

Popular Summary

AREVA Resources Canada Inc. (AREVA) is proposing to construct, operate and decommission a uranium mine, called the Kiggavik Project (Project), in the Kivalliq Region of Nunavut. The development of the Kiggavik Project can contribute to the overall well-being of Beneficiaries and other Nunavummiut without a compromise to ecosystem integrity.

Nunavummiut and the Inuit Organizations, Institutions of Public Government and territorial and federal governments that represent them want a healthy environment and vibrant communities both now and in the future. Development can bring positive economic opportunities and proponents must demonstrate that project designs, mitigation and monitoring plans, company performance, and decommissioning plans meet the requirements for development in Nunavut. The following Tier 1 Draft Environment Impact Statement (DEIS) for the Kiggavik Project and all supporting documents were prepared to demonstrate the soundness of the proposed Kiggavik Project and the ability of the company to implement the Project.

The DEIS reflects five years of recent engineering, environmental and engagement studies by AREVA, in addition to historical work conducted for the Project. The integrated engineering and environmental work allowed for potential environmental impacts to be assessed as the Project is designed allowing for informed alternative selection, optimizations and design based mitigation to reduce potential adverse effects. Community engagement also influences Project design and management preferences and Inuit Qaujimajatuqangit (IQ) provides valuable knowledge of the land.

This DEIS will be reviewed by the Nunavut Impact Review Board (NIRB) to ensure it contains all the information as outlined in the *Guidelines for the Preparation of an Environmental Impact Statement for AREVA Resources Canada Inc.'s Kiggavik Project* (NIRB File No. 09MN003) and then it will be made publicly available for review. There will be a number of opportunities for participation in the review.

Proponent

AREVA is a Canadian company, headquartered in Saskatoon, Saskatchewan. The company is a 100% subsidiary of the AREVA Group of companies headquartered in Paris, France. The AREVA Group is a world leader in supplying electrical energy systems with low CO₂ production including nuclear and renewable energy systems for electricity production. AREVA would be the operator of the Kiggavik Project with minority interests owned by Japan-Canada Uranium Company Limited

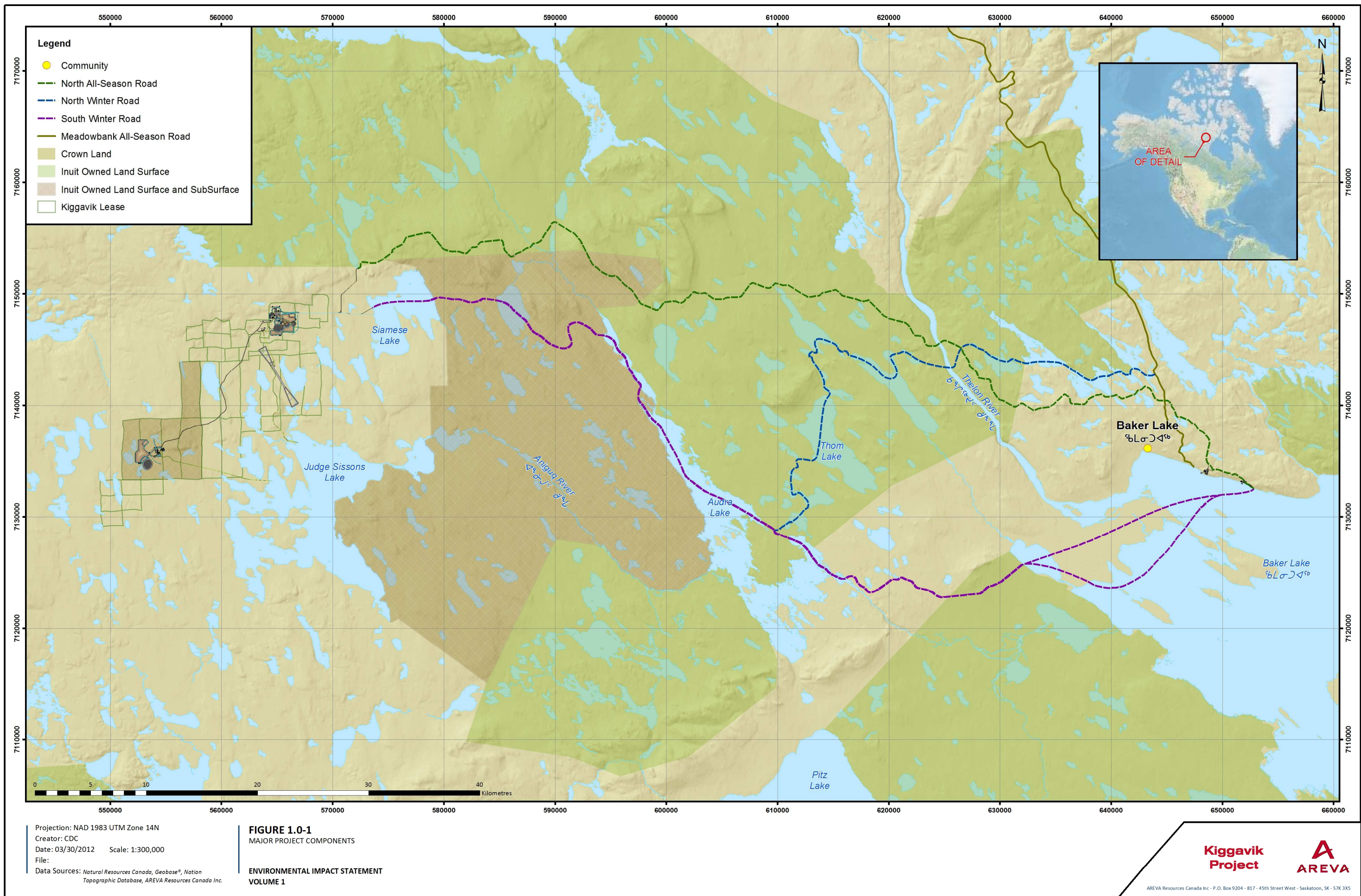
and Daewoo International Corporation.

Project

The Kiggavik Project is a proposed uranium ore mining and milling operation located in the Kivalliq region of Nunavut approximately 80 km west of the community of Baker Lake.

