KIGGAVIK PROJECT

GEOTECH DRILLING - THELON RIVER CROSSING - TECHNICAL SUPPORT

1 INTRODUCTION

On November 25, 2008 AREVA submitted the "Kiggavik" mine project proposal to the Nunavut Impact Review Board (NIRB). On March 13, 2009, pursuant to Section 12.4.4 (b) of the Nunavut Land Claim Agreement, the NIRB recommended to the Minister that the Project Proposal requires reviews under Part 5 or 6.

The proposed "Kiggavik" project is located in the Kivalliq Region, approximately 80 kilometers (km) west of Baker Lake. The project is a proposed uranium ore mining and milling operation that includes two properties: Kiggavik and Sissons (collectively called the Kiggavik Project).

Reagents, fuel and supplies for the Project would be barged to a storage facility near Baker Lake and then transported to Kiggavik via truck on a 90 – 100 km access road. Several options for this access road have been presented in the project proposal, including all-weather road options and a winter road option. These options have been further developed and compared from technical, economical, biological and heritage perspectives since submission of the project proposal in November 2008. In parallel, consultation with the community continued in 2009 and the various access road options have been presented to the community for comparison and discussion.

Although no final selection of the road has been made to date a preferred option has been identified. The preferred option is an all weather-road with the route beginning on the north shore of Baker Lake. The proposed route generally follows the existing ATV trail north of Baker Lake and crosses the Thelon River approximately 20 km north of Baker Lake (Appendix 1). The preferred access road would therefore require a bridge to allow the road to remain open year-round. The preferred location for the bridge was selected on the advice of the Bake Lake Community Liaison Committee and engineering considerations (i.e., shortest feasible crossing, stability of the river banks, hydrology, ice conditions at breakup, etc.).

Additional field data was also collected in 2009 to further assess the technical requirements of the bridge option. LIDAR and orthophoto data was collected and a Ground Penetration Radar (GPR) survey was conducted in April 2009 to gather data for the Thelon River Crossing. In addition to providing bathymetry information about the crossing, the GPR survey gives an indication of the stratigraphy and permafrost conditions at the proposed bridge crossing location.

This information is considered to be a good basis to initiate a bridge general arrangement. However, without the drilling information there would be a relatively high level of uncertainty associated with the design of the bridge

The objective of the proposed geotechnical drilling program at the bridge location is to confirm the feasibility of the bridge option and to develop feasibility level designs that can be included with the Environmental Impact Statement for the Kiggavik Project.

2 PROPOSED GEOTECHNICAL DRILLING PROGRAM

Scope of work

The geotechnical investigations for the bridge site will be most effectively carried out during the winter when it can be carried out from the surface of the river ice. The proposed drilling period is March/April to ensure sufficient ice thickness and reasonable daylight working conditions. Additional benefits to winter drilling include absence of recreational canoeists and lower wildlife numbers.

The proposed drilling plan includes drilling a total of approximately 10 to 12 boreholes using a heli-portable drilling rig. One or two boreholes will be drilled on each abutment and one or two boreholes will be drilled at each pier location for a total of six to eight boreholes in the (frozen) river. The proposed drilling diameter is NQ with triple barrel (NQ3); this drilling program would meet the criteria as small diameter/low density drilling as defined in the Fisheries and Oceans Operational Statement for Mineral Exploration Activities. The expected completion depth for each borehole will range between 20m and 30m.

This proposed drilling program would be solely based out of Baker Lake and use of the Kiggavik camp would not be necessary other than possibly obtaining certain drilling equipment during the winter haul. Drill transport is to be conducted by helicopter and transportation of personnel to and from the drill site would be by helicopter or snowmobile. All geotechnical work would be conducted at the drill sites when weather permits, alternatively geotechnical work can be conducted within the AREVA office located in Baker Lake.

3 ENVIRONMENTAL PROTECTION MEASURES

Environmental Protection Measures – Best Management Practices

It is proposed to conduct the geotechnical drilling program using the Best Management Practices (BMP) found in the Mineral Exploration Guidelines in Saskatchewan document

as guidance for Drilling on Ice. Although these BMP were developed for drilling activities on ice in Saskatchewan they remain relevant for drilling on ice in Nunavut.

An integral part of the BMP is that nothing can be deposited on the ice surface. A closed loop system must be used in case of drill fluids returning to the surface. A casing has to be installed to prevent contamination of the water under the ice, as all fluids will return to the surface. An extract from the Drilling on Ice BMP is attached.

These BMP are considered to be appropriate to prevent the release and the spread of drilling fluid to the Thelon River area. AREVA will sub-contract the geotechnical drilling campaign to an experienced drilling company and daily inspections will be conducted by AREVA personnel.

Existing AREVA Environmental Management Plans

All wastes generated through the proposed drilling program would be shipped to Baker Lake for proper disposal as per the Kiggavik Project's Waste Management Plan. Additionally, it is proposed that fuel required for this drilling program temporarily be stored on land near the drilling operations at a minimum distance of 31m from the ordinary high water mark of the river. It is estimated that 25 drums of fuel will be needed to carry out the proposed drilling program. Only fuel required for immediate use would be located on the ice with appropriate secondary containment and spill kits in place. All fuel is to be stored and maintained as per the Kiggavik Project's Spill Contingency Plan.

