



## POPULAR SUMMARY

Cumberland Resources Ltd. (Cumberland) is proposing to develop an open pit gold mine on the Meadowbank property, located 70 km north of the Hamlet of Baker Lake. Cumberland has written this Final Environmental Impact Statement (FEIS) based on guidelines issued by the Nunavut Impact Review Board (NIRB). This report and many others describe the proposed Meadowbank project, the land, the wildlife, and the people. These reports also identify potential effects of the project and the steps Cumberland will take to make sure that the water stays clean, the fish and wildlife stay healthy, and that local people benefit from the project. The information contained in the FEIS and supporting documents will be used by NIRB and other regulators to review the project and determine if there is enough information to grant a permit.



The Meadowbank property is located in the Kivalliq Region of Nunavut, approximately 70 km north of the Hamlet of Baker Lake on Inuit-owned surface lands. Cumberland has been actively exploring the Meadowbank area since 1995, and has outlined an open pit mining reserve containing an estimated 2.77 million ounces of gold. Meetings with the people of Baker Lake and extensive studies during this time have helped Cumberland to plan the construction and operation of the proposed mine. The economics of the project are sensitive to fuel prices and construction capital costs, both of which are common factors of northern mine development and operations. A feasibility study on the Meadowbank Gold project was completed in early 2005.



Cumberland has complied with all governmental policies and regulations pertaining to environmental and socioeconomic issues in developing the Meadowbank project, and has an exemplary local employment and safety record over nine years of exploration in Canada's Arctic.



Many alternatives were considered in developing the Meadowbank project, including the “no-go alternative.” Environmental and economic impacts were important in evaluating the alternatives and deciding the preferred options.



The Meadowbank mine is planned to have a 12-year project life (this includes 2 years of construction, 8 of operations, and 2 years of closure and post-closure activities), during which up to 310 direct jobs will be created through construction, and 370 jobs through operations. Similar to other gold and diamond mines currently operating in the Arctic, Meadowbank is planned as a “fly-in/fly-out” operation with personnel rotated every several weeks by air transportation. Access to the site for shipping of materials and goods will be by a 115 km long all-season road. It is estimated that the proposed mine could create about 90 jobs for Baker Lake and Kivalliq region residents during various project phases, depending on the workforce capacity, skill level, and training programs available. It is reasonable to expect that the mine life could be extended as a result of continued exploration.



## THE MEADOWBANK PROJECT

Cumberland has outlined an open pit mining reserve estimated to contain 2.77 million ounces of gold. It is proposed that three open pits be created to remove the gold. Of the three pits, which are called “Portage,” “Vault,” and “Goose Island,” the largest would be Portage. Similar to the diamond mines in the NWT, some of the areas to be mined are under shallow lakes. Dikes, built from rock at the project, will allow lake water to be temporarily removed from these areas to a nearby lake. Mining will take place in the open pits behind the dikes and then at closure, the pits will be re-flooded.



In addition to the pits and dikes, the mine site will consist of a mill for ore processing, accommodations, fuel tank farm, explosives storage area, airstrip, roads, and water and mine rock management facilities. Supplies and equipment for the proposed project will be transported to a newly built barge landing facility and storage area located east of the Hamlet of Baker Lake. The storage area will accommodate fuel tanks and other supplies. From Baker Lake, the supplies will be transported along an all-weather road to the proposed mine site.

### Mine Rock Management

Rock that is removed from the pits but does not contain gold is called “waste rock.” Waste rock will be used to build the dikes, airstrip, roads, and building pads, or safely stored in two separate waste rock storage sites. Rock that contains the gold is called “ore” and will be sent to the mill to be processed to remove the gold. Approximately 93.5% of the gold is removed from the rock in the milling process. The crushed rock left over from the gold removal process is called “tailings” and will be safely stored in the bottom of a partially drained arm of Second Portage Lake called the “tailings storage area”. The tailings and waste rock storage areas are designed to freeze, such that there will be very little water

draining from rock piles and tailings. According to detailed thermal modeling, permafrost will develop and remain intact under the most extreme climate change predictions. At mine closure, the frozen piles will be shaped in a natural way.

## Water Management

Any water that comes into contact with the mine or is used at the site is called “contact water” and will be collected and treated as necessary before being released back to the environment. To keep the amount of contact water as small as possible, ditches and other methods will be used to divert rain and melting snow away from the mine area. The tailings area will largely provide water for reuse at the process plant. Water will be drawn from Third Portage Lake for use in the accommodations building and for drinking.