The Kiggavik Project is comprised of three main areas referred to as the Kiggavik site, the Sissons site and Baker Lake Dock Site. AREVA will mine three uranium ore deposits at the Kiggavik site: East Zone, Centre Zone and Main Zone, and the Sissons site has two uranium ore deposits to be mined: Andrew Lake and End Grid. Open pit mining will be used to extract the three Kiggavik deposits as well as the Andrew Lake deposit. Mining of End Grid will require underground mining methods. Mineral resources are estimated at approximately 51,000 tonnes uranium (133 million lbs U₃O₈) at an average grade of 0.46% uranium.

All extracted ore from the mine sites will be processed through a mill located at the Kiggavik site using hydrometallurgical processes. Mined out pits at the Kiggavik site will be used as tailings management facilities (TMF). The uranium product will then be packaged and transported using aircraft to southern transportation networks. Mill reagents, fuel and other supplies will be transported by ship and barge to Baker Lake and then by truck to the Kiggavik Project over a winter access road. An all-season road between Baker Lake and the Kiggavik Site is a secondary option under consideration in case the winter road cannot adequately support the Project. Figure 1.0-1 shows the major Project components including the access road alternatives and Figure 1.0-2 shows potential shipping and barging routes.



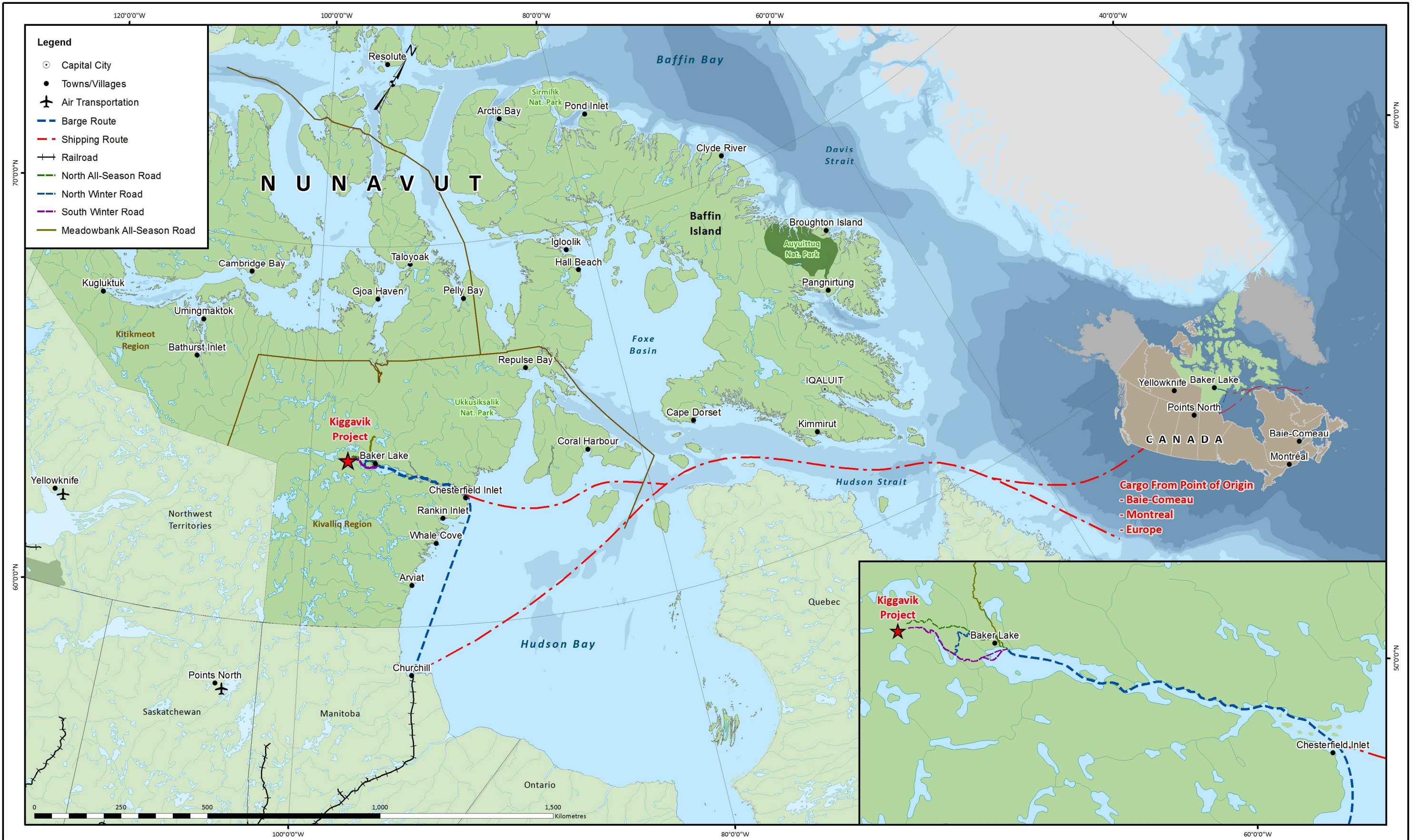


FIGURE 1.0-2
MAJOR PROJECT COMPONENTS - SHIPPING ROUTES

Based on existing resources, mine life is estimated at 14 years of operation after three to four years pre-operational construction. It is expected that additional resources will be found. Decommissioning is anticipated to last five years with post decommissioning monitoring lasting an additional 10 years. Decommissioning of the Project will include demolition of the site and reclamation of any contaminated areas. Closure of the TMFs will consist of covering and then blending the final cover in with the existing topography. Mine rock piles will be covered and re-graded to promote vegetative growth and to provide wildlife access. Decommissioning plans and financial security are required for the Kiggavik Project. Financial assurance provides certainty that decommissioning and reclamation work will take place with available and adequate resources.

Direct job estimate averages are up to 750 and 600 workers for construction and operations respectively. Indirect and induced jobs may be as high as 400 during construction and 1,300 during operations. The total taxes and royalties to be paid on the Kiggavik Project would be approximately \$1 billion payable to Nunavut Tunngavik Inc. (NTI), the Government of Nunavut (GN), and the Government of Canada.