The use of the BMP in addition to Kiggavik's pre-existing management plans, which include but are not limited to the Kiggavik Project's Noise Abatement Plan, Abandonment and Restoration Plan, Spill Contingency Plan, Waste Management Plan, and Wildlife Mitigation and Monitoring Plan will minimize any risk to the integrity of the Thelon ecosystem.

Company commitments:

- Only small diameter/low density drilling to be carried out on ice
- All drill cuttings will be contained and prevented from entering any water body
- No drilling with saltwater will occur in permafrost conditions
- No explosives will be used in or near any water body
- The DFO Mineral Exploration Activities Operational Statement will be posted at the work site and will be readily available for reference by workers
- *Measures to Protect Fish and Fish Habitat during Mineral Exploration Activities* as listed in the Mineral Exploration Activities Operational Statement will be incorporated
- Saskatchewan's *Best Management Practice (BMP-011) Drilling on Ice* will be followed
- All drilling contractors and field personnel shall:
    - Be fully trained in proper fuel transfer and Spill contingency Plan
    - Ensure drill set-up allows for continual air movement through the base preventing heat from being transmitted from the equipment into the tundra
    - Record GPS coordinates for each drill hole location
    - Locate all sumps and fuel caches at a distance of at least 30 m from the ordinary high water mark of any adjacent water body and carry out inspections on a regular basis
- All drilling activities and fuel caches will be inspected on a daily basis by AREVA staff
- All drilling activities shall abide by all DIAND Caribou Protection Measures and those mitigation measures outlined in the Wildlife Mitigation and Monitoring Plan
- Activities will be carried out in such a way that known archaeological and/or palaeontological sites will be avoided. Activities that disturb an archaeological or palaeontological site encountered during the course of the land use operation will cease until permitted to proceed with the authorization of the Department of Culture, Language, Elders and Youth, Government of Nunavut
- All garbage and debris will be removed from this site and disposed of in accordance to the Waste Management Plan. Appropriate records will be kept for all waste backhauled to Baker Lake
- The sealing of drill holes and abandonment of this drill site will be conducted in compliance with the Abandonment and Restoration Plan
- Prior testing of the thickness of the ice will be conducted to ensure the river is in a state capable of fully supporting the necessary drilling equipment prior to moving any equipment onto the ice
- The proposed drilling activities will not cause erosion to the banks of the Thelon River and necessary controls to prevent such erosion will be used

- As per the Spill Contingency Plan the following measures will be used to further minimize the potential for spills during fuel handling, transfer and storage:
  - Carefully monitor fuel content in the receiving vessel during transfer. Always have additional absorbent pads on hand while transferring fuel.
  - Clean up drips and minor spills immediately.
  - Regularly inspect drums, tanks and hoses for leaks or potential to leak and for proper storage.
  - Create fuel caches in natural depressions that are located at least 30m from the normal high-water mark of any water body.
  - Train personnel, especially those who will be operators, in proper fuel handling and spill response procedures. This training is to include a "mock" spill, review of spill kit contents and their use and reporting.
- A review of all contingency plans will be conducted during the fall of 2009 and will be revised as necessary to include the proposed on-ice drilling program. These plans include but are not limited to the Spill Contingency Plan, Waste Management Plan, Abandonment and Restoration Plan, Environmental Code of Practice, Noise Abatement Plan, Wildlife Mitigation and Monitoring Plan, Health and Safety Program Manual, and Safety Code of Practice

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ᐃᓄᑦᖃᓂᑦ – ᓄᖅᒥ ᐃᑲᖅᓕᕆᖅ - ᐃᑲᔪᖅᑎᑲᖏᑦ

1 ᖃᓐᓄᐃᑐᓂᓱ

ᓄᕐᓕᐸᐱᓇ 25 ᐊᓇᕐᑲᓄᑦ ᑐᓂᓯᒪᐅᖅᓴᑦ ᐅᓇ “ᑭᓱᓕᐅᒃ” ᐅᓴᕋᑕᓇᐊᕈᒪᓂᖅᒧᑦ ᐱᔪᒪᑦᔪᑕᐅᔪᒥᒃ ᑕᐸᓄᓄᓄᓂᖅᒧᑦ ᑲᑎᒪᓕᓄᑦ. ᒪᑦᓴᓂ 13, 2009 ᑕᒪᑐᒧᖓ ᑎᑎᖃᖓ 12.4.4 (ᐱ) ᓄᓇᕗᒻ ᐊᖏᑭᑎᑕᐅᖅᓴᓕᒪᔪᑦ, ᑕᐸᓄᐊ ᓄᓇᕗᒻ ᐊᕐᕈᑎᑕᓇᓂᒋᖅᒧᑦ ᑲᑎᒪᓕᑦ ᐱᖃᓄᐅᑕᐅᖅᓴᑦ ᒥᓂᔾᔪᓇᐅᔭᐅᔪᒃ ᑕᒪᓐᓇ ᖃᐅᔨᓴᖅᑕᐅᓂᖃᖅᓇᐊᖃᓂᖓ ᑎᑎᕋᓕᒪᔪᒥ ᐃᓕᓐᓂᓂ 5 ᐅᕐᔪᓂᓂ 6.