## Ore Processing

The gold-bearing rock at Meadowbank contains simple and common iron minerals such as pyrite and pyrrhotite. These minerals contain mainly iron. Other minerals that contain metals that can have a negative effect on the environment are present in very small amounts (arsenopyrite, sphalerite, and chalcopyrite).



The gold-bearing rock from the open pits will be hauled to the process plant where it will be crushed and ground into small pieces. Since gold is heavy, the crushing process will allow some of it to fall away from the rock and be retrieved. To separate the remaining gold from the ore, a mixture of water containing small amounts of cyanide will be used. When all the gold has been separated, it will be melted into gold bars. The remaining water mixture will be treated by a commonly used and accepted process, which will destroy the cyanide before the water is released along with the crushed rock to the tailings storage area.



### **Additional Mine Site & Baker Lake Facilities & Services**

Facilities at Meadowbank will include a process plant, power plant, maintenance area, a fuel storage area, accommodations for about 250 people, a large kitchen, water treatment plant, incinerators, and sewage treatment plant. In Baker Lake, storage areas will be built for fuel, equipment, and other supplies.





## BASELINE STUDIES

To conduct an environmental assessment of the Meadowbank project, Cumberland studied the rocks, weather, soil, fish, water, vegetation, and wildlife, and collected traditional knowledge over a period of 10 years.

Features of the land that are most important to people of Baker Lake and Nunavut are called “valued ecosystem components.” They were chosen by talking to the people of Baker Lake and the government, and include:

- permafrost
- air quality
- noise
- surface water quantity
- water quality
- vegetation cover (wildlife habitat)
- ungulates (caribou and muskox)
- predators (grizzly bear, wolverine, fox, and wolf)
- small mammals
- raptors (falcons, hawks, and owls)
- waterfowl (ducks and geese)
- other breeding birds (ptarmigan, cranes, and singing birds)
- fish populations
- fish habitat.

Issues concerning the people of Baker Lake and Nunavut are called “valued socioeconomic components.” They are: employment (jobs), training and business opportunities, traditional ways of life, individual and community wellness, infrastructure and social services (buildings, roads, and help for problems), and heritage sites.

### Permafrost

Permafrost, or permanently frozen land, in the area is generally thought to be up to 550 m thick, except near some of the large lakes that do not



freeze to the bottom in winter. Permafrost is absent beneath some large lakes that do not freeze to the bottom in winter. The surface of the land that melts each year during the summer is usually around 2 to 4 m thick, and is called the “active layer.” Ground temperatures have been recorded at the site since 1996.

### Water Quantity

The water levels in lakes and streams around Meadowbank have been measured since 2002, and climate data have been recorded since 1996. The highest water levels occur in the spring when the snow melts. The mine will temporarily affect the amount of water flowing in three lakes: Third Portage Lake, Second Portage Lake, and Vault Lake.

Groundwater occurs in two areas: (1) just below the surface, and (2) deep below the permafrost. Groundwater near the surface of the land flows to small ponds and lakes that sometimes flow into one of the larger lakes. Deep groundwater below the permafrost, which moves very slowly, is sometimes connected by taliks, which are non-frozen areas below lakes.

### Water Quality

The quality of surface water in the Meadowbank area is very good because there is little disturbance and there are no large streams that bring sediment into the lakes. There are many different rock types in the Meadowbank area. Groundwater quality differs depending on what type of rock it flows through.

### Geochemistry

Cumberland has conducted extensive research on the chemistry of rocks in the Meadowbank area. These studies are necessary to avoid potential water quality problems during construction and operations and are used



to design mine structures (such as roads and dikes), as well as the mine rock storage and water management systems.



### Vegetation Cover or Wildlife Habitat

Vegetation at Meadowbank consists of lichens, mosses, willow and birch shrubs, heaths, herbs, grasses, and sedges. In 1999, 2002, and 2005, plant surveys found that the Meadowbank area has many of the same plants found in other areas of the Arctic. No sensitive or rare species of vegetation or habitat were identified.

### Wildlife

According to traditional knowledge and conversations with Elders, caribou are not often hunted in the Meadowbank area because it is far from Baker Lake and there is uncertainty as to whether caribou will be present in the area. This has been confirmed by Cumberland during their 10 years of activity in the project area.