Project Need and Purpose

The purpose of the proposed Kiggavik Project is development that will:

- Realize a return on investment by the owner - The capital cost of the Project is estimated at \$2.1 billion with operating costs estimated at \$240 million per year. The market price for uranium concentrate over the last five years has been within the range needed for reasonable return on investment to owners and future opportunities are strong enough to encourage Project advancement with the intent of development that will coincide with viable future markets.
- Benefit Nunavut communities and contribute to sustainable development - The Kiggavik Project would benefit communities through employment, business opportunities and procurement. Benefits will be preferentially targeted to and realized by the seven communities of the Kivalliq Region. The Project can contribute to the goals of economic self-sufficiency and balanced economic development.
- Help meet global energy demands and future needs for nuclear power - World uranium production currently falls short of projected future annual requirements for generation of clean electricity using nuclear power (as an alternative to electricity generated by fossil fuel

consumption). Uranium from the Kiggavik Project would help to meet the future needs for nuclear power, which will help reduce, on a global scale, greenhouse gas emissions.

No-Go Alternative

Abandoning the Project, other than for significant environmental impacts or cultural concerns that are determined to be unacceptable, would be inconsistent with the economic strategies and development policies established for the area. Should the NIRB environmental review find the Kiggavik Project to protect ecosystem integrity and human health, the potential economic benefits would not be realized with a decision to abandon the Project.

Uranium Development in Nunavut

The Nunavut Territory has given special consideration and planning to uranium development as evidenced in the consideration of uranium development in the broad principles, objectives and conditions for uranium exploration and mining outlined in the NTI Uranium Policy and the six guiding principles for uranium developed by the GN. AREVA's values and sustainable development commitments along with existing Canadian law and international agreements ensure consistency between the NTI uranium policy and GN guiding principles and the proposed Kiggavik Project. AREVA is committed to sustainable development that does not compromise the land or people of Nunavut.

AREVA's Integrated Approach to Environmental Protection

Environmental assessment (EA) is used to identify all possible Project-environment interactions and their potential to result in an environmental effect(s). Mitigation to reduce potential effects is then considered and the significance of the remaining residual effects determined. AREVA believes this process should be iterative so that a good understanding of the local environment and site-specific constraints can influence design and mitigation and the subsequent evaluation of potential environmental effects. This iterative process leads to a selection or narrowing of Project alternatives and further refinement of Project design.

Key features of the alternatives analysis for the Project included environmental performance, economic viability and project operability. Project design considered environmental performance from the perspective of minimizing water and reagent use, optimizing water recycle, minimizing the Project footprint, capturing and treating water that may have come in contact with operational areas and minimizing release of atmospheric and treated effluent emissions.

Mitigation measures identified in this iterative EA-design can be identified in a variety of forms. Design-based mitigation can allow for the avoidance of potentially significant effects by changing spatial or temporal aspects of the Project. Specialized mitigation, environmental protection measures and protocols, and compensation (e.g. fish habitat compensation) are all categories of effective mitigation that minimize or avoid residual environmental effects of the Project.

During facility operation, compliance monitoring maintains operational performance standards. Environmental effects monitoring programs determine operational effects.

Adaptive management decisions are made on the results of monitoring when results are beyond the level anticipated and additional design, mitigation or other modifications are required. Continual improvement drives forward thinking, minimal impact management decisions even when operations are performing as predicted. Both adaptive management and continual improvement are integral parts of AREVA's approach to environmental protection.

The approach builds on the outcomes of EA predictions and on operational monitoring and follow-up programs to provide a robust defense against the development of significant adverse effects. Optimization of performance, of monitoring, and follow-up programs is achieved through continual improvement based on experience.

Community Engagement

AREVA's commitment to broad public engagement is evidenced in our sustainable development commitments, values charter, on-going corporate social responsibility initiatives and presence in Nunavut. Although AREVA has used a variety of communication tools, time spent in Kivalliq communities was a priority. In addition to formal and informal meetings with various stakeholder groups and open houses, AREVA has hosted tours of northern Saskatchewan uranium operations so that people can see first hand what an operating uranium mine and mill look like as well as decommissioned uranium mine.

Figure 1.0-3 shows the locations of potentially affected communities. Potentially affected communities identified prior to and within the draft environmental impact statement includes the seven Kivalliq communities and four communities outside the Nunavut Settlement Area that have communicated an interest in the Kiggavik Project.

Understanding that language is essential to communication and strongly tied to culture, AREVA makes efforts to translate print material and videos and use an English-Inuktitut translator when possible.



Looking at comments, questions and concerns raised regarding nuclear energy and/or the Kiggavik Project in Nunavut over the last six years, caribou were raised as a topic of discussion the most frequently. The land/wildlife habitat, marine mammals and clean water all generated considerable discussion.

Similar levels of interest were generated for community engagement, including the need and desire to better engage the youth while also respecting the elders; respect for, use of, and value attributed to IQ; employment opportunities and other benefits; and health and safety – both general and uranium specific.

With respect to the Project description, the access road alternatives and potential Thelon crossing were topics of most interest followed by general questions regarding the mine site and then tailings.

Comments received during engagement events have been considered and used to shape future engagement activities, the Project design and aspects of the EIS. Key influences of engagement include removal of the south all-season access road alternative, addition of youth specific engagement activities, radiation education initiatives including radiation protection demonstrations in all seven Kivalliq communities during open houses and creation of two videos related to radiation education, modifications to baseline field programs for caribou and marine mammals to better incorporate local knowledge and preferences.

Inuit Qaujimajatuqangit

IQ interviews and workshops focused on elder groups and Hunter and Trapper Organizations in the seven Kivalliq Communities. Each community provided information on the following topics: wildlife and harvesting of both land and sea mammals, bird and egg harvesting, fishing, plants, travel routes and cultural sites, ice formation, water, changes in weather, and Project-specific questions and concerns.

Information related to socio-economic concerns was obtained through interviews and focus groups that included rotational workers,



rotational workers' spouses, young adults, and women. Topics discussed included women's roles, dependency on country foods, and traditional activities.