ᑕᒪᓐᓇ ᐱᓪᓇᐊᖏᔪᒪᔪᖅ “ᑭᓱᓕᐅᒃ” ᐱᓪᓇᐊᖏᔪᖅ ᑕᒪᓂᑐᖅ ᑭᕐᓪᓂᐅᑦ ᐃᓗᐊᓂ. ᐃᒪᒃᖅ 80 ᖃᓄᐃᒥᑐᖅᓂᒃ ᐅᖏᓪᓗᓂᖃᖅᑐᖅ ᖃᒪᓂᑐᑦᑕᖅᒥᑦ. ᑕᒪᓐᓇ ᐱᓪᓇᐊᖏᔪᒪᔪᖅ ᓄᖏᔪᓱᐃᑐᓪᓇᓂᖅᒧᑦ ᐅᓴᕋᑕᓇᐊᕈᒪᓂᖅ ᓱᖃᓐᑎᓇᐃᖃᓄᖅ ᓄᓇᕗᒻᒥᐅ: ᑭᓱᓕᐅᒃ ᐊᒪᓗ ᖃᑭᐹᑕᒥ ᑕᒪᒥᐅᒃ ᑕᐃᒪᐅᐊᕈᒪᓂᖅ ᑭᓱᓕᐅᒃ ᐱᓪᓇᐊᖏᓐᓇᑦ.

ᐱᓪᓇᓂᑦ, ᐅᖃᓱᐊᓗᐃᑦ ᐊᒪᓗ ᐱᖏᒧᑦ ᑕᒪᑐᒧᖏᓐᓇ ᓱᓕᐅᓂᒋᖅᑐᑦ ᐱᖏᑕᐅᓱᐊᕆᔭᖅᑐᑦ ᐱᖏᑎᑕᐅᓱᐊᕆᔭᖅᑐᑦ ᖃᒪᓂᑐᑦ ᖃᓄᖅᑐᑦᑕᖅᒥᑦ ᐊᒪᓗ ᐊᓱᖅᖃᑐᖅᑐᑦ ᑭᓱᓕᐅᒃ ᐃᑲᖅᑐᑦᑕᐅᓗᓂᖅ ᑭᓱᓕᐅᒃ 90 - 100 ᐅᖏᓱᓕᓂᖃᖅᑐᒧᑦ ᐊᑦᑎᓇᓱᐅᖅᓱᒪᔪᓂᑦ. ᐊᓕᒥᓂᒃ ᐊᑐᖅᑕᐅᔪᓇᖅᑐᓂᒃ ᐊᑦᑎᓇᓱᐅᐅᓱᒪᔪᖅᓴᓂᒃ ᖃᐅᔨᐸᑎᐊᖅᓱᒪᓕᖅᑐᖅ ᑕᒪᑐᒧᖏᓐᓇ ᐊᑐᖅᑕᐅᓗᓂᖅ. ᐅᑭᐅᓗᓄᑕᖅ ᐊᑦᑎᓇᑕᐅᔪᓇᖅᑐᑎᒃ ᐅᑭᐅᖏᓐᓇᓕᔾᔪᓂᓂᒃ ᐊᑦᓇᑕᐅᔪᓇᖅᑐᓂᒃ. ᐅᒪᐃᓐᓇ ᐱᓪᓇᐊᖏᔪᒪᓂᖅᓱᒪᔪᑦ ᖃᐅᔨᐸᑎᐊᖅᑕᐅᓱᒪᔪᑦ ᐊᖏᑭᐅᒪᔪᓇᕐᓂᖅᓂᒃᑎᑦ ᐱᓪᓇᐊᓕᓴᐅᓇᐊᖃᓂᖅᓱᓐᓂᓪᓗ ᖃᓄᐃᑐᑕᖅᑕᐅᓱᒪᔪᑦ ᑕᒪᓐᓇ ᓇᓗᐃᑐᑕᖅᑕᐅᓱᒪᔪᑦ ᑕᒪᒥᐅᒃ ᑐᓂᓯᒋᐊᕐᓂᖅᑐᑦ ᓄᖏᔪᖅ 2009. ᑕᒪᓐᓇᓕᓗ ᓄᓇᓕᓂᒃ ᖃᓄᐃᑎᐸᑕᐅᑕᖅᓱᒪᔪᑦ ᑕᒪᓐᓇ ᑲᔪᓯᖅ 2009Γ ᑕᒪᓐᐊᓗ ᐊᓕᒥᑐᑦ ᐊᑦᑎᓇᓱᐅᖅᓴᓕᒪᓂᖅᑐᑦ ᐅᖃᖅᑕᐅᓱᒪᔪᖅᑐᑦ ᓄᓇᕗᒻᓄᑦ.