The number and location of caribou were studied from airplanes, helicopters, and from the ground in 1999, and between 2002 and 2005. Information on caribou also came from wildlife logs kept at Meadowbank, from the Baker Lake Hunter's and Trapper's Organization, Department of Environment biologists, existing literature, and, most importantly, from Elders. Based on this information, we know that the Meadowbank area is not used as a calving area, but is used mostly in winter. These caribou come from several herds including the Beverly, Ahlak (Queen Maud), Lorrillard, Wager Bay, and possibly the Boothia Peninsula and Qamanirjuaq. Grizzly bears have only been seen twice since 1996, with both sightings more than 10 km from Meadowbank, while wolverines, wolves, and ermine are seen once in a while. Animals that are seen almost every day are Arctic fox, Arctic hare, ermine, sik sik, and voles.





Birds that are common in summer at Meadowbank are the Lapland longspur, horned lark, and savannah sparrow. Rock ptarmigan are common all year. Peregrine falcon, rough-legged hawk, gyrfalcon, and snowy owl are sometimes seen, but no active nests have been found, probably due to the absence of large cliffs. Canada goose, long-tailed duck, and northern pintail are known to nest; while loons, although they are seen each summer, have not been seen nesting.



### **Fish Populations & Habitat**

Lake trout, Arctic char, and round whitefish are common fish species found in the Meadowbank area. The Arctic char are permanent residents because the St. Clair Falls on the Quoich River acts as a barrier preventing movement from the ocean. Around Baker Lake, fishing occurs all year but mostly in spring and early winter when ice is on the lakes. Lake trout are the most common fish caught. The Elders of Baker Lake have noted that the area around the proposed mine is not often used for fishing, probably because of its distance from Baker Lake.

Fish populations and water quality have been studied in lakes in the Meadowbank area since 1996. Lakes farther away have also been studied to see how they might differ from the lakes closer to Meadowbank. All of the species that have been identified are common and known to occur throughout the Arctic.

### **Socioeconomic Conditions, Heritage Resources & Traditional Knowledge**

In 2001, about 7,500 people lived in the Kivalliq Region in seven towns. Baker Lake, with about 1,500 people, is the only town in the Kivalliq Region not on the ocean. Compared to the rest of Canada, the unemployment rate in Baker Lake and the Kivalliq Region is high. The government provides most of the jobs in the Kivalliq Region. There are few other jobs

available, and most people looking for work often do not have enough education. As a result, family income is declining, and in Baker Lake it is already much lower than other communities in the Kivalliq Region.

For most Baker Lake residents, a traditional lifestyle is necessary. Hunting and fishing are used to feed their families and to augment the income for those who are employed.

Baker Lake residents travel through the Meadowbank area on their way to the Back River, a traditional winter hunting and fishing area. Cumberland, with the help of Elders and local Inuit heritage experts, studied the past and present land use in the Meadowbank area in 1999, 2003, and 2005. Most of the sites identified (e.g., tent rings, qarmait, hearths, shelters, inuksuit, markers, blinds, caches, storage features, kayak stands, and fox traps) showed signs of recent (less than 50 years old) and temporary human activity. No ancient sites were found. Commercial outfitters and tourists are not known to use the area.



## Meetings

Cumberland has held regular meetings in Baker Lake and will continue to meet with local people to talk about the project, collect information on traditional knowledge, and to tell everyone about project developments. These meetings have helped Cumberland plan and design the mine. Cumberland has opened an office in Baker Lake and has appointed a full-time community liaison representative.

## Inuit Impact Benefit Agreement

A benefit agreement is now being negotiated with the Kivalliq Inuit Association (KIA). This agreement focuses on jobs, training, liaison, local hiring programs, and contracting.



## ENVIRONMENTAL MITIGATION & IMPACT AVOIDANCE

Overall, the Meadowbank project will have minor impacts on the existing environment in a regional context and low impacts in a site-specific context. The majority of the project impacts on the environment will be mitigated through project design or by following effective management and monitoring plans.

### Permafrost

Buildings and structures will be constructed using standard permafrost engineering methods. Permafrost will be preserved by elevating and ventilating structures where possible, insulating the permafrost with appropriate fills, or by promoting ground freezing through passive ventilation systems. In some cases, buildings may be constructed on bedrock.

### Air Quality

Although the Meadowbank project will create some dust, studies have shown that the quality of air after the proposed mine development has taken place will be acceptable.