IQ was used to inform Project design, contribute to baseline information and influence company collection of baseline field information, select valued components for assessment, identify issues of importance and identification of appropriate mitigation and monitoring to reduce potential adverse effects to both the biophysical environment and communities.

Existing Biophysical Environment

The Project area experiences a continental climate characterized by cold temperatures, low precipitation and high winds. The winters are long and cold and the summers are short and warm; transitional seasons are very short. Extreme temperatures in Baker Lake have ranged between -50.6°C in January and 33.6°C in July with a mean annual air temperature of -11.9°C. The most frequent wind direction and speed at Baker Lake are north-northwest at 20.5 km/h to 31.7 km/h. Wind speeds greater than 39.6 km/h (11 m/s) are most frequent over the period of January to March. Wind speeds exceeding 100 km/h are expected to occur only once in 30 years.

Air quality, noise and vibration are all typical of a remote, relatively undisturbed environment.

Streams average less than 1 m deep and most streams in the area are frozen to the bottom throughout the winter. Lakes are typically shallow with maximum depths of less than 3 m and they are ice covered from October through June with ice thicknesses of approximately 2 m. Overwintering habitat is found in a few lakes deeper than 3 m. Streams become active at spring snowmelt in mid-June with flows gradually receding over the remainder of the open water season. Lakes reach their level and volume peaks during the spring freshet in mid-June.

The most widely distributed fish species found in lakes in the area is Arctic grayling. Other commonly identified fish species include burbot, cisco, lake trout, ninespine stickleback, round whitefish and slimy sculpin. Arctic char, fourhorn sculpin, lake whitefish and longnose sucker are additionally found in Baker Lake. Arctic grayling, lake trout, ninespine stickleback, and slimy sculpin are common to streams in the area and burbot, cisco, lake whitefish and round whitefish are also observed. Arctic char and longnose sucker use the Thelon River.

Some parameters (pH, ammonia, aluminum, cadmium, chromium, cobalt, copper, iron, lead, silver, and zinc) of baseline water quality levels in some lakes and some metal concentrations (arsenic, cadmium, chromium, copper, mercury, and zinc) in sediment samples were higher than Canadian

Council of Ministers of the Environment guidelines. This indicates that background levels of these elements are naturally elevated.

Thickness of active layer is highly variable, ranging from 1 to 2 m in surficial sediments to 5 m in bedrock outcrops. Permafrost depth is estimated to range from about 210 m depth in the Kiggavik area to about 250 m depth in the Sissons area. There is little to no connection between the deep (beneath permafrost) and shallow (active layer) groundwater flow systems. Rock within and below the permafrost has little water movement and is not used as a drinking water source.

The area is dominated by flat lying or gently sloping terrain with rolling and hummocky topography, frequent bedrock outcrops, and a few low escarpments. Eskers are rare. Surficial deposits consist of a thin organic layer underlain by mainly glacial till, which varies in texture and composition. Some soil samples showed trace element concentrations (arsenic, molybdenum, boron) higher than the Canadian Council of Ministers of the Environment guidelines indicating that background levels of these elements are naturally elevated. Average depth of topsoil available to salvage for later use in reclamation is approximately 11 cm, with a minimum of 2 cm in upland lichen tundra, heath upland and heath tundra areas, and a maximum of 31 cm in low-lying wet graminoid and graminoid tundra areas with thick peats.



The Project area is dominated by tundra vegetation interspersed with lichen-dominated bedrock outcroppings and boulder fields. Tundra vegetation is characterized by short shrubs such as dwarf birch, willows and heath species, as well as sedges and grasses, herbs, mosses and lichens.

The Project area is not within caribou calving grounds. The historical Beverly caribou calving ground is located approximately 70 km away and the Qamanirjuaq calving ground approximately 200 km away. The Qamanirjuaq, Beverly and Ahiaq herds are migratory and they move into the Kivalliq Region during the spring and summer months. Field observations and satellite collar locations show that the migratory herds use of the area is transient. Three tundra-wintering caribou herds, Lorillard, Wager Bay and Baker Lake, may use the area during winters but move further north for calving.

Muskox occupy the region year-round.

Large predatory species, including grizzly bear, wolverine and wolf, are present throughout the area but are observed infrequently. Smaller predatory species, such as Arctic fox and ermine, are also present with Arctic foxes seen as relatively common in the region. Small mammals such as voles, lemmings and ground squirrels are widespread.

Waterfowl, shorebirds, jaegers, raptors and upland birds annually migrate from southern wintering grounds to breed in the region during the summer. Only ptarmigan, gyrfalcon and common raven are residents throughout the year; they are scattered throughout the region and present in relatively small numbers. The most common species of waterfowl observed in the Baker Lake and Chesterfield Inlet area are Canada goose, long-tailed duck and common loon. Red-throated, arctic and yellow-billed loons, and tundra swans also use the area.

Chesterfield Narrows drains Baker Lake and empties into Chesterfield Inlet. Chesterfield Inlet is a 200 km, salt-water tidal corridor that joins Baker Lake with Hudson Bay. Arctic cod, Arctic sculpin, Arctic char, fourhorn sculpin, banded gunnel, and whitefish are found around the mouth of Chesterfield Inlet. In Hudson Bay ice generally starts to form in late October and the bay usually becomes ice free in early August. Capelin and starry flounder are abundant near-shore species in Hudson Bay and fourhorn sculpin are abundant in shallow waters (below 45 m) throughout Nunavut. Greenland halibut and Arctic cod are abundant offshore marine fish species in Hudson Bay.

Marine mammals occurring in the regional marine shipping area are polar bear, beluga whales, and ringed seals. Walrus, bowhead whales and bearded seals are common in other locations throughout Hudson Bay, Hudson Strait or Foxe Basin but are considered rare or uncommon near the local shipping route.