ᑭᓱᐊᓂᓕ ᓇᓗᓇᐃᖅᓱᓕᖅᑎᑐᑎᓗᐃᑦ ᓇᓕᐊᓂᒃ ᐊᑦᓇᓱᐅᑦᑎᓗᒃ ᓂᕈᐊᖅᓱᓕᖅᑎᑐᑎᓗᐃᑦ ᒪᓐᓇᒍ ᑭᑎᓗᒍ ᐃᓱᒪᑎᐅᓱᒪᔪᖅ ᐅᖃᐅᓱᒪᔪᖅ. ᑕᒪᓐᓇ ᐃᓱᒪᑎᐅᓱᒪᔪᖅ ᐊᑦᓇᓱᐅᑎᓂᖅᖃᖅ ᖃᓄᖅᑐᑦᑕᖅᒥᑦ ᐊᑐᖅᑕᐅᔪᓇᖅᑐᖅ ᖃᐅᔨᓴᖅᑕᐅᓂᖃᖅᓇᐊᖃᓂᖅ ᐊᑐᖅᑕᐅᔪᓇᖅᑐᖅ ᑕᒪᒥᐅᒃ ᐊᐅᓚᐅᖅᑕᐅᓂᖅ ᐊᑐᖅᑕᐅᔪᓇᖅᑐᖅ ᐊᑐᖅᑕᐅᓗᓂᖅ ᑕᒪᓐᓇ ᐊᑐᖅᑕᐅᔪᓇᖅᑐᖅ ᐊᑦᑎᓇᓱᐅᐅᓱᒪᔪᖅᓴᓂᒃ ᐊᑐᖅᑕᐅᔪᓇᖅᑐᖅ ᐊᑦᑎᓇᓱᐅᐅᓱᒪᔪᖅᓴᓂᒃ ᐊᑐᖅᑕᐅᓗᓂᖅ

2 ᐃᓱᒪᒋᔭᐅᓱᒪᓂᖓ ᐃᑯᑕᖅᓂᐅᓂᐊᖅᑐᓄᑦ

ᐱᓕᕆᐊᖃᓲᓇᖅᑐᖅ

ᑕᒪᑐᐃᓄᑦ ᖃᐅᔨᓴᖅᓂᐅᔪᑦ ᐃᑲᖅᐸᓴᓕᐅᓂᖅᓯᒪᑦ ᐱᐅᓂᖅᑕᖃᖅᐸᑦ ᐱᓕᕆᐊᖃᓲᓇᖅᑐᖅ ᐱᓕᕆᐊᖃᓲᓕᖅᑕᖅᐸᑦ
ᖃᐅᔨᓴᖅᑕᐅᐸᑦ ᐅᑭᐅᑯᑦ ᖃᐅᔨᓴᐸᓇᕆᖅᖃᒪᑦ ᓱᑯᓱᒪᓕᖅᑕᖅᐸᑦ ᑕᒪᓐᓇ ᑯᐢ. ᐃᑯᑕᕆᖅᑐᖅᑐᑦ ᐃᒪᒃᖅ ᑕᒪᓐᓇ
ᒪᑦᔨ ᐊᐃᓗᓕ ᑕᒪᓇ ᓱᑯ ᐃᑦᔪᓂᓂᖓᓐᓄᑦ ᓇᒪᒃᓱᓱᒪᓕᖅᑕᖅᐸᑦ ᐊᒪᓗ ᐅᑦᓗᖅᑐᓱᓂᓇᓕᖅᑕᖅᐸᑦ.
ᐃᓗᐊᓂᐸᓲᓇᖅᑐᖅᓄᑦ ᑕᒪᑯᓇᓂ ᑕᖅᑭᓂ ᓱᑯᓱᒪᓂᓐᓚᓂ ᑯᐢ ᐊᑐᖅᑕᐅᓗᐊᓂᖅᑐᒪᑦ ᐊᒪᓗ
ᓂᖅᔪᑎᖅᑲᓗᐊᔪᓂᖅᑐᒪᑦ ᑕᒪᓇ.

ᑕᒪᓇ ᐃᑯᑕᓂᐅᓇᓕᖅᑐᖅᓄᑦ ᐱᑕᖅᑭᓕᖅᑐᖅᓄᑦ ᐃᒪᒃᖅ ᖃᑯᓂᓂᒃ ᖃᑯᓂᓗ ᒪᑭᒃᓗᓂᒃᓗᓂᑦ ᐃᑯᑕᖅᓗᑎᒃ
ᐅᑭᖅᑐᒥᒃ ᐃᑯᑕᖅᒥᒃ ᐊᑐᑎᓕᖅᑐᑦ. ᐊᑕᐅᓱᐅᒪᓂᒃ ᒪᑭᐃᓂᓂᒃᓂᑦ ᐃᑯᑕᖅᑕᑎᖅᑐᑦ ᐊᓪᒥᓂᒃ
ᐅᖓᑓᓱᓂᒃᐅᓗᑎᒃ ᐃᒪᒃᖅ ᑕᒪᓂ ᐱᖓᑓᓱᓂᒃ ᐊᖅᑲᐃᓂᓪᓂᑦ ᐃᑯᑕᖅᑕᑎᖅᑐᑦ ᖃᐅᔨᓴᖅᑕᐅᓇᖅᑐᓂᒃ. ᑕᒪᓇ
ᐃᑯᑕᖅ ᐊᑐᖅᑕᐅᓇᓕᖅᑐᖅᓄᑦ ᐱᖓᑓᓱᐃᓂᒃ ᑕᒪᑯᐊ ᑭᓇᓪᓂ ᓄᖅᑐᓪᓂ ᐊᒪᓗ ᐊᖓᒪᓗᖓᑎᖅᑐᖅᓄᑦ ᓱᓪᓗᐊᖓᑎᖅᑐᖅᓄᑦ
ᑕᒪᑯᓇᖓ ᐃᒪᖅᒥᐅᑕᓪᓚᓱᑯᑦ ᒪᓪᓚᓪᐅᖅᓱᒪᖅᓗᓂᑦ ᐃᒪᖅᒥ ᐃᑯᑕᖅᓂᖅᓴᖅᒪᑦ ᐊᑐᐊᖅᓱᓪᓘᑦ
ᐊᑦᓱᓂᖅᑲᖅᑐᖅᓄᑦ ᐃᑯᑕᖅᑕᐅᔪᑦ ᑕᒪᓂ 20 ᐅᓕᓗᓂᑦ 30 ᐅᖅᑐᑎᐅᑎᑯᑦ.