Operating equipment, vehicles, and the power plant will affect air quality, but studies have shown that these emissions will be small. Measures taken to maintain air quality will include: keeping equipment running smoothly; enforcing vehicle speed limits to reduce dust; minimizing dust with water sprays; making sure that garbage is burned completely; avoiding fuel spills; collecting exhaust from the mine and venting from a tall, well-designed stack; using dust filters where rocks are being crushed and ground; and covering tailings with clean rock to control wind erosion.

## Noise

The noise levels for the proposed mine were modeled using the best technology available. The results showed that noise generated by the mine would be within the acceptable range. Ways to reduce noise include: wearing hearing protection where required, making sure that vehicles are in good shape and that mufflers are working well; providing silencers on exhaust systems; installing noise barriers or enclosing noisy equipment; developing a noise monitoring program; enforcing vehicle speed limits; keeping roads in good shape to reduce tire noise; and making sure vehicles are not left idling.



## Surface Water Quantity

Construction of the East and Bay Zone dikes will separate the small channel that connects Third Portage and Second Portage lakes. As a result, water levels in Third Portage Lake may be higher and the water flowing in two small creeks nearby may increase in speed. Pumping about 12 million cubic metres of water from Second Portage Lake into Third Portage Lake for pit development could increase the maximum spring water elevation in Third Portage Lake by 4 to 5 cm depending on whether this occurs during a normal year or a wet year. Water levels are 12 to 15 cm higher in fall. All water is discharged from Third Portage Lake to Tehek Lake by fall of Year 1.



Some parts of Second Portage, Third Portage, and Vault lakes will be altered for only 8 to 10 years when the Portage and Vault pits are being developed. Altering part of Second Portage Lake for the frozen tailings storage area would be permanent.

When the mine is closed, the size of Third Portage Lake will increase as open pits are flooded. The overall size of Second Portage will be smaller because of the tailings storage area and addition of the Portage Pit area to Third Portage Lake.



Water will be managed by making sure that culverts are working well, runoff in disturbed areas is directed to storage ponds, and runoff from natural areas is directed to lakes. Also, any runoff and seepage from rock piles, open pits, and other disturbed areas will be collected, contained in water storage ponds and treated if necessary before discharge. At closure, the site will be contoured where necessary to restore natural drainage conditions; culverts and bridges will be removed; disturbed areas will be reclaimed, and permanent stable drainage channels will be constructed wherever they are needed.



Because the main creek between Third Portage Lake and Second Portage Lake will need to be removed, one of the other two creeks will be increased in size. The new creek will be able to handle the same water flows as the creek that was lost, and will allow more fish to move between the lakes than before the mine was constructed.

Vault, Portage, and Goose Island pits will be refilled with water from Wally and Third Portage lakes. These “drawdowns” will happen in the spring when more water is present in the lakes, and will be done slowly (over several years) so that not too much water is taken out of the lakes at one time.



### Water Quality

To protect the quality of the water, comprehensive water and solid waste (rock, soil, tailings, garbage) management plans have been developed. Ditches, sumps, and water storage ponds will collect and store surface water and groundwater from disturbed areas. This water will be monitored and treated before being returned to the lakes; however, we expect water quality to remain high. Water that comes into contact with mine tailings or waste will not be discharged to the lake, but will be contained in a pit and treated if necessary.



The rock storage areas will be built and managed in a proven, conventional way. The rock pile and any associated water in the piles will quickly freeze. Studies have shown that the tailings will also freeze before any water can reach groundwater.

During mine operation, water will be released from Vault Lake water storage pond to Wally Lake, and from the Second Portage water storage pond to Third Portage Lake. Water released from the Vault pond will not need to be treated. Water released from the Second Portage pond in early years of mine operation is also expected to not need to be treated. After approximately 5 years of project operations, when tailings and grey water will also be included, the water will be managed within the Second Portage reclaim pond. At end of mine life, the reclaim pond water quality will require treatment to meet MMER criteria for arsenic, copper, nickel, zinc, and possibly nitrate and ammonia. The plant site will be modified to treat the water. Once the water has been treated, the reclaim pond will be filled with waste rock and will freeze. Although there may be a possible short-term increase in some metal concentrations in Third Portage Lake at closure, this is expected to be temporary.

