Kiggavik Project
Final Environmental Impact Statement

Tier 3 Technical Appendix 5L:
Conceptual Fisheries Offsetting Plan

September 2014

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Abbreviations and Units

% ..... percent
AEMP ..... Aquatic Effects Monitoring Plan
AREVA ..... AREVA Resources Canada Inc.
BMP ..... Best Management Practice
CCME ..... Canadian Council of Ministers of the Environment
CFOP. ..... Fisheries Offsetting Plan
CRA ..... commercial, recreational and Aboriginal
CSP ..... corrugated steel pipe
CWQG ..... Canadian Water Quality Guidelines
DFO ..... Fisheries and Oceans Canada
e.g. ..... example
EEM ..... Environmental Effects Monitoring
EIS ..... Environmental Impact Statement
EMP ..... Environmental Management Plan
ERED ..... Environmental Effects Residue Database
FHCP ..... Fish Habitat Compensation Plan
FOP ..... Fisheries Offsetting Plan
ha ..... hectares
HTO ..... Hunters and Trappers Organization
i.e. ..... id est, in other words, that is
KIA ..... Kivaliq Inuit Association
Kiggavik Uranium Mine Project ..... Project
km ..... kilometre
kPa ..... kiloPascals
m ..... metre

m^2 .... square metres

m^3 .... cubic metres

m^3/s .... cubic metres per second

m^3/day .... cubic metres per day

mm^3 .... cubic millimetre

MMER .... Metal Mining Effluent Regulations

ms-LAA .... mine site Local Assessment Area

RO .... Reverse Osmosis

ROQ .... Run-of-Quarry

sa-LAA .... site access Local Assessment Area

SSWQO .... Saskatchewan Surface Water Quality Objectives

TMF .... Tailings Management Facility

TSS .... Total Suspended Solids

UV .... ultraviolet

WTP .... Water Treatment Plant

Glossary

Acceptable levels	A level deemed acceptable based on its being maintained within or below a pre-determined or pre-approved range of objectives, standards or guidelines.
Best management practice (BMP)	A standard management method for maintaining a level of quality that exceeds mandatory legislated standards; best management practices can be based on self-assessment or used as a benchmark.
Contingency plan	A contingency plan is a plan devised for an outcome other than the usual (expected) plan.
Critical habitat	Critical habitat is vital to the survival or recovery of fish species. The habitat may be an identified spawning site, nursery area or foraging area.
Decommissioning	Withdraw from service.
Dewater	To remove water from; drain.
Duration (of effect)	Length of time over which the effect is measureable.
Dyke	A wall built to prevent water from covering an area.
Effluent	Treated wastewater from the mine, mill, tailings, treatment ponds, seepage and surface drainage, discharged to surface waters after treatment to acceptable standards at the wastewater treatment plant.
Erosion	The process of weathering or wearing away of streambanks and adjacent land slopes by water, ice, wind or other factors. Removal of rock and soil from the land surface by a variety of processes including gravitational stress, mass wasting or movement in a medium.
Fishery	Includes the area, locality, place or station in or on which a pound, seine, net, weir or other fishing gear or equipment is used, set, placed or located, the area, tract or stretch of water in or from which fish may be taken by the pound, seine, net, weir or other fishing gear or equipment, and the pound, seine, net, weir or other fishing gear or equipment used in connection therewith.
Forage fish	Small-bodied fish species, as well as small (i.e., young) large-bodied or sportfish species, that are preyed on by larger predatory fishes.
Foraging	Searching for food resources.
Freshet	Refers to the increase in stream flows or lake levels that occurs in spring as a result of melting snow and ice.
Monitoring	Monitoring completed to confirm that proposed project design features, mitigation measures, environmental protection measures, or benefit agreements are being implemented as proposed and in accordance with regulatory requirements. Monitoring of the biophysical and socio-economic environment that is completed to verify predictions of environmental effects; determine effectiveness of mitigation and other environmental protection measures; support environmental management systems, and support implementation of adaptive management measures to address unforeseen environmental effects.

Negligible	Refers to an effect or a change from baseline that is not measureable or detectable.
Potable	Safe to drink; drinkable.
Permafrost	Refers to soil or rock that remains below zero degrees Celcius (°C) for at least two years at a time; in continuous permafrost regions, over 90 percent (%) of the ground surface is underlain by permafrost.
Productivity	The rate of production of new biomass by an individual, population, or community; the fertility or capacity of a given habitat or area.
Rearing	Take care of and support up to maturity
Riparian	Banks on waterbodies where sufficient soil moisture supports the growth of vegetation that requires a moderate amount of moisture.
Serious harm	Under Section 35 of the federal *Fisheries Act*, serious harm refers to 'the death of fish or any permanent alteration to, or destruction of, fish habitat".
Sediment	Solid fragments of inorganic or organic material that come from the weathering of rock and are carried and deposited by wind, water, or ice and settle to the bottom of a waterbody,
Substrate	In underwater environments, it is the surficial layer of material on/in which organisms may live, grow or feed.
Sustainability	Highest rate at which a renewable resource can be used without reducing its supply.
Total suspended solids (TSS)	Particles in water which will not pass through a 1.5 µm pore filter paper.
Turbidity	Refers to the cloudiness or haziness of a fluid caused by individual particles (total suspended or dissolved solids) that may be invisible to the naked eye.
Turbidity curtain	A floating geotextile barrier positioned in a lake or stream to minimize sediment transport from an active work area to an undisturbed area of the waterbody.
Toxicity	The magnitude of harmful effects observed in organisms related to poisoning from the alteration of natural environmental conditions.
Waterbody	A general term that refers to ponds, bays, lakes, estuaries and marine areas.
Watercourse	A general term that refers to riverine systems such as creeks, brooks, streams and rivers.
Watershed	The area of land bounded by topographic features that drains water to a larger waterbody such as a river, wetlands or lake. Watersheds can range in size from a few hectares to thousands of kilometres.
Water quality	Chemical, physical and biological characteristics of water.