ᑕᒪᓇ ᐃᑯᑕᖅᓂᖅ ᐱᓕᕆᐊᖃᓴᓇᖅᓂᐊᖅᑐᖅᓄᑦ ᑕᐃᒃᖅᓚᑦ ᖃᒪᓂᑐᐊᖅᒥᑦ ᑭᒃᓚᕕᑯᑦ ᐱᓕᕆᓚᖅᓂᒃ
ᐊᑐᓕᐊᖃᖅᑎᓪᓗᒪᑕ ᑭᓱᐊᓂ ᐊᑐᓕᐊᖃᖅᑕᒥᓂᒃ ᐃᑯᑕᕆᐅᑎᒃ ᑕᐃᒃᖅᓚᑦ ᐊᑐᑎᖅᑐᑦ ᑕᒪᑯᐊ ᐃᑯᑕᕆᑎᒃ
ᐃᑯᑕᖅᑎᓪᓗ ᖃᑯᓕᒍᑯᑯᑦ ᐊᑐᖅᑕᐅᑕᕐᖅᑐᑦ ᐱᓕᕆᓕᓪᓗ ᐃᒪᒃ ᐃᓕᓂᑯᑯᑦ ᓄᓇᑯᕐᑎᑯᑦ ᐊᒪᓗ ᑕᒪᑯᐊ
ᖃᐅᔨᓴᖅᑕᐅᓯᒋᔭᐊᓂᑦ ᑕᐃᒃᓂᖅᓴᐃᓇᖅ ᐃᑯᑕᖅᐃᓚᖅᓂᒃ ᖃᐅᔨᓴᖅᑕᐅᑕᕐᖅᓗᑎᒃ ᓱᓕ ᓇᒪᒃᖅᓂᑦ.
ᐱᓕᕆᐊᖃᓲᓇᖅᒪᔭᑎᒃ ᐊᓪᓚᖅᑯᑦ ᑎᑎᕋᐃᖅᓂᒃ ᖃᒪᓂᑐᐊᖅᒥᑦ.

3 ᐊᖓᑎᓕᓪᓂᓂᖅᓯᑦ ᒥᐊᓂᖅᓱᓪᓛᑎᑦ

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ᐃᒪᖅᒧᑦ ᐊᓱᑕᐃᓂᖃᖅᑎᒋᒪᓕᑕ ᐊᖁᓱᒪᓕᑦᓱᐊᖅᑎᒃ.

ᑕᒪᑯᐊ ᐃᑯᑕᐅᑎᓄᑦ ᐊᑐᒪᔪᑦ ᐃᒪᖅᒧᑦ ᐊᑲᐃᓕᖅᑐᖅᓄᑦ ᑯᒥ ᐃᑯᑕᖅᑐᓂᑦ. ᐊᓪᓚᖅᑯᑦ ᑕᒪᑯᐊ ᐃᑯᑕᖅᑎᓂᓱᓂᖅᓴᖅᑐᖅᓄᑦ ᐃᑯᑕᖅᑎᑦᓱᓂᐊᖅᑐᒪᓕᑕ ᐊᒪᓗ ᑕᒪᑯᐊ ᐱᓕᕆᐊᖃᓲᓇᖅᑐᑦ ᖃᐅᔨᓴᖅᑕᐅᓇᓕᖅᑐᖅᓄᑦ
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ᑕᒪᖅᑭᒃ ᑕᒪᑯᐊ ᐊᑲᑕᑯᑦ ᐊᑐᖃᑦᑐᓂᓂᓂ ᑕᒪᑐᐃᓄᑦ ᐊᑐᓕᐊᖃᓲᓇᖅᑐᖅᓄᑦ ᐃᑯᑕᖅᓂᓂᖅᓯᑦ ᖃᓚᒥᐊᓐᓚᓄᓯᑦ
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Legend
Community
Proposed Drilling Location
All-Weather Access Road (North Option)
615000
620000
625000
630000
635000
640000
645000
7150000
7145000
7140000
7135000
7130000
N
Thelon River
Baker Lake
Thom
AREA OF DETAIL
Nunavut
Yukon Territories
Northwest Territories
British Columbia
Alberta
Saskatchewan
Manitoba
Quebec
0 1.25 2.5 5 7.5 10
Kilometres
PROPOSED GEOTECHNICAL DRILLING LOCATION
FIGURE 1.0
Projection: UTM Zone 14 NAD83
Creator: CDC
Date: 10/02/2009
File: KI09A013
Data Sources: Natural Resources Canada, GeoBase®, Nunavut Topographic Database, Areva Resources Canada Inc
AREVA
KIGGAVIK PROJECT

TECHNICAL MEMORANDUM

DATE 6 October 2009 **PROJECT No.** 09-1362-0610/1000/1310

TO Ms. Nicola Banton, Senior Project Engineer
AREVA Resources Canada Inc.