### **Vegetation Cover**

About 703 ha of vegetation will need to be removed to construct the proposed mine, while 281 ha will need to be removed to construct the all-weather access road. Wherever and whenever possible, disturbed areas will be reclaimed, and restored to natural conditions. Dust may also fall on vegetation areas near construction sites, especially in downwind areas. Keeping the mine structures as close together as possible, controlling dust and emissions, and storing fuel safely will reduce impacts to vegetation.

## Wildlife



Potential effects to wildlife could include: avoiding the mine site and area because of noise and disturbance, loss of habitat, drinking water from mine water storage ponds, coming into contact with vehicles or planes, or eating vegetation covered by dust. The garbage area may also attract predators, such as a wolverine, if it is not properly burned.

Hawk and falcon nests have not been found in the Meadowbank area, probably due to the absence of cliffs. The mine will therefore not affect these species. Removing water from Second Portage, Third Portage, and Vault lakes may affect waterfowl because some feeding areas will be lost. Storage ponds with untreated water may be a problem if waterfowl rest on them.

Ways to avoid hurting or disturbing wildlife include: keeping the noise level as low as possible, enforcing speed limits, no hunting policies, giving animals the right-of-way on all roads, keeping dust down, safely storing fuel and explosives, raising the environmental awareness of all employees, keeping animals away from areas that may be harmful, burning all garbage, and not allowing hunting. During closure, tailings and waste rock piles will be capped and contoured to allow wildlife to move through the site.

To avoid animals that could create problems (e.g., wolverine), all garbage will be burned. Items with a strong scent that could attract animals will be stored in airtight containers. Small animals will not be fed. A safety education program will be given to all workers to teach them how to deal with bears and to avoid problems with wildlife in general.

Impacts to birds will be reduced by keeping noise down around nests, scaring away birds that land on the airstrip or reclaim ponds, creating

new habitats wherever possible, keeping water quality high in all lakes, and treating mine water before it is directed to clean lakes.

### **Fish Populations & Habitat**

During mine construction and operation, the removal of the one of three creeks between Third Portage Lake and Second Portage Lake may keep fish from moving between the lakes. As well, areas of Second Portage, Third Portage, and Vault lakes that are cut off by dikes to allow mining will temporally prevent fish from using these areas. Fish will be removed from these areas before they are drained. The area of Second Portage Lake where tailings will be stored will not be recovered for fish habitat. No fishing will be allowed by Meadowbank employees.

During the proposed construction and mining activities, important fish areas will be protected by silt curtains and dikes designed as fish habitat. Changing the creek between Third Portage and Second Portage lakes will also allow fish to move more easily between the lakes. After the mining is complete, the pits will be flooded. When the water quality is suitable, the dikes will be breached and the fish allowed to return to the newly created habitat.



It is anticipated that there will be more high value habitat for fish created than was removed because of mine development activities.

### **All-Weather Road**

A 115 km all-weather road is proposed to be constructed between Baker Lake and Meadowbank camp. This proposed road will cross about 19 streams using 5 bridges and 14 culverts. Only six of these streams are used by Arctic grayling as a migration route and/or for spawning. Almost all streams containing Arctic grayling will be crossed using bridges to ensure that any impact to the migratory fish populations are minimized.



One stream containing grayling will be crossed using a large culvert that will not prevent movement by grayling. It is not expected that use of the road by mine staff or local people will result in undue harvest pressure on lakes or rivers in the vicinity of the road, as these are currently all accessible by ATV or snowmachine during winter.

### Socioeconomic Conditions & Heritage Resources

The project will not change traditional activity or impact heritage resources in the Meadowbank area; however, because about 90 Baker Lake and Kivalliq region residents will have well-paying, full-time jobs, they may not be able to participate as regularly in traditional activities.



People with jobs at the mine will have more money to spend, and will need to manage it carefully.

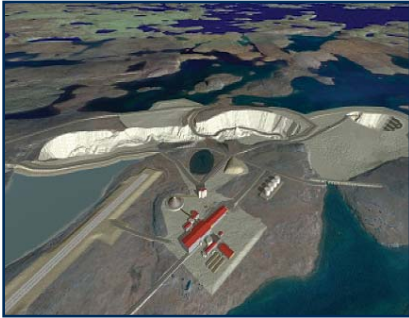
Rotational employment (two weeks working, followed by two weeks not working) is attractive because of the regular income from work and time off for traditional activities. Some families may have difficulties adjusting to the absence of a family member for two weeks at a time.



Mitigation and management of socioeconomic impacts will be determined by the Inuit Impact and Benefit Agreement (IIBA), which is being negotiated between Cumberland and the Kivalliq Inuit Association (KIA).