There are no Schedule 1 or 2 listed aquatic, plant or terrestrial wildlife species listed under the *Species at Risk Act* (SARA) that occur in the Project area. Three marine fish species, the Northern, Atlantic, and spotted wolfish, are listed on Schedule 1 of SARA; however, Hudson Strait is designated as 'probable' range. Ross's gull is also listed on Schedule 1 of SARA and is known to breed and use coastal habitat in southwest Hudson Bay. Ross's gull are most commonly seen in the Churchill area than anywhere else in Canada and the last observation of Ross's gull in the Churchill area was four individuals in 2005.

There are no Important Bird Areas (IBA), as identified by Bird Studies Canada, Nature Canada and BirdLife International through the IBA Program, within the local marine shipping area. The Harry Gibbons and McConnell River migratory bird sanctuaries include coastal habitat in the region.

Existing Socioeconomic Environment

Nunavut's economy and people have unique characteristics including 1) the importance of the mixed economy; 2) a requirement to use renewable and non-renewable resources in sustainable ways that benefit Inuit; 3) the value of IQ to economic and social development decision making; 4) decentralization to give communities control of their own development; 5) a need to develop self-reliance in face of overdependence on federal transfers; and 6) a very young and rapidly growing population with important socio-economic challenges.

Nunavut's mixed economy has both wage and land based parts. The wage based economy provides cash income. The land based economy provides food, but also important social and cultural benefits to Inuit. Most people try to be active in both the wage and land based parts of the economy. The unemployment rate in Nunavut was about 19% in July 2011, but for young people it was almost 40%. Most of the unemployed are young Inuit men. In 2006, Kivalliq unemployment rates were worse than the rest of Nunavut and much worse than Canada. Since 2006 many new jobs for Kivalliq people became available with the development of Meadowbank, exploration companies and businesses supplying mining companies.

Very few people hunt full time or almost full time anymore but most people continue to go out on the land. The importance of harvesting to Kivalliq households is demonstrated by country food substituting for about half of what total food costs would be if all food was bought in stores. The practice of harvesting also confirms identity, social relations, values and knowledge.

The Kivalliq population grew from 7,944 to 9,479 people between 2001 and 2009, an average growth of close to 2% per year. Dated information on education levels shows that less than 40% of adults have completed high school. On average, younger people are less educated than older people. The Kivalliq has lower crime rates than Nunavut as a whole but rates are still much higher than in the rest of Canada. Housing is an ongoing problem in all of Nunavut, but is worse in most Kivalliq communities. More than half of houses are overcrowded or in need of major repairs.

People have maintained their language over the last decade with a strong commitment to Inuktitut. Most people feel they speak Inuktitut well but they note many children are using English more now than they did in the past. It has been hard for some people to adjust as a new culture, with different

values, has come in. Inuit no longer live on the land and the culture has changed. Everybody knows this and most people are focused on how to manage the change.

Radiation

Regardless of where people live or work, they are exposed to radiation from natural sources; it is present in the air we breathe, the food we eat, the water we drink, and in the construction materials used to build our homes. Levels of natural or background radiation can vary greatly from one location to the next. Consumption of caribou by people living in the Project area, and across northern Canada, has been shown to add some exposure, primarily due to the natural background levels of Polonium-210.

Residual Biophysical Effects

The Kiggavik Project has the potential to impact the biophysical environment throughout all phases of Project life.

Climate

Greenhouse gas emissions (GHGs) will be generated. Energy efficient and emissions minimization features will be incorporated into building design and in the operation of any equipment and ancillary facilities. Use and management of heavy equipment operation, vehicles and marine vessels will be optimized. Maximum annual GHG emissions are estimated to result in an increase to the baseline GHG emissions for Nunavut and Canada, but are assessed as not significant.

Air

Ambient air concentrations of contaminants of potential concern (COPCs; dust, metals, gaseous compounds and radionuclides) within the local and regional environments will increase. Dispersion modeling studies were used to select preferred locations of several Project facilities including the acid plant, power plant, storage piles and accommodation complex to minimize effects to air quality. Exhaust emissions controls will be used, dust minimized and suppressed and permanent mine rock stockpiles will be compacted to encourage growth of vegetation and suppress the release of dust emissions. All predicted residual effects resulting from the Project are not expected to extend beyond the local area, will only occur a few times per year and are reversible. Therefore, the increased concentrations of COPCs are assessed as not significant.

Noise and Vibration

Noise and vibration will increase. Noise levels are expected to be low, with the exception of some short term construction activities, and not anticipated to result in any community annoyance. Vibration levels are expected to be negligible during all phases of the Project. The predicted increase in noise and vibration are assessed as not significant.

Surface Hydrology

Ponds will be dewatered, a section of Andrew Lake will be dewatered and pumped into the remainder of Andrew Lake, Andrew Lake pit will be re-flooded, contact water will be collected, treated and released, treated effluents and greywater will be released and freshwater will be used for industrial and domestic purposes and flooding of the winter road. The Project has been designed to most effectively minimize effects to surface hydrology by selecting large water bodies for withdrawal and discharge, water will be recycled where possible and the effective use of diversion channels and sedimentation ponds. Changes in flow rates, lake levels (with the exception of Andrew Lake) and under-ice volumes will remain below appropriate thresholds. Effects to surface hydrology are assessed as not significant.

Hydrogeology

Groundwater levels will be affected by dewatering activities in the vicinity of open pit and underground mines. Limited groundwater will flow into mines and tailings management facilities during operation or post closure. Similarly there will be limited interaction between mines, tailings management facilities and receiving surface water bodies. Given the project design features and the slow groundwater movement, all project effects on hydrogeology are assessed as not significant, for both current permafrost conditions and potential no-permafrost conditions that would result from dramatic warming conditions.

Water and Sediment Quality

Treated effluent will be released. Dust and air emissions can also affect water quality. The water treatment plant has been designed so that effluent quality will meet or exceed applicable regulations. Dust control measures will be in place and emissions controlled and reduced as possible. Diversion channels will be used to re-route fresh water around the development areas. Modeling data indicate that changes to receiving water quality due to effluent discharge will occur during operation and final closure but will return to baseline levels post closure. Changes in water quality due to dust deposition are predicted to be minor with annual minor increases in metals, radionuclides and total suspended solids not measurable above natural background variation. Any

change to lake pH will be small and likely brief, due to the short residence times of the lakes. Sediment concentrations of all constituents of potential concern are predicted to be below Canadian Council of Ministers of the Environment guidelines in all segments of Judge Sissons Lake with the exception of nickel. Predicted future nickel levels with effluent release are similar to baseline nickel levels in sediment so no substantial effects due to nickel levels are predicted. Effects to water and sediment quality are assessed as not significant.