CC

FROM Brent Topp/David Hamilton **EMAIL** brent_topp@golder.com/David_Hamilton@golder.com

RELEVANT INFORMATION IN SUPPORT OF AREVA'S DRILLING PERMIT APPLICATION

It is Golder's understanding that AREVA Resources Canada Inc. (AREVA) is applying for approval to conduct geotechnical drilling in the Thelon River to gather information in support of the proposed bridge crossing. The drilling program is scheduled to occur over the winter of 2009/2010, once ice thickness is sufficient to support drilling equipment. This memo is intended to provide information on hydrology, fish and fish habit, and archaeology in the vicinity of the proposed bridge in support of AREVA's application to regulators.

Hydrology - Historical Data

Environment Canada maintains a hydrometric station on the Thelon River at the outlet of Schultz Lake (Station Number 06MA006). This station has an estimated gross drainage area of 152,000 $km^2$and is located approximately 60 km upstream of the proposed river crossing. Considering the large upstream drainage area, it is assumed that the stream flows located near the proposed crossing would only be marginally larger than those presented here.

Average monthly discharge is presented in Table 1 over the period of record (1983-2008). Included in Table 1 are also the maximum, minimum, and 25th and 75th percentiles of data over the same period of record.

Environment Canada has also been collecting water level data at this station over the period 2002-2008. The average, maximum and minimum monthly values are presented in Table 2. A plot of coincident stream discharge and water elevation data is presented in Figure 1. Water levels are an assumed datum. The relationship between discharge and water levels is for the cross-section at the hydrometric station, though the relationship is likely similar near the proposed bridge crossing location.

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Table 1: Summary Discharge Statistics for Thelon River at the Outlet of Schultz Lake (1983-2008) (m^3/s)

Month	Average	Max	Min	25th Percentile	75th Percentile
Jan	461	746	276	396	528
Feb	405	699	228	340	473
Mar	379	673	226	308	432
Apr	390	593	232	325	434
May	415	546	238	350	466
Jun	1,953	3,470	914	1,383	2,433
Jul	2,434	3,440	1,480	2,090	2,800
Aug	1,329	1,820	829	1,120	1,520
Sep	1,125	1,610	729	965	1,290
Oct	989	1,440	591	854	1,150
Nov	673	982	522	596	721
Dec	529	850	386	424	579
Annual	928	1,200	671	868	1,025

Table 2: Summary Water Level Statistics for Thelon River at the Outlet of Schultz Lake (2002-2008) (m)

Year	Average	Max	Min
Jan	24.31	24.63	24.07
Feb	24.24	24.57	24.03
Mar	24.17	24.54	23.94
Apr	24.16	24.43	24.00
May	24.18	24.33	24.04
Jun	25.66	26.99	24.74
Jul	26.22	26.46	25.88
Aug	25.25	25.61	25.01
Sep	25.04	25.56	24.61
Oct	24.87	25.39	24.43
Nov	24.55	24.91	24.35
Dec	24.36	24.76	24.15
Ann	24.75	24.90	24.49

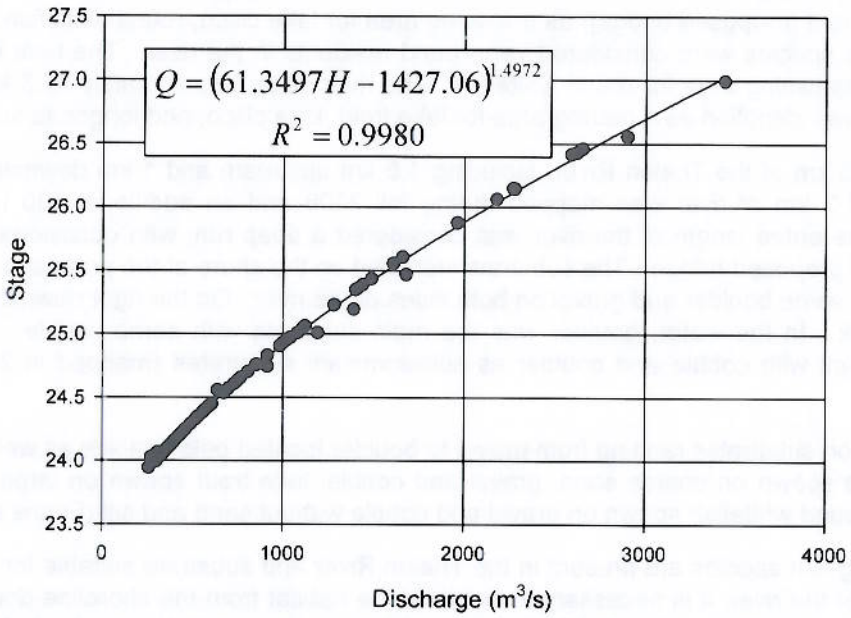

Figure 1: Stage-Discharge Curve for the Thelon River at the Outlet of Schultz Lake

Real-Time Data

The Thelon River at the outlet of Schultz Lake is also a real-time data station, which means instantaneous water level data are available. Visual inspection of water level data for September 2009 indicates an estimated average level of 24.8 m. Using the curve generated through regression yields the following estimate for average September discharge:

$$Q = (61.3497H - 1427.06)^{1.4972}$$

Where Q is discharge (m^3/s) and H is water level (m). Therefore,

$$Q = (61.3497(24.8m) - 1427.06)^{1.4972}$$

$$Q = \frac{906m^3}{s}$$

Relative to historical data (1983-2008), this discharge is lower than average for the month of September, and in fact is lower than the 25th percentile data. The historical record also indicates that average monthly stream discharge peak in July and steadily decrease until March. Therefore, average monthly discharge can be assumed to decrease from 906 m^3/s until approximately March or April, when the hydrograph will begin to rebound due to spring melt.

