be conducted routinely during this Project to minimize the likelihood of leaks. In the event that a leak does occur and fluids spill onto the ice surface, it can be easily detected and cleaned up without residual effects to the environment.

Environmental Monitors and other Project personnel will conduct regular inspections to detect spills from leaking equipment (or stemming from other accidents) on the winter access, the drill site (including refuelling area) and the camp throughout the Project.

In the event that a leak does occur, UGFI will implement their spill clean-up procedures. Any spilled material will be contained with absorbent materials from the spill kit and placed in a plastic lined container, along with any contaminated snow or ice that is removed for disposal off-site. The spill will be reported as required by regulatory guidelines to the NWT 24-Hour Spill Report Line (867- 920-8130). It is anticipated that by following these procedures, effects to the environment resulting from hydraulic leaks will be not significant.

6.4.2 Spills

There are numerous potential sources of spills associated with the Project. Hydraulic systems, vehicles, and fuel and wastewater storage containers are some of the potential sources.

Monitoring, inspection and maintenance measures will be employed to reduce the likelihood of spills. Environmental Monitors and other Project personnel will conduct regular inspections to detect spills on the winter access and the drill site during the Project.

All fuel tanks on-site will be double walled. All vehicles and equipment will have drip pans placed underneath when stationary. Refuelling will take place at a specially designated, bermed area and will be performed by trained personnel as outlined in previous sections of this Report. It is anticipated that by following these procedures, effects to the environment resulting from inadvertent spills will be not significant.

6.4.3 Well Kicks and Blowouts

Drilling fluids, sand or sediment, and gaseous or liquid hydrocarbons may be released to the flare stack or surface in the event of a well kick. A loss of well control could result in a blow-out and could include the uncontrolled release of drilling fluid, produced water and hydrocarbons from the well. The released substances would affect the surface environment in the immediate

area of the well, and could enter subsurface and aquatic environments (depending on the volume).

The original J-35 well was drilled into what is considered to be a normal pressure gradient, and therefore did not require any well control activities. The UGFI ET AL IKHIL 2 / J-35 well is being drilled into the same reservoir, which has now been partially depleted. Therefore, the well control risks have been greatly reduced as the current bottom hole pressure is less than the hydrostatic pressure created by a column of fresh water.

Well kicks are infrequent and blowouts are extremely rare, especially in situations where a well has been previously drilled nearby (the new 2 / J-35 well will be located in close proximity to J-35; Figure 3). Well kicks and blowouts are primarily managed through prevention.

In the unlikely event of a well kick, emergency flaring can be carried out using standard equipment and well control procedures to minimize effects on the environment.

UGFI and its partners are using proven technology in the prevention of blowouts such as blowout prevention equipment and adequate training of key personnel. Standard blowout prevention equipment includes triple redundancy and hydraulic chokes that can be activated from the rig floor at any time.

Any potential well blowout risk is further mitigated through strict and ongoing monitoring by trained personnel.

With the mitigation measures in place and the strict adherence of the ERP, environmental effects resulting from accidents and malfunctions are not likely to be significant.

6.5 MITIGATION IMPLEMENTATION

Through acknowledging the value of local knowledge, UGFI is able to plan its Project work in the most environmentally and culturally responsible manner. Important sources of local knowledge include, but are not limited to, the knowledge of Environmental and Wildlife Monitors and community knowledge shared through consultations and ongoing communications.

6.5.1 Wildlife and Environmental Monitors

UGFI will use Environmental Monitors and Wildlife Monitors throughout the duration of Project activities. The monitors will be familiar with the environmental and cultural concerns and the proposed mitigation measures, and they will be encouraged to communicate local concerns and solutions to Project crews. The monitors will have the appropriate training and experience as well as local knowledge of the Project area. Environmental Monitors will be encouraged to bring environmental concerns (such as e.g., leaking equipment) to UGFI's attention. Daily reports will be prepared that describe the activities observed during their shift, including any concerns and recommended steps to resolve them. Monitor observations will be submitted to the appropriate organization as required.

6.5.2 Communications

Effective communication is considered to be critical for the successful completion of the Project in an environmentally, culturally and socially responsible manner. UGFI will establish communication links at the start of the Project, and continue these efforts through the life of the Project. This will ensure that all Project personnel are educated with respect to their responsibilities related to safety, the environment and cultural considerations. The following procedures will be completed to facilitate communication:

- a Project start-up meeting will be conducted with UGFI representatives, construction and advance crews (e.g., winter access and camp construction), camp staff, drill crew and Environmental and Wildlife Monitors. The meeting will present the environmental, cultural and social sensitivities identified and outline the mitigation measures that UGFI has proposed;
- ongoing communication (e.g., use of radios) will occur between the monitors and the crews so that identified issues can be addressed in a timely manner;
- crew managers will highlight the commitment to environmental protection on an ongoing basis (e.g., at daily safety meetings) to make sure that crews understand this commitment and its importance; and
- Environmental and Wildlife Monitors will be encouraged to participate and report at the daily meetings.

7 EMERGENCY RESPONSE PLANS

7.1 EMERGENCY RESPONSE PLAN

During the Project, appropriate regulatory agencies will be contacted immediately in the event of an emergency. In the event of a fuel spill, the updated Project-specific Spill Contingency Plan (included in Appendix B) will be followed, and the Northwest Territories 24-Hour Spill Report Line (867-920-8130) will be contacted. Other safety, contingency and emergency response procedures will be followed, as outlined in the applicable comprehensive documents provided in the appendices of this Project Summary (Emergency Response Plan [Appendix B] and HSE Manual [Appendix C]).

7.2 ENVIRONMENTAL PROTECTION PLAN

A Project-specific EPP has been designed that outlines and summarizes proposed mitigation measures for the Project based on environmental protection procedures identified by UGFI. It is presented in Appendix D.

8 CLEAN-UP, RECLAMATION, DISPOSAL AND / OR DECOMMISSIONING PLAN

All equipment, materials, and any debris will be removed from the Project area prior to spring breakup and taken to Inuvik (and further south as applicable) for appropriate disposal. Any waste fluids generated, and excess fuel containers will also be removed from the Project area and disposed of appropriately. Spill containment kits will be available at camps and staging sites, and carried on vehicles to properly contain accidental spills. Spills will be cleaned up and impacted materials remediated through excavation and disposal. An updated Spill Contingency Plan is provided as part of the Emergency Response Plan in Appendix B. Any disturbed areas will be covered with snow and / or ice to maintain protection of vegetation, soil, and water, as appropriate.

The Project area will be re-inspected by helicopter in the summer following Project completion and any remaining debris or other materials will be cleaned up and removed from the area.