Aquatic Organisms and Fish Habitat

Changes to water quality will affect fish habitat quality. Fish habitat will be lost with Andrew Lake dewatering and the Mushroom-End Grid stream diversion. Fish habitat will be affected by watercourse crossings along the access and site roads. Natural flow paths will be maintained where possible. Cadmium and sulphate concentrations in select areas of Judge Sissons Lake will be elevated compared to baseline conditions but no appreciable adverse effects on the abundance and distribution of aquatic biota are expected. Activities resulting in a harmful alteration, disruption or destruction of fish habitat will be compensated under the federal Department of Fisheries and Oceans “no-net-loss” Policy. Effects on aquatic organisms and fish habitat are assessed as not significant.

Fish

Effects to water quality and fish habitat can affect fish. Detonation of explosives in or near water results in pressure change and vibration that can affect fish. It is expected that cadmium and copper concentrations in some shallow areas of Judge Sissons Lake will be elevated compared to baseline conditions but no appreciable adverse effects on the abundance and distribution of predator and forage fish are expected. Blasting setback distances, charge sizes and timing will be used to provide adequate protection for fish populations. Given the mitigation measures, there will be no residual effects to fish from blasting. Effects to fish are assessed as not significant.

Topography, Landforms, Surficial Geology and Permafrost

Construction and operation will change the local active layer depths and terrain stability. Project footprint including mine and mill areas, the access road, quarry sites and others will be disturbed. The Project layout considered sittings that would minimize footprint area and avoid permafrost sensitive and uncommon landforms. Padding and platforms will be used to maintain existing permafrost conditions and drainage will minimize water pooling during spring thaw. Effects on

permafrost and landforms will be confined to the Project footprint. The effects on permafrost and terrain are determined to be not significant.

Soils

Soil quality will be affected by dust, contaminants and emissions. Soil quality can also be affected by compaction and erosion. Soil quantity can be affected by burying of soils where topsoil stripping will likely not occur (soils saved for reclamation where possible) and erosion. Where possible soil will be salvaged and stored away from dust and emissions to use for reclamation and standard mitigation to reduce dust, contaminants and emissions will be in place. Potential acid inputs and emissions will only occur around the Kiggavik mine site. Changes in concentrations of constituents of potential concern are predicted to be below Canadian Council of Ministers of the Environment guidelines. Admixing, compaction, and erosion effects will be negligible. Effects on soils are assessed as not significant.

Vegetation

Vegetation will be lost to clearing during construction. Dust, air emissions, and changes to soils can affect vegetation. The mine footprint will be minimized and winter road alignments have maximized use of water bodies and watercourses. Dust and emissions will be minimized and controlled. Heath tundra vegetation will be the primary habitat type affected by the Project. Disturbance to vegetation abundance and community diversity are anticipated to be negligible. Potential acid inputs are below the critical load value and exposure to NO₂ or SO₂ are below benchmark guidelines. Effects to vegetation are assessed as not significant.



Terrestrial Wildlife and Habitat

Mortality is likely to result from vehicle collisions or through problem animal kills. Previously available habitat will be temporarily unavailable due to mine infrastructure. Dust and sensory disturbance will reduce the quality of near-by habitat. Changes to air, soil and vegetation quality could affect wildlife. Sensory disturbance and/or avoidance may result

in changes to movement or reduced local raptor and migratory bird nest success.

Road alignments will minimize blind spots and road profile and snow management will allow animals to get off the road to avoid traffic. Temporary road closures, speed limits and reduced

traffic will all also help reduce mortality. Dust and sensory disturbance will be minimized when possible. AREVA will not construct a road within 10 km of a designated caribou water crossing and will give caribou the right-of-way where possible and safe.

Mortality effects will be undetectable at the local scale. Direct and indirect loss of available habitat for Qamanirjuaq (migratory) and Baker Lake (resident) caribou herds (the two herds anticipated to potentially be affected) will be approximately 0.5% of the Baker Lake winter range, and 0.2% of the Qamanirjuaq growing season range and a considerably smaller proportion of habitat over the annual range. Other mammals, raptors and migratory birds will also have some previously available habitat become unavailable. Caribou will be unable to move through some areas (e.g. mine site, airstrips) that were previously available but no satellite collared caribou from the Qamanirjuaq, Beverly and Ahiak migratory herds have been documented within or crossing the mine and access road areas. Resident herds have been recorded crossing the mine and road area including four Baker Lake caribou during spring migration and one Lorillard caribou during fall migration. Cadmium and uranium exposure to caribou and muskox will not exceed exposure levels associated with adverse effects and the level of exposure to all other constituents of potential concern are not predicted to change from baseline. Exposure to raptors and migratory birds are also not predicted to change from baseline. Any reduction in nest productivity will be local. Therefore, effects to wildlife and habitat are assessed as not significant.

Marine Fish

Underwater noise from marine vessels can harm, disrupt, and/or displace fish from habitat in Hudson Bay and Chesterfield Inlet. Operating procedures to reduce underwater noise will include maintaining a constant course and speed whenever possible, avoidance of unnecessary acceleration, and maintenance of propellers. Fish response is anticipated to be minor, short-term and reversible. Effects on marine fish are assessed as not significant.

Marine Mammals

Polar bears will not interact with the Project as all marine shipping will occur in the open-water season when the bears are seasonally forced onto land in the Hudson Bay region waiting for new ice to form. The ringed seal and beluga whale, common marine species in the area, may be disrupted or disturbed from vessel noise or experience a vessel-mammal strike. Marine mammal monitors can be onboard vessels to monitor marine activities when transiting sensitive areas along the proposed barge route from Churchill to Baker Lake. A constant course will be maintained

whenever possible and unnecessary acceleration will be avoided. Noise levels will be almost half the sound required to cause a behavioural response in marine mammals. There is potential that a vessel-mammal strike could occur over the life of the Project but with proposed mitigation, strikes are less likely to result in mortality. The effect on marine mammals is assessed as not significant.