Fish and Fish Habitat

Eight fish species are present in the Thelon River (McLeod et al. 1976). Arctic char (*Salvelinus alpines*), lake cisco (*Coregonus artedi*), lake trout (*S. namaycush*), and round whitefish (*Prosopium cylindraceum*) are fall spawning species, while Arctic grayling (*Thymallus arcticus*), longnose sucker (*Catostomus catostomus*), and slimy sculpin (*Cottus cognatus*) are spring spawning species; and ninespine stickleback (*Pungitius pungitius*) is a summer spawning species. Golder conducted fish sampling at the proposed bridge crossing. Lake trout were capture in fall 2008, while Arctic grayling, lake trout were captured and slimy sculpin was observed in summer 2009.

McLeod et al. (1976) identified the mouth of the Lower Thelon River (approximately 12.4 km downstream of the 2009 bridge alignment [proposed bridge]) as a feeding area for lake cisco, round whitefish, lake trout, and some Arctic char. These species were considered year-round residents in the river. The river was also identified as providing nursery/spawning area for round whitefish. The river delta (appoximately 22.3 km downstream of the proposed bridge) was identified as a rearing area for lake trout, lake cisco, and longnose sucker juveniles.

Golder mapped 2.5 km of the Thelon River, including 1.5 km upstream and 1 km downstream of the proposed bridge. A total of 2 km of river was mapped during fall 2008 and an additional 500 m downstream during summer 2009. The entire length of the river was considered a deep run, with occasional back-eddies located downstream of the proposed bridge. The substrate identified on the shore at the proposed bridge (Figure 1) was mainly cobble with some boulder and gravel on both sides of the river. On the right downstream bank, there was also some bedrock. In the water, boulder was the main substrate with some cobble. Further downstream, gravel was dominant with cobble and boulder as sub-dominant substrates (mapped in 2009, not available on Figure 1).

Arctic char spawn on substrates ranging from gravel to boulder located below rapids as well as rock (Evans et al. 2002). Lake cisco spawn on coarse sand, gravel and cobble; lake trout spawn on large boulder, cobble, and gravel in eddies; round whitefish spawn on gravel and cobble without sand and silt (Evans et al. 2002).

Since fall spawning fish species are present in the Thelon River and substrate suitable for spawning is available along the margin of the river, it is necessary to consider the habitat from the shoreline down to 4 m deep in the water at the proposed bridge location and further downstream to be potential spawning habitat.

Limnology

In 1975, McLeod et al. (1976) collected water chemistry about 12.4 km downstream from the proposed bridge. Golder only took limnology measurements (i.e., dissolved oxygen, conductivity, pH) at the proposed bridge location in fall 2008 (Table 3).

Table 3: Water Quality and Limnology Collected at the Surface of the Thelon River in 1975, 2008, 2009, values in mg/l unless otherwise indicated

Location	12.4 km downstream			0.5 km upstream
Date	20 July 1975	6 August 1975	2 September 1975	9 September 08
Temperature (°C)	8.0	9.1	9.5	6.93
Dissolved oxygen	12.2	11.4	11.5	11.96
pH	6.9	6.9	6.9	7.33
Total dissolved solids	8.4	28.0	28.8	-
Total suspended solids	-	0.9	0.8	-
Total hardness ($CaCO_3$)	12	14	18	-
Alkalinity ($CaCO_3$)	8.0	7.0	7.3	-
Total inorganic nitrogen	0.12	0.10	0.04	-
Total phosphorus	0.18	0.03	0.02	-
Calcium	2.4	2.4	5.6	-
Magnesium	1.4	1.9	1.0	-
Sodium	0.4	0.4	0.4	-
Potassium	0.1	0.1	0.1	-
Sulfate (SO_4)	<0.5	<1.0	2.0	-

Location	12.4 km downstream			0.5 km upstream
Chlorine	-	2.5	2.3	-
Bicarbonate (HCO_3)	9.8	8.5	8.9	-
Free carbon dioxide	3.3	2.6	2.9	-
Conductivity (µmhos/cm)	22	22	23	27

- = not available.

Mitigation Measures

Fisheries and Oceans Canada (DFO) recently released the Operational Statement (OS) for Mineral Exploration in Nunavut (DFO 2009a). This document outlines threshold limits of activity and mitigation measures to minimize the risk of causing a harmful alteration, disruption or destruction of fish habitat. The permitting process can be streamlined if the activities can be done within the limits outlined in the OS. The OS outlines a series of conditions or requirements, which if met, the activity can proceed with a simple notification (Table 2).