The main objectives of the IIBA will be to:

- Reduce the impacts and increase the benefits of the proposed project development
- Create opportunities for the people of Baker Lake specifically, and the Kivalliq Region generally, to participate in the project, thereby enhancing self-determination



- Establish Cumberland's role as an active member of the community and participant in the sustainable development of Baker Lake
- Maintain goodwill and good relations with the communities and their governments.

Sustainability criteria will be incorporated by emphasizing the need to enable local and territorial participation in employment and business opportunities, training, and partnerships with government and community.

## MONITORING

### Permafrost

Climate and weather information has been collected at Meadowbank since 1996 and will be collected during all phases of the project. Thermometers buried in the ground allow the temperature of the ground to be monitored. Other instruments will be used to determine whether the tailings and waste rock piles are freezing as predicted.

### Air Quality

Air quality will be monitored by assessing the concentration of particles and nitrogen oxides in the air near the mine and the quantity of particles that fall to the ground.



### Noise

Noise measurements will be taken at locations where noise levels are likely to be the highest.

### Surface Water Quantity

Monitoring of lake levels, lake outlet flows, and snow surveys will be continued during all phases of the project. The monitoring program will also continuously monitor runoff quantity from waste rock piles, tailings, mine facilities and roads, and lake levels when water is pumped from one lake to another.



### Water Quality

Water quality will be monitored in storage ponds on a regular basis so that it can be treated, if necessary. Water from the surrounding lakes will be monitored on a regular basis to evaluate the mitigation measures so that adaptive management strategies can be implemented if necessary. There are very strict regulations that must be followed to ensure that any water

discharged to the lakes is not harmful to aquatic life. Groundwater quality will also be monitored from wells located within the different types of rock.



## Vegetation & Wildlife

Vegetation and wildlife will be monitored by regularly surveying within the local and regional study areas, keeping wildlife logs, and conducting ongoing studies. The results of these studies will be compared to studies before the mine was built and to control areas far away from the mine. Cumberland will cooperate with other monitoring programs in the region. During construction and operations the health of wildlife will be monitored by sampling soil and vegetation (such as lichens) and comparing the results to samples taken before the mine development. A method called a Screening Level Risk Assessment will be used to determine whether there is a problem.

## Fish Populations, Habitat & the Aquatic Environment

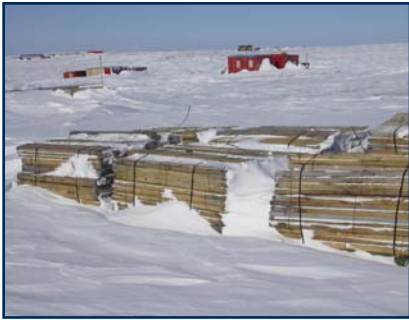
There are three monitoring programs for fish habitat and fish populations:

- The Aquatic Environment Management Plan (AEMP), which describes management plans for lakes and streams for all mine phases
- An Environmental Effects Monitoring Plan under the Metal Mining Effluent Regulations, as required by the government, which will monitor pollution levels and health of fish
- A No-Net-Loss Plan, which describes how aquatic habitat that is lost because of the mine will be created so that in the end, no habitat has been lost.

## Socioeconomic Conditions & Heritage Resources

Opportunities for business, employment, training, and education will be monitored, as will trends in community wellness. Monitoring of vegetation, water quality, and fish and wildlife health will ensure that fish, caribou, and other traditional foods are not affected by mining activities.





## RESIDUAL EFFECTS

Minor residual effects of the project (i.e., the effects that remain after all efforts to reduce impacts have been carried out) include:

- Change in water movement and surface area of Second Portage Lake because of the tailings deposits and Portage pit
- Local changes in small mammal, bird, and fish populations due to temporary habitat loss
- Increase in fish habitat at the mine site at closure (positive effect).

## CUMULATIVE EFFECTS

The Meadowbank project is not expected to cause any significant cumulative effects to valued ecosystem components within the Kivalliq region.

## CLOSURE & DECOMMISSIONING

Once the mine is closed, Cumberland will reclaim the disturbed areas so that erosion does not occur, and will contribute to the regrowth of vegetation and return of wildlife. Any rocks or other substances that could pollute the land or waters of the area will be stabilized or removed to avoid long-term impacts. The closure plan will be in accordance with industry accepted standards and practices.