Worker Health

Exposure to Hazardous Substances and Constituents of Potential Concern (COPCs)

Workers in the construction, milling, mining, decommissioning and reclamation process for the Kiggavik Project may be exposed to hazardous substances or COPCs. Guidance to ensure worker health is established by the American Conference of Governmental Industrial Hygienists (ACGIH). An evaluation of potential exposures to hazardous materials and COPCs was conducted to confirm exposures would be less than guidance values. Operational experience gained from the mining and milling processes at AREVA's northern Saskatchewan operations, which use many of the same chemicals that will be used at the Kiggavik mine and mill, provided a basis for the Kiggavik Project evaluation.

The greatest opportunity to implement controls for exposure to hazardous substances and COPCs is at the design stage. This opportunity is being taken for the Kiggavik Project. Standard work



practices, together with practices implemented as part of a radiation protection program, in uranium mining and milling are effective at minimizing exposures to hazardous substances and COPCs found in the mine rock and ore. Important mitigation measures include ventilation, maintenance and housekeeping, education and training and personal protective equipment. With

effective design features and proposed mitigation measures in place, there are no exposures to workplace hazardous substances or COPCs expected to exceed the threshold limit values established by the ACGIH.

Exposure to Radiation

A precautionary approach is applied to the control of radiation exposures so they are As Low As Reasonably Achievable (ALARA), social and economic factors considered. Exposure to radiation is

measured in terms of radiation dose, typically in units of millisieverts (mSv). Dose limits for individuals have been developed by the international scientific community to protect against the radiation risk.

In Canada, the Canadian Nuclear Safety Commission (CNSC) regulates the nuclear industry and regulations under the *Nuclear Safety and Control Act* specify the limits on exposure to radiation for workers and for members of the general public. Like hazardous substances and COPCs, the greatest opportunity to implement controls for exposure to radiation is at the design stage. This approach was adopted for the Kiggavik Project. Dose and dose rate constraints below the regulated dose limits are established as objectives to be achieved during operations. Radiation protection objectives were used when designing facilities, processes, equipment, and work practices in order to minimize exposure to workers and the public. A Radiation Protection Plan is implemented at uranium mine sites.

Base case and upper bound radiation doses were estimated for open pit and underground miners, mill personnel and personnel transporting yellowcake. No workers are expected to receive radiation doses higher than the dose limits set by the Canadian Nuclear Safety Commission.

Public Health

Atmospheric and aquatic emissions from the Project may enter the environment and then subsequently expose members of the public. To better understand possible pathways for contaminants to reach the public near the Project, IQ for Baker Lake was used to identify caribou and fish as primary food sources, with ptarmigan, arctic hare and squirrel also consumed. Differences in the consumption of water, fish, vegetables, berries, and wildlife for permanent residents of the Baker Lake community (adult, child and toddler family members), hunters at Judge Sissons Lake that take game back to their families and non-nuclear workers (non-NEW) at the Project site (e.g. camp cook, security guard), were all considered in the human health assessment.

Design of the water treatment plant to have appropriate and environmentally safe effluent discharge quality and design and mitigation to minimize air emissions and/or their potential effects are primary items to reduce potential effects to all environments, including the human environment.

Air Contaminants, particulate matter, non-radionuclide COPCs and radioactivity were evaluated. Findings showed all concentrations well within applicable limits or criteria with the exception of infrequent, short-term NO₂ and fine particulate matter concentrations at the Kiggavik camp. Although infrequent short-term concentrations of NO₂ elevated above World Health Organization

(WHO) health-based criterion occur at the Kiggavik camp, they remain well below WHO levels of concern for healthy adults. Levels at Baker Lake are well below any level of concern. As with NO₂, fine particulate matter concentrations are predicted to infrequently exceed values designed to be protective of sensitive individuals at site but remain below levels of concern in healthy adults and levels at Baker Lake will remain well below any level of concern.

The highest exposure predicted is for the non-NEW worker at the Kiggavik site who receives some incremental dose from radon and inhalation of dust at the site. None of the doses to members of the public are expected to exceed Health Canada dose constraints or the Canadian Nuclear Safety Commission allowable dose for members of the public. In fact, the incremental dose to the public is expected to be less than 1/10th of the dose limit and less than 1/20th of the average natural background dose to Canadians.

Residual Socioeconomic Effects

The Project will create *employment and business* opportunities. In-migration is anticipated in Baker Lake and Rankin Inlet (despite pick-up points in each Kivalliq community). Employment and contracting opportunities will be maximized with preferential hiring; preferential contracting; education, training and scholarship programs; considerations for Inuit culture in the workplace and contractor benefit enhancements. *Education and training* will include pre-employment, life skills, high school completion, postsecondary, on the job, and mentoring programs for workers and prospective workers. Effects on *community economies* will be positive with incomes increasing for many people. Economic opportunities will have ripple effects beyond direct employment and business opportunities and community economies will grow. Job experience, education and training, and contracting experience will enhance the capacity of the labour force.

Growing economic opportunities can encourage *traditional culture* by providing an income that can be used towards harvesting expenses. Economic opportunities may conversely contribute to the cultural shift away from the traditional culture as people adapt to expectations and requirements in a cross cultural working environment. Any reduction of harvesting, or sharing of harvest, has potential for effect on food security (particularly of the more vulnerable), nutrition and therefore health. Ongoing government support for traditional culture is expected to assist in the retention of traditional skills, language, values and knowledge. Effects on traditional culture are expected to be negative overall. The Project will not force or require changes to traditional culture but some drift away from harvesting, use of Inuktitut, and traditional values and knowledge is expected, particularly in the context of other forces of cultural change.

Increased incomes and cultural shifts have implications for *wellbeing* at the individual, family and community levels. Many people thrive with expanded economic opportunity but some do not. Individual, family and community wellbeing support will include a confidential employee and family assistance program; availability of peer and elder counsellors; communication systems for people to stay in touch with families; and supporting community initiatives to address community priorities towards enhanced wellbeing. Effects on well-being are expected to be positive overall. Although negative effects on traditional culture have potential to erode wellbeing for some, broadening choices and opportunities for livelihoods are counteracting factors and standards of living and household economic security will improve.