Table 2: Summary of DFO Conditions for Mineral Exploration and the Proposed Thelon Drilling Program

Condition/Objective	Yes	No	Comment
Your project involves only small diameter[1]/low density drilling (see definition below) when carried out on ice,	✓		AREVA will need to confirm drill diameter and density of the drill pattern
No drill set-up (unless carried out on-ice), pitting, trenching or stripping operations are proposed below the Ordinary High Water Mark (HWM) (see definition below) of any water body	✓		
No on-ice drilling in known fish spawning habitat, and no large diameter on-ice drilling (>100 mm), will occur	✓		Based on the habitat assessments, fish collections, and IQ information fish would not be spawning in immediate vicinity of the proposed bridge (see above). However, drilling should not occur in close proximity to the shoreline areas, where it is possible that spawning habitat is available.
No drilling with saltwater in permafrost conditions will occur	✓		
No explosives will be used in or near any water body	✓		
All drill cuttings will be contained and prevented from entering any water body	✓		
Pits or trenches will be dug by hand or mechanical means other than hydraulic (water) trenching			Not applicable
This Operational Statement is posted at the work site and is readily available for reference by workers	✓		
You incorporate the Measures to Protect Fish and Fish Habitat during Mineral Exploration Activities listed below in this Operational Statement.	✓		

[1]Small Diameter/Low Density Drilling (for on-ice drilling) – small diameter boreholes (<100 mm diameter) with drill sites consisting of no more than three boreholes each, and drill sites spaced no closer than 15 m apart.

The instream works window from DFO (2009b) restricts instream activities to the period from August 15 to July 15, because of the presence of spring and fall spawning species in the river. The fish habitat assessment suggests that fish are using the area near the proposed crossing for feed, rearing and migration; although there

is potential for spawning habitat for lake trout spawning along the margins of the channel. One of the conditions of the mineral exploration OS (DFO 2009a) is that "no [small diameter/low density] on-ice drilling in known fish spawning habitat, and no large diameter on-ice drilling (>100 mm) will occur" in the river. Furthermore, Point 9 under the Exploratory Drilling Section specifies to "avoid drilling in gravel or rock rubble substrates in water depths less than four metres within water bodies where fall-spawning fish species (e.g., trout, whitefish) are likely to be present". Therefore, if the drilling program occurs in deeper water portions of the river, it should have little impact on spawning resources in this portion of the Thelon River, even though the activity will occur outside the preferred window for instream activities.

Based on our understanding of the proposed drilling activities, it appears that the proposed drilling activity can meet the DFO conditions. Incorporation of the mitigation measures for site management, fuel management, and containing the drill cuttings and fluid would bring the geotechnical drilling in alignment with environmental protection measures of the OS.

Heritage Resources

There are six locations that contain heritage resources within 500 m of the proposed crossing on the Thelon River. A brief description along with the UTM coordinates (Table 4) for each site is provided below. These sites were discovered during baseline studies in 2008 and full descriptions are included in that Final Report.

Table 4: UTM Coordinates for Known Heritage Sites

Borden Number	UTM 14W (NAD 83)
LcLb-4	E 624496 N 7145192
LcLb-5	E 624201 N 7145062
LcLb-6	E 624135 N 7144882
LcLb-7	E 623557 N 7145708
LcLb-11	E 624725 N 7145680
LcLb-12	E 624656 N 7145633

LcLb-4

LcLb-4 consists of four hunting caches located on a rock outcrop on the west bank of the Thelon River. The first cache consists of nine large boulders with associated artifacts including a small scatter of caribou bone, three pieces of glass, an old Skoal tin, and one rusty juice can. The second cache is 1 m diameter and was built from 18 cobbles. The third cache had a tin can built into its construction and another tin can nearby. The fourth and last cache has a 2 m diameter and was constructed of 15 cobbles.

LcLb-5

LcLb-5 consists of two unopened caribou caches located on a high hill overlooking the Thelon River to the east, and an unnamed lake to the west. The first cache measured 1.8 m by 1.2 m with 25 cobbles. A caribou skull was visible within this feature. The second cache measured 1.7 m by 1.0 m with 20 cobbles.

LcLb-6

LcLb-6 is a campsite located on a rocky outcrop on the west bank of the Thelon River. This site consists of one rectangular shaped tent outline likely from a relatively recent camp. The feature measures 1.8 m by 2.6 m. A small amount of caribou bone as well as one piece of wood was observed on the surface.

LcLb-7

LcLb-7 is a hunting blind located on a rock outcrop overlooking the Thelon River to the east. This oval shaped blind consists of about 16 boulders and measures 2 m by 1.4 m.

LcLb-11

LcLb-11 is an unopened cache that was recorded on the side of a hill on the eastern crest of the Thelon River valley. This feature measured 1.33 m by 0.72 m and still had caribou bone evident within it.

LcLb-12

LcLb-12 is a campsite located on the eastern crest of the Thelon River, just west of LcLb-11. One tent ring was recorded at this site measuring 0.8 m by 1.5 m and consisting of 15 cobbles. A plastic bag was observed under one rock indicating that it is likely a recent camp site.

Closure

We trust that the information provided describe the results of any previous work done at the site. If you have any questions or concerns, please contact myself or Mr. David Hamilton at your convenience.

Yours very truly,

GOLDER ASSOCIATES LTD.

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Associate, Senior Hydrologist

J. David Hamilton, M.Sc. R.P.Bio., CPESC
Associate, Senior Aquatic Scientist

BTBT/JDH/BN/pls

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