1 Introduction

The Kiggavik Uranium Mine Project (the Project) is a proposed uranium ore mining and milling operation located approximately 80 kilometres (km) west of the community of Baker Lake in the Kivalliq region of Nunavut. The Project is operated by AREVA Resources Canada Inc. (AREVA), in joint venture partnership with JCU (Canada) Exploration Co., Ltd. and Daewoo International Corp. It is estimated that the Project will produce up to 4,000 tonnes of uranium ore concentrate (i.e., yellowcake) per year over its production lifetime.

Three main geographical areas are included in the Kiggavik Project; these are the Kiggavik site, the Sissons site, and the Baker Lake dock site. A Winter Road, with an option to develop an All-Season Road, will connect the Kiggavik mine site with the Baker Lake dock site. The Kiggavik site will be the main base of operations; site activities and facilities will include open pit mining, power generation, ore processing, warehouse facilities, administration, and employee accommodations. A barge dock and supply storage facility will be constructed on the north shore of Baker Lake and will serve as a transfer and storage site. Proposed activities at the Sissons site include open pit mining, underground mining, and the ancillary activities required to support these mining operations.

1.1 Fisheries Act (2012)

On June 29, 2012, amendments to the federal *Fisheries Act* received Royal Assent. On November 25, 2013, new Fisheries Protection Provisions included in the amended *Act* came into force. The purpose of the Fisheries Protection Provisions included in the *Fisheries Act (2012)* is to maintain or enhance the sustainability and ongoing productivity of commercial, recreational and Aboriginal (CRA) fisheries. The prohibition under Section 35 (1) of the *Fisheries Act (2012)* states that “No person shall carry on any work, undertaking, or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery.” This prohibition replaces previous prohibitions against killing fish by means other than fishing (Section 32, *Fisheries Act* 1985) and the harmful alteration, disruption or destruction of fish habitat (Section 35, *Fisheries Act* 1985), such that “serious harm to fish” includes the killing of fish and the permanent alteration or destruction of habitats that are part of, or support, a CRA fishery.

New regulatory tools have been included in the *Act* to streamline project reviews and modernize the regulations. These tools include listings of information proponents must provide to Fisheries and Oceans Canada (DFO) when requesting an Authorization, as well as prescriptive timelines for issuance of an Authorization. Under the *Fisheries Act (2012),* DFO scientists are required to consider public interest, fisheries management objectives, mitigation measures or standards that may be available to avoid, minimize, or offset harm to fish; and whether fish are relevant to the ongoing productivity of a fishery prior to issuing an Authorization.

Prior to issuance of a *Fisheries Act (2012)* Authorization, the Minister will consider the avoidance and mitigation measures proposed by the Proponent for the protection of fish and fish habitat that are part of, or support, a CRA fishery. Measures that enable the Proponent to effectively avoid serious harm to fish are considered as a first step in the Hierarchy of Measures for Fisheries Protection. Where it is not possible to avoid serious harm to fish, the next step in the Hierarchy of controls would be to implement mitigation measures intended to minimize serious harm to fish that could result from Project components or activities. Any potential serious harm that cannot be addressed through avoidance or mitigation measures must be controlled through offsetting.

Under the Fisheries Protection Provisions of the *Act*, proponents of projects that cause serious harm to fish are required to offset that harm to maintain and enhance the productivity of the fishery. This is one of the primary Measures of Fisheries Protection for maintaining or enhancing the ongoing productivity and sustainability of CRA fisheries.

Project proponents are responsible to make the necessary investments to protect CRA fisheries and to offset any residual impacts that may result from their project. Outcomes of the offsetting measures must support local and territorial fisheries management objectives and restoration priorities by counter-balancing adverse project impacts. Benefits to the fishery must be realized over the long-term, and must be self-sustaining.

To align the Kiggavik Project with the new Fisheries Protection Provisions and the *Fisheries Act (2012)*, a Conceptual Fisheries Offsetting Plan (CFOP) was developed for the Kiggavik Project and is presented in this Tier 3 Technical Appendix.

1.2 Objectives and Approach

A draft Conceptual Fish Habitat Compensation Plan (FHCP) was prepared for the Project for inclusion in the December 2011 draft Environmental Impact Statement (EIS) (Tier 3, Technical Appendix 5L). The draft FHCP was prepared and submitted prior to the federal Fisheries Protection Provisions receiving royal assent on November 25, 2013.

To align the Project with the Fisheries Protection Provisions and the current *Fisheries Act (2012)*, the content of the FHCP has been revised from the draft EIS (December 2011) to the final EIS (this version, September 2014). The CFOP provided in this Tier 3 Appendix replaces the draft FHCP and reflects the current regulatory framework.

Under the Fisheries Protection Provisions, any work, undertaking, or activity that results in the death of fish or the permanent alteration or destruction of fish habitat is considered to be a source of serious harm to fish (Government of Canada 2012a, internet site). To the greatest extent possible, Project components and activities are designed to avoid and/or mitigate serious harm to fish. This approach is expected to minimize Project effects to fish and fish habitat, often to the point of residual effects being negligible or un-measurable. However, some Project activities or components may result in residual serious harm to fish that are part of, or support, CRA fisheries. In these cases, offsetting activities are proposed to offset residual serious harm to fish and maintain or enhance the productivity of local CRA fisheries.

This CFOP has been prepared in anticipation of additional consultation with DFO to address anticipated potential residual serious harm to fish that may result from the Project, despite the implementation of avoidance and mitigation measures. This CFOP must be finalized and approved by DFO before an Authorization to proceed can be issued.

The objectives of this CFOP are to:

- describe Project components and activities that could result in serious harm to fish;
- describe avoidance and mitigation measures that will be implemented to minimize serious harm to fish;
- quantify the residual serious harm to fish that is expected to result from the Project, despite the implementation of avoidance and mitigation measures;
- describe proposed offsetting for any predicted residual serious harm to fish that could not be avoided or mitigated;
- describe how the selected offsetting activities are anticipated to maintain or improve the productivity of CRA fisheries in the Project area;
- describe plans to monitor offsetting activities and assess effectiveness of the proposed offsetting work(s); and
- present contingency offsetting options that may be implemented should monitoring show that avoidance and mitigation measures are not entirely successful or when unanticipated residual serious effects are documented.

Pathways of Effects diagrams (DFO 2010a internet site; and included as Attachment A) for land-based and in-water activities are used in the CFOP to identify connections between Project components and activities (i.e., the stressors) and potential effects to the aquatic environment. These Pathways of Effects are used to assess the proposed avoidance and mitigation measures for the Project and determine whether these measures are anticipated to be sufficient to eliminate effects to the aquatic environment (i.e., “break” the connection or pathway) or reduce effects to an acceptable level (e.g., sediment concentrations within 10% of baseline values).

The CFOP was also developed based on guidance provided in the Fisheries Productivity Investment Policy. Guidance under the Policy is intended to assist Proponents in developing and implementing effective measures to offset residual serious harm to fish. The policy plans include prescribed procedures for developing an effective offsetting plan that is aligned with DFO's Fisheries Protection Provisions. Procedures for selecting the appropriate type and scale of offsetting measures, as well as identifying suitable monitoring and reporting targets are also considered in this CFOP.

Following approval of the finalized Fisheries Offsetting Plan (FOP) and subsequent implementation of offsetting work(s) proposed therein, no additional residual serious harm to fish and fish habitat that are part of, or support, a CRA fishery is anticipated. All unavoidable or non-mitigable serious harm to fish resulting from development of the Kiggavik Project will be fully offset.

1.3 Public Engagement

Prior to the Fisheries Protection Provisions coming into force on November 25, 2013, a draft conceptual (FHCP) was prepared and its contents discussed during Inuit consultation. The objective was to identify potential compensation (now offsetting) options and evaluate the acceptability of proposed works described in the FHCP. The contents of the FHCP were discussed with the Kivalliq Inuit Association (KIA) during an Information Request meeting held on January 16, 2013 in Winnipeg, Manitoba. Fish Habitat Compensation was discussed at a high level with the Baker Lake Hunters' and Trappers' Organization on October 27, 2010 (Tier 2, Volume 3, Public Engagement and Inuit Quajimajatuqangit, Part 1, Public Engagement, Table 3.4-3). An aquatic environment posterboard outlining AREVA's commitment to compensate (now offset) for any lost or altered fish habitat was presented during AREVA's 2012 Kiggavik Project Open House tour. This tour was held in seven Kivalliq communities.

Because the FHCP is replaced by the CFOP under the *Fisheries Act (2012)* provisions, further consultation activities focused on the works proposed in the CFOP. Community input for the CFOP was obtained from community members in Baker Lake. A presentation on Fisheries Offsetting was given to the Baker Lake Hunters and Trappers Organization (HTO) on April 24, 2014, and a questionnaire in English and Inuktituk left with the HTO (Attachment B). On June 23, 2014, a group of eight Baker Lake residents who fish regularly was invited to a discussion group meeting at the AREVA Baker Lake office. On the same date, fisheries offsetting was discussed at a Community Liaison Committee meeting. Discussions were based on questions presented in the fisheries offsetting questionnaire that had been previously distributed.

No feedback has been received from the Baker Lake HTO to date, however a total of 12 people participated in the June 23, 2014 discussions, including HTO Board members and community Elders. From this discussion, suggested opportunities for potential offsetting in the general Baker Lake area included removing natural stream blockages to upstream fish migration, removal of in-stream obstructions resulting in stranding of downstream migrants, erosion control at a number of sites where natural erosion is causing turbid water, and removal of garbage and debris from a number of local waterbodies. Locations of potential offsetting opportunities were identified on maps (in Attachment B).

1.4 General Site Description

The Project is located within the physiographic region of the Canadian Shield; the land contains features formed by glaciation, including eskers and boulder moraines (Environment Canada [EC] 2009, internet site). The topography is gently undulating, and is filled with hummocks and patterned ground resulting from permafrost. Vertical drainage is impeded by the permafrost layer, and wetlands, small ponds, and lakes are common over the landscape. The Project is located in the Southern Arctic terrestrial ecozone, which is characterized by continuous permafrost that may be present just a few centimetres (cm) below the surface (EIS Volume 6, Appendix 6A; EC 2009, internet site). Low levels of precipitation and extremely low winter temperatures prevent tree growth in this ecozone (National Resources Canada [NRCAN] 2009, internet site). Summers in the Southern Arctic Ecozone are cool and approximately four months in duration. This ecozone is bounded to the south by the treeline and the Taiga Shield Ecozone and to the north by the Northern Arctic Ecozone, which includes most of the islands off the northern shores of Nunavut and the Northwest Territories, as well as the northern-most portion of the Ungava Peninsula. Common types of vegetation found in the Project area include low-lying shrubs such as willow (*Salix* sp.), shrub birch (*Betula glandulosa*) and Labrador tea (*Rhododendron* sp.), as well as lichens and mosses (EC 2009, internet site; EIS Tier 2, Volume 6).

Climate and permafrost play an important role in the hydrological regime of this area. Peak stream flows in this region are a result of spring melt, which can account for the majority of the volume of total annual runoff. Throughout the summer and fall, the active layer of permafrost increases, thereby increasing the amount of storage available within the ground. Secondary peaks on the annual hydrograph are common in late summer or early fall due to late summer precipitation. Stream flow generally ceases during the winter months. Streams in the Project area are characterized as nutrient-poor and having low ionic strength, neutral to alkaline pH, and very soft water hardness (McNeely et al. 1979).

Baker Lake is the largest lake in the Project area (189,000 hectares [ha]). Judge Sissons Lake is another large lake, with a maximum depth of 20 metres (m) and a surface area of 9,550 ha. Most other lakes in the Project area are relatively shallow and may freeze to the bottom in winter. Ice cover on area lakes generally lasts from October through June; mean maximum ice thicknesses may reach approximately 2 m. Lake levels and volumes peak during spring freshet in mid-June, then decline over the course of the open-water season. Lakes in the Project area are characterized as nutrient-poor and having low ionic strength, neutral to alkaline pH, and very soft to soft water hardness (McNeely et al. 1979).

1.4.1 Fish and Habitat

Baseline conditions for fish habitat in the Kiggavik Project area are described in detail in the Aquatics Baseline (Tier 3, Technical Appendix 5C and Attachment 5C-1), Section 10.0 of the EIS (Aquatic Organisms and Fish Habitat) and the Existing Environment Section of Tier 2, Volume 5. A summary of baseline fish and fish habitat data is provided below.

Most lakes and ponds in the Project area are shallow and freeze to the bottom during winter, which means they would only provide seasonal foraging and rearing habitat for fish. Waterbodies less than 2 m deep generally freeze to the bottom during winter and, as a result, fail to provide suitable over-wintering habitat for fish. A substantial portion of the volume of larger lakes (lakes >2 m depth) is also frozen by the end of winter. Overwintering habitat for fish is found in a few deeper lakes (i.e., Baker, Cigar, Cirque, Judge Sissons, Mushroom, Ridge, and Siamese lakes, as well as Pointer Pond) (Figure 1.3.1, EIS Volume 5, Appendix 5C). It is uncertain whether lakes having maximum depths between 2 and 3 m deep (i.e., Caribou, Crash, Fox, Pointer, and Willow lakes) support over-wintering fish.

By late winter all streams and rivers in the Project area, with the exception of the Thelon River, are thought to freeze to the bottom. Smaller streams that freeze all the way to the bottom begin to flow over the anchor ice when the spring melt begins. During spring, many of the larger stream systems in the area (i.e., within the sub-basins of the Willow, Lower and Caribou lakes) support Arctic grayling (*Thymallus arcticus*) spawning runs, as well as other fish species that move into the streams during the open water period to forage or escape predatory fish in the over-wintering lakes (EIS Volume 5, Appendix 5C, Section 11.2.2). The diversity of fish species in streams tends to be highest close to over-wintering lakes and decreases in a gradient up the watershed, unless a deep, over-wintering lake exists in the headwaters of a stream system.

Fish species reported in the mine site Local Assessment Area (ms-LAA) for the Project include Arctic grayling, burbot (*Lota lota*), cisco (*Coregonus artedi*), lake trout (*Salvelinus namaycush*), ninespine stickleback (*Pungitius pungitius*), round whitefish (*Prosopium cylindraceum*), and slimy sculpin (*Cottus cognatus*) (McLeod et al. 1976; BEAK Consultants Ltd. [BEAK] 1987, 1990, 1992a,b; Technical Appendix 5C). Four additional species are reported in Baker Lake (EN-BL CLC 2008[1]). These include Arctic char (*Salvelinus alpinus*), fourhorn sculpin (*Myoxocephalus quadricornis*), lake whitefish (*Coregonus clupeaformis*), and longnose sucker (*Catostomus catostomus*). None of the species in the Project area are listed under Schedule 1 of the *Species at Risk Act* or considered

[1]EN-BL CLC 2008 *….In Baker Lake we have white fish, graylings, lake Trout, char, and others (sucker fish)…..*

threatened or endangered by the Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2012b). Fish species identified in waterbodies and watercourses in the Kiggavik Project LAA are summarized in Table 1-1.

Table 1.4-1 Distributions of Fish Species Reported in the Kiggavik Project Area

Watershed	Sub-Basin	Waterbody	Information Source	Fish Observed/Captured
Aniguq River	Willow Lake	Meadow Lake	BEAK 1990	none
		Felsenmeer Lake	BEAK 1987, 1990, 1992ab	Arctic grayling; lake trout; round whitefish
		Escarpment Lake	BEAK 1987, 1990, 1992ab	Arctic grayling; lake trout; round whitefish
		Drum Lake	BEAK 1987, 1990, 1992b	Arctic grayling
		Lin Lake	BEAK 1987, 1990, 1992ab	Arctic grayling
		Scotch Lake	BEAK 1987, 1990, 1992ab	lake trout; ninespine stickleback; round whitefish; slimy sculpin
		Jaegar Lake	BEAK 1987, 1990, 1992ab	Arctic grayling
		Pointer Pond	EIS Volume 5, Appendix 5C	no fish observed or captured in pond; slimy sculpin captured in the stream immediately upstream
		Pointer Lake	BEAK 1987, 1990, 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling; cisco; lake trout; ninespine stickleback[a]
		Sik Sik Lake	EIS Volume 5, Appendix 5C	ninespine stickleback
		Rock Lake	BEAK 1990; EIS Volume 5, Appendix 5C	Arctic grayling; lake trout
		Willow Lake	BEAK 1987, 1990, 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling; lake trout; ninespine stickleback
	Lower Lake	Mushroom Lake	BEAK 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling; cisco; lake trout; round whitefish
		Pond 1	EIS Volume 5, Appendix 5C	no fish observed or captured
		Pond 2	EIS Volume 5, Appendix 5C	no fish observed or captured
		Pond 3	EIS Volume 5, Appendix 5C	no fish observed or captured
		Pond 4	EIS Volume 5, Appendix 5C	no fish observed or captured
		Pond 5	EIS Volume 5, Appendix 5C	no fish observed or captured
		Pond 6	EIS Volume 5, Appendix 5C	no fish observed or captured
		Pond 7	EIS Volume 5, Appendix 5C	no fish observed or captured
		Pond 8	EIS Volume 5, Appendix 5C	no fish observed or captured

Table 1.4-1 Distributions of Fish Species Reported in the Kiggavik Project Area

Watershed	Sub-Basin	Waterbody	Information Source	Fish Observed/Captured
		End Grid Lake	EIS Volume 5, Appendix 5C	Arctic grayling
		Smoke Lake	BEAK 1992ab	Arctic grayling; cisco
		Cigar Lake	BEAK 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling; burbot; cisco; lake trout; round whitefish
		Knee Lake	BEAK 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling
		Lunch Lake	BEAK 1992a	Arctic grayling; lake trout; round whitefish
		Andrew Lake	BEAK 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling; burbot; cisco; round whitefish
		Shack Lake	BEAK 1992ab; 2008	Arctic grayling
		Bear Island Lake	BEAK 1992ab	Arctic grayling
		Lower Lake	BEAK 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling; burbot; cisco; ninespine stickleback; round whitefish
	Caribou Lake	Ridge Lake	BEAK 1987, 1990, 1992ab; EIS Volume 5, Appendix 5C	lake trout
		Cirque Lake	BEAK 1987, 1990, 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling; ninespine stickleback
		Crash Lake	BEAK 1987, 1990, 1992b; EIS Volume 5, Appendix 5C	Arctic grayling
		Fox Lake	BEAK 1987, 1990; EIS Volume 5, Appendix 5C	Arctic grayling; cisco; lake trout; ninespine stickleback
		Caribou Lake	BEAK 1987, 1990, 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling; burbot; cisco; lake trout; ninespine stickleback; round whitefish
		Calf Lake	EIS Volume 5, Appendix 5C	burbot; cisco; ninespine stickleback
		Sleek Lake	Traditional Land Use Study	assumed to contain lake trout or other domestically/traditionally valuable species
	Judge Sissons Lake	Judge Sissons Lake	BEAK 1987, 1990, 1992ab; EIS Volume 5, Appendix 5C	Arctic grayling; burbot; cisco; lake trout; ninespine stickleback; round whitefish; slimy sculpin
	Siamese Lake	Siamese Lake	EIS Volume 5, Appendix 5C	lake trout
	Skinny Lake	Skinny Lake	BEAK 1987, 1990, 1992ab	Arctic grayling; cisco; lake trout; round whitefish

Table 1.4-1 Distributions of Fish Species Reported in the Kiggavik Project Area

Watershed	Sub-Basin	Waterbody	Information Source	Fish Observed/Captured
	Kavisilik Lake	Kavisilik Lake	BEAK 1987, 1990, 1992ab	Arctic grayling; cisco; lake trout; round whitefish
Thelon River	Squiggly Lake	Squiggly Lake	BEAK 1987, 1990, 1992ab	Arctic char; Arctic grayling; burbot; cisco; lake trout; round whitefish
Baker Lake	Baker Lake	Baker Lake	McLeod et al. 1976; EN-BL CLC Sept 2008; EIS Volume 5, Appendix 5C	Arctic char; Arctic grayling; burbot; fourhorn sculpin; cisco; lake trout; lake whitefish; longnose sucker; ninespine stickleback; round whitefish; slimy sculpin

SOURCE: Modified from Tier 2, Volume 5, Table 5.3-1. For Project baseline (2007, 2008, 2009, 2010 and 2013) information collected by Golder and Nunami Stantec, please refer to Volume 5, Appendix 5C and Attachment 5C-1.

[a] Inuit Qaujumajatuqangit indicates that fish are no longer found in Pointer Lake (IQ-BL02).

[b] Based on its identification as a traditional fishing area in the IQ.

BEAK = BEAK Consultant's Limited; Arctic grayling = *Thymallus arcticus*; lake trout = *Salvelinus namaycush*; round whitefish = *Prosopium cylindraceum*; ninespine stickleback = *Pungitius pungitius*; slimy sculpin = *Cottus cognatus*; cisco = *Coregonus artedi*; burbot = *Lota lota*; Arctic char = *Salvelinus alpinus*; EN = engagement; BL CLC = Baker Lake Community Liaison Committee; fourhorn sculpin = *Myoxocephalus quadricornis*; lake whitefish = *Coregonus clupeaformis*; longnose sucker = *Catostomus catostomus*.

Sections of cascades on the Aniguq River appear to be effective barriers to Arctic char and other fish that may attempt to move upstream from Baker Lake. Arctic char were not captured in any lakes or rivers in the upper Aniguq watershed near the proposed mine site LAA. Judge Sissons Lake and its contributing watersheds are therefore unlikely to support populations of Arctic char.

Arctic grayling were the most widely distributed species in lakes and streams in the Project area (Tier 2, Volume 5), despite streams and shallow lakes freezing to the bottom during winter. They likely overwinter in deeper lakes (i.e., Pointer, Mushroom, Cigar, Cirque, Caribou, Fox and Judge Sissons lakes) and migrate into tributaries in spring to spawn. Spawning was confirmed in four streams of the Willow Lake and Lower Lake sub-basins. Shallow lakes that freeze to the bottom are re-colonized in spring by individuals that migrate in from deeper lakes. Cirque Lake, near the headwaters of the Caribou Lake sub-basin, may support an isolated Arctic grayling population; obstructions in the outlet stream channel prevent upstream movement of fish into the lake.

Burbot were found in sub-basins of Lower, Caribou, Judge Sissons, Squiggly, and Baker lakes, and in two streams in the Willow Lake and Aniguq River sub-basins. Burbot are able to move freely between Pointer, Judge Sissons, Cigar and Caribou lakes (Tier 2, Volume 5). Spawning and overwintering habitat may be limited to these four lakes; rearing and foraging habitats are abundant in accessible lakes and streams.

Cisco were found in the sub-basins of the Willow, Lower, Caribou, Judge Sissons, Skinny, Kavisilik, and Baker lakes, and in two streams in the Willow Lake and Thelon River sub-basins. Cisco can move freely between Pointer, Judge Sissons, Cigar and Fox lakes. Spawning and overwintering habitats occur in Pointer, Cigar, Mushroom, Fox, Caribou, and Judge Sissons lakes; rearing and feeding habitats are present in all lakes and streams accessible to cisco (Tier 2, Volume 5).

Fourhorn sculpin are reported in Baker Lake (McLeod et al. 1976). No fourhorn sculpin were captured during recent fish sampling. Spawning, overwintering, rearing, and feeding activities are expected to occur within Baker Lake.

Lake trout were found in the sub-basins of the Willow, Lower, Caribou, Judge Sissons, Siamese, Skinny, Kavisilik, Squiggly, and Baker lakes, as well as streams throughout the Willow Lake, Lower Lake, Caribou Lake, Aniguq River, and Thelon River sub-basins.

Lake trout are anticipated to overwinter in Mushroom, Cigar, Ridge, Judge Sissons, Siamese, Skinny, Kavisilik, Squiggly, and Baker lakes. Potential overwintering habitat may be available in the deeper portions of Pointer, Fox, and Caribou lakes, but the absence of lake trout during the fall spawning surveys suggests that lake trout are transient residents. Use of these lakes by spawning lake trout is unlikely. Lake trout spawning was confirmed in Mushroom, Cigar, Ridge, Judge Sissons, and Siamese lakes. During the open water period, lake trout may remain in deeper, over-wintering lakes or move into shallower tributaries and lakes to feed. Sik Sik Lake is likely inaccessible to lake trout.

Lake whitefish were not captured in any lakes or rivers in the upper Aniguq River watershed; however, they are known to occur in Baker Lake. Spawning, overwintering, rearing, and feeding activities are expected to occur in Baker Lake.

Longnose suckers were not captured in any lakes or rivers in the upper Aniguq River watershed. However, they have been caught in the Thelon River and Baker Lake. Spawning, overwintering, rearing, and feeding habitats are expected to occur in both the Thelon River and Baker Lake.

Ninespine stickleback were distributed throughout the sub-basins of the Willow, Lower, Caribou, Judge Sissons, and Baker lakes, and in streams of the Willow Lake, Lower Lake, Aniguq River, and Thelon River sub-basins. Ninespine stickleback likely overwinter in Pointer, Cirque, Fox, Caribou, Judge Sissons, and Baker lakes.

Round whitefish were found in the sub-basins of the Willow, Lower, Caribou, Judge Sissons, Skinny, Kavisilik, Squiggly, and Baker lakes, and in streams of the Willow Lake and Thelon River sub-basins. Round whitefish likely overwinter in larger lakes and rivers.

During the open water season, slimy sculpin are found in lakes of the Willow, Lower, Judge Sissons, and Baker sub-basins, and in streams of the Willow Lake, Aniguq River, and Thelon River sub-basins. Slimy sculpin overwinter in large lakes and rivers, and may rear, feed, and spawn at these locations; some migration into tributaries may also occur.

1.4.2 Area Fisheries

Results of community engagement discussions and Inuit Qaujimajatuqangit (IQ) interviews generally indicate that fisheries activities in the Project area are limited; however, some Elders indicated that all small lakes within the Project region were used for fishing (IQ-BL16 2008[2]). Important fishing areas are generally located north of the proposed Project site, namely on Shultz Lake (EN-BL OH Nov 2010[3]), Tehek and Whitehills lakes (IQ-Riewe 1992[4]), and near the Qamanaajuk Lakes. Quglungnilinaaq Lake, Pitz Lake, the Qamanaujaq Lakes, Iqalulik Lake, Maguse Lake (IQ-ARVJ 2011[5]) and the northwest arm of Tunuhuk Lake are located southeast of the Project site and have been identified as traditional fishing areas (Tier 2, Volume 3, Part 2 and Tier 3, Technical Appendix 3B). Domestic or traditional (i.e., Aboriginal) fishing and recreational fishing also occur on Aberdeen Lake, which is located west of the Kiggivik Project area (Figure 1-1 and 1-2).

The Traditional Land Use study conducted as part of the environmental assessment baseline indicated that portions of Judge Sissons Lake, Caribou Lake, Sleek Lake and Siamese Lake are considered traditional fishing areas (Figure 1-1). A listing of the waterbodies within the ms-LAA, as well as their status' as traditional fishing areas is provided in Table 1-2. Waterbodies that support, or are likely to support, a CRA fishery are identified accordingly in the table.

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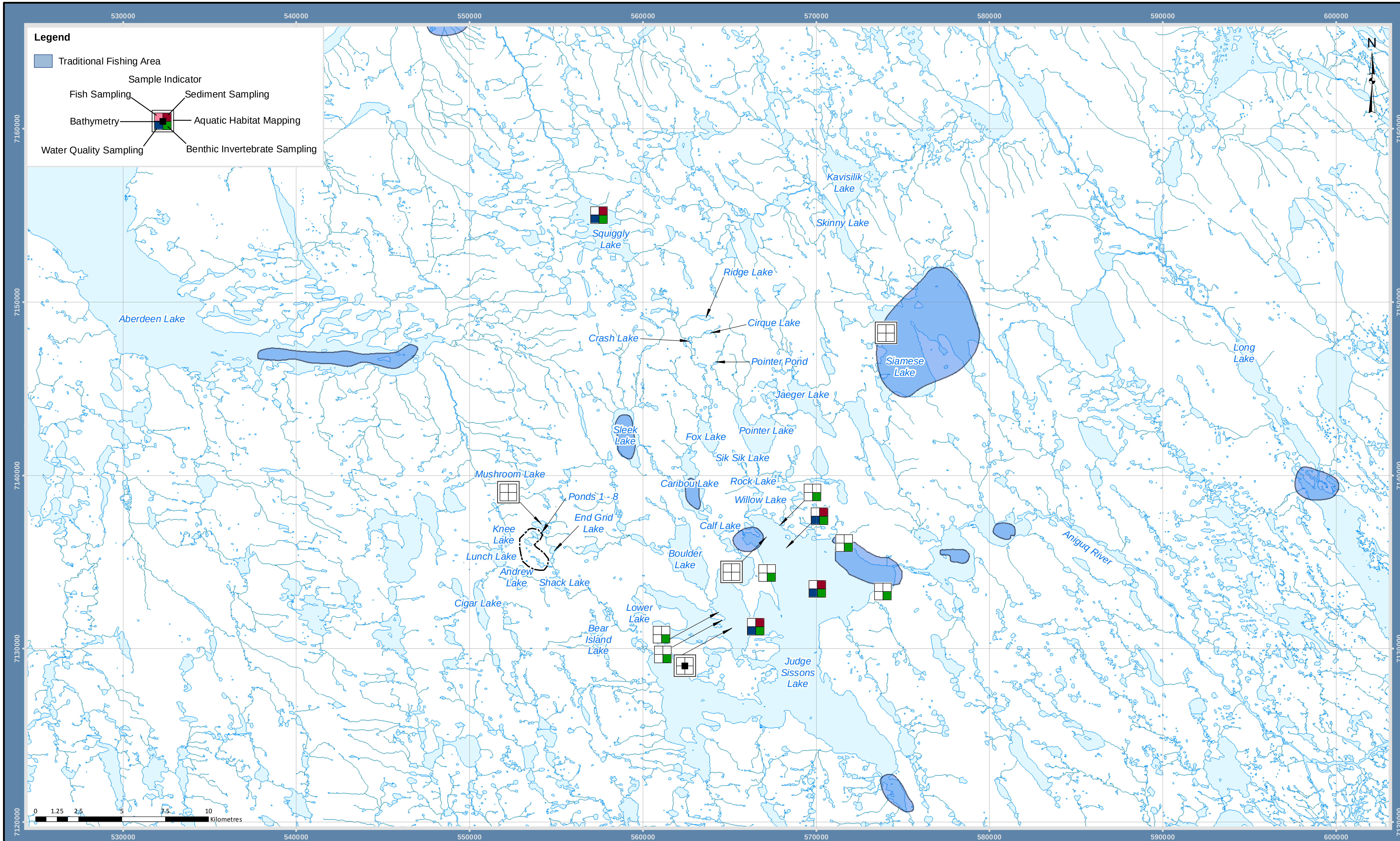
[2] IQ-BL16 2008: The west shore of Baker Lake and Judge Sissons Lake were identified as fishing areas, as well as numerous fishing lakes in the Baker Lake region including areas close the Project lease area, such as Siamese Lake and the east shore of Aberdeen Lake.

[3] EN-BL OH Nov 2010: 1) Fishing west end of Schultz Lake. Travels all round . Herds by Manitoba. Travels north of NAWR to Schultz and further north is fishing.

[4] IQ-Riewe 1992: Fishing at the southeast end of Tehek Lake and Whitehills Lake often provided food during hunting and trapping trips.

[5] The participants identified Mageuse Lake

as an important fishing lake.



Projection: NAD 1983 UTM Zone 14N
Creator: LMR
Date: 27/08/2014 Scale: 1:200,000
File: KI08C397
Data Sources: *NTS Mapsheet 66A 02; AREVA Resources Canada Inc. Hattie Mannik and the Baker Lake Elder's Focus Group Baker Lake HTO, Baker Lake Hunter Focus Group*

FIGURE 1-1
AQUATIC BASELINE LAKE SAMPLING
2013

KIGGAVIK PROJECT - CONCEPTUAL FISHERIES OFFSETTING PLAN

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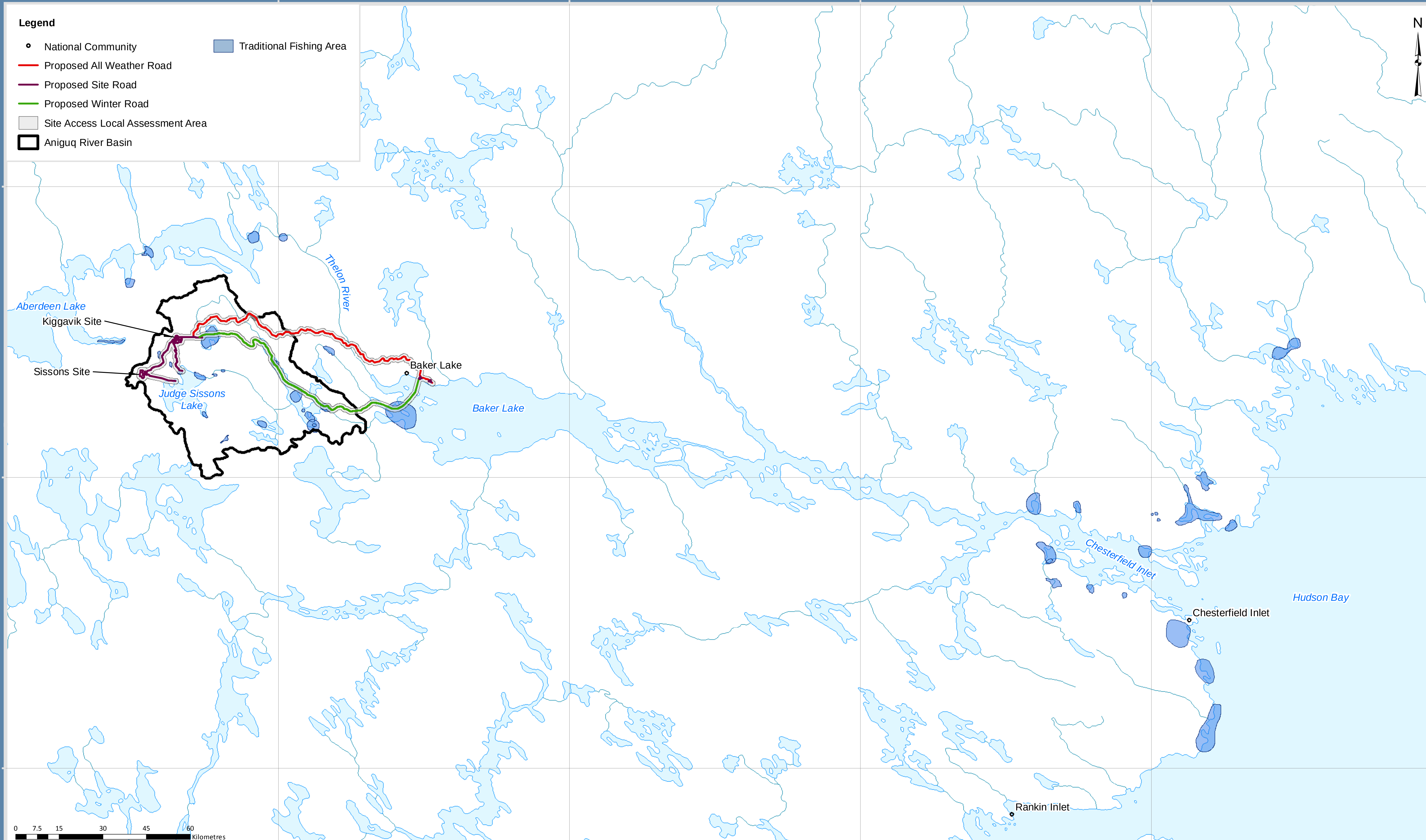

Projection: NAD 1983 UTM Zone 14N
Creator: LMR
Date: 27/08/2014 Scale: 1:1,250,000
File: KI08C396
Data Sources: *NTS Mapsheet 55 O/P, AREVA Resources Canada Inc.*
ET/RT/AT/LP/HA/JK/TA/JI/PA/LM
Hattie Mannik and the Baker Lake Elder's Focus Group
Baker Lake HTO, Baker Lake Hunter Focus Group

FIGURE 1-2
MINE SITE AND SITE ACCESS LOCAL ASSESSMENT AREAS
WITH TRADITIONAL KNOWLEDGE OF FISHING AREAS

KIGGAVIK PROJECT - CONCEPTUAL FISHERIES OFFSETTING PLAN

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Table 1.4-2 Fishing Activities Reported in the Kiggavik Project Area

Watershed	Sub-Basin	Waterbody	Sources	Status	CRA
Aniguq River	Willow Lake	Meadow Lake	-	No fishing activities reported	No
		Felsenmeer Lake	-	No fishing activities reported	No
		Escarpment Lake	-	No fishing activities reported	No
		Drum Lake	-	No fishing activities reported	No
		Lin Lake	-	No fishing activities reported	No
		Scotch Lake	-	No fishing activities reported	No
		Jaegar Lake	-	No fishing activities reported	No
		Pointer Pond	-	No fishing activities reported	No
		Pointer Lake	-	No fishing activities reported	No
		Sik Sik Lake	-	No fishing activities reported	No
		Rock Lake	-	No fishing activities reported	No
		Willow Lake	-	No fishing activities reported	No
	Lower Lake	Mushroom Lake	-	No fishing activities reported	No
		Pond 1	-	No fishing activities reported	No
		Pond 2	-	No fishing activities reported	No
		Pond 3	-	No fishing activities reported	No
		Pond 4	-	No fishing activities reported	No
		Pond 5	-	No fishing activities reported	No
		Pond 6	-	No fishing activities reported	No
		Pond 7	-	No fishing activities reported	No
		Pond 8	-	No fishing activities reported	No
		End Grid Lake	-	No fishing activities reported	No
		Smoke Lake	-	No fishing activities reported	No
		Cigar Lake	-	No fishing activities reported	No
		Knee Lake	-	No fishing activities reported	No
		Lunch Lake	-	No fishing activities reported	No
		Andrew Lake	-	No fishing activities reported	No

Table 1.4-2 Fishing Activities Reported in the Kiggavik Project Area

Watershed	Sub-Basin	Waterbody	Sources	Status	CRA
		Shack Lake	-	No fishing activities reported	No
		Bear Island Lake	-	No fishing activities reported	No
		Lower Lake	-	No fishing activities reported	No
	Caribou Lake	Ridge Lake	-	No fishing activities reported	No
		Cirque Lake	-	No fishing activities reported	No
		Crash Lake	-	No fishing activities reported	No
		Fox Lake	-	No fishing activities reported	No
		Caribou Lake	Traditional Land Use Study	Traditional fishing area	Yes
		Sleek Lake	Traditional Land Use Study	Traditional fishing area	Yes
		Calf Lake	-	No fishing activities reported	No
	Judge Sissons Lake	Judge Sissons Lake	Traditional Land Use Study; IQ-BL01 2008; IQ-BL02 2008; IQ-BL04 2008; IQ-BL05 2008; IQ-BL06 2008; IQ-BL13 2008; IQ-BL14 2008; IQ-BL16 2008; BLHT 2011	Traditional fishing area; Aboriginal and limited recreational fishing	Yes
	Siamese Lake	Siamese Lake	Traditional Land Use Study; IQ-BL16 2008	Traditional fishing area	Yes
	Skinny Lake	Skinny Lake	-	No fishing activities reported	No
	Kavisilik Lake	Kavisilik Lake	-	No fishing activities reported	No
Thelon River	Squiggly Lake	Squiggly Lake	-	No fishing activities reported	No
Baker Lake	Baker Lake	Baker Lake	Riewe 1992; 254; BLHT 2011	Traditional fishing area	Yes

SOURCE: Modified from Tier 2, Volume 5, Table 5.3-1. Information is summarized from the Traditional Land Use Study and Inuit Qaujimajatuqangit (IQ) Documentation (DEIS Tier 3, Technical Appendix 3B) for the Project. Individual IQ interviews are cited where available (e.g., BL01 2008 for Baker Lake Interview #1 of 2008).

CRA = commercial, recreational and/or Aboriginal; BL = Baker Lake; BLHT = Baker Lake Hunters and Trappers.

Historically, fish were used to augment food supplies for humans and dog teams when caribou were not abundant. Currently, subsistence fisheries in the Project area primarily target lake trout, lake whitefish, and Arctic grayling