With expectation for overall increase in community wellbeing, the need for some *social services*, particularly social assistance, is expected to decrease. The demand for health, housing, municipal services and potentially police are expected to increase with increased incomes. Improved economic opportunities are expected to motivate more demand for education. Revenues to GN and NTI will allow the addition of *public infrastructure and services* to meet a potential increased demand and this is a benefit to the people. An increased demand for services would be a negative effect if the government were unable to meet that demand.

Economic and fiscal effects at the territorial level are positive. There will be very large jumps in gross domestic product, employment, labour income, own source GN revenues and payments to NTI. Subsequently Kiggavik will represent a sustained contribution to the economy and revenues until closure.

Overall, as people adjust to change with time, most negative effects are expected to be moderate and positive effects are expected to gain momentum. A Community Involvement Plan and a Human Resource Development Plan will be in place and updated throughout the Project. AREVA will continue to *engage*, including with elders to capture *IQ*, for input on socioeconomic management, collaborative monitoring and any needed adjustments.

Different individuals can respond differently to an effect but the overall effect to socioeconomics is positive and significant. It is important to note that although the Project will end, the life-long benefits of job experience and learning are not reversed. Further commitments to enhance benefits will be negotiated with the Kivalliq Inuit Association through an Inuit Impact Benefit Agreement.

Heritage Resources

Archeological resources need to be protected from disturbance or appropriately mitigated. Archaeological studies were conducted and four small sites, including three stone markers and one cache, were recorded in the mine site area. The significance of these sites was assigned as low. The locations of additional sites have been and will continue to be incorporated into the Project design so they can be avoided if possible and an Archaeological Mitigation Plan will be implemented over the Project life. Documentation of each site is kept on file with the Canadian Museum of Civilization as well as with the Government of Nunavut and records are available for interested persons and future researchers.

Cumulative Effects

Project effects are generally limited to the Project area with no potential interaction with other environmental effects from other human activities. Only air quality, terrestrial wildlife, health and socioeconomics had potential to act cumulatively.

Air Quality - No other projects or activities are located close enough to interact spatially with the air quality effects from the Kiggavik Project mine site. Given the proximity of the preferred dock site to the Meadowbank dock site, emissions from equipment and vehicle use may act cumulatively. Emission concentrations increase in the immediate dock area but are limited to within 2 km of the dock and are assessed as not significant.

Terrestrial Wildlife and Habitat - The alternate option of an all-season access road (winter road preferred option) may act in combination with local hunter harvest resulting in a cumulative mortality effect on caribou. Use of the road for harvesting may affect the distribution of harvest or the total harvest taken. Should the all-season access road be required and approved, AREVA will work with caribou stakeholders in determining how to control and manage public access on a potential Kiggavik access road in ways that respect safety, the environment and company use of the road.

Worker Health - Exposures to radioactivity, hazardous substances, and constituents of potential concern were assessed for workers and members of the public, including residents of Baker Lake. All exposures remained well below acceptable limits.

Socioeconomics - Additional projects in the Kivalliq and/or throughout Nunavut are expected to have the same types of socio-economic effects as Kiggavik. If the combined demand for labour and goods outstrips supply capacity, mining proponents may be forced to meet the supply from the south and benefits that could have been retained by Inuit would not be. Nunavut's labour force is

growing so quickly this is a short term versus a longer term concern. Rapidly growing capacity in the Kivalliq Region to supply the mining sector suggests there could be spill-over effects into the Kivalliq Region even when projects are located elsewhere in Nunavut. Mining projects eventually close and the availability of new projects to take the place of older ones provides alternative jobs and markets for labour and business so the effect is positive.

Transboundary Effects

A transboundary effect may occur when a residual effect occurs outside the Nunavut Settlement Area as in the case of marine shipping or when animals move across jurisdictional boundaries which occurs with the Qamanirjuaq, Beverly and Ahiak caribou herds that migrate across political boundaries. In both cases the absence of significant Project and cumulative effects remove the potential for significant transboundary effects.

Effects of Environment on Project and Accidents and Malfunctions

The natural environment has the potential to affect the Project through a number of mechanisms, these include: extreme weather, such as blizzards, high winds, extreme precipitation, storm surges, fog; climate factors, such as thaw susceptible soils; seismic activity; wildlife encounters; and fires. Resulting potential impacts include: increased risk to personnel safety; damage to infrastructure; upsets to the site water balance; and difficulties with logistics and transportation.

Accidents and Malfunctions, including those caused or compounded by environmental hazards, were identified and assessed. Key Project components assessed include marine transport, activities at the Baker Lake dock facility, transportation on the Baker Lake to Kiggavik access road, open pit mining, underground mining and the milling operation.

Mitigation measures consider personnel, local communities, the environment, and the operation and include 1) measures to reduce the risk of an occurrence (design features such as site containment, management programs and routine monitoring); 2) measures to minimize the consequences if the event occurs (emergency response, spill contingency, management and monitoring programs); and 3) measures to ensure control is regained before activities recommence. A preliminary Emergency Response Plan has been prepared for the Project.

Sustainability

Strong Project design, implementation of effective mitigation and comprehensive monitoring, continuing two-way communication and partnership with communities and a commitment to

adaptive management and continual improvement ensure adverse effects are minimized and benefits maximized throughout Project life as identified within the balance of environment, people and economics.

During the Bruntland Commission, the World Commission on Environment and Development defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” As identified in the socioeconomic assessment, the life-long benefits of job experience and learning will extend beyond Project life. Project benefits help to meet the needs of the present generation but many benefits and investments can also assist future generations in meeting their needs.

Acknowledging residual effects associated with development, the development of the Kiggavik Project will not compromise ecosystem integrity. Socioeconomic impacts will be positive overall with existing and future well-being of Nunavut residents protected and promoted.

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- AREVA Resources Canada Inc.
Kiggavik Project EIS
April 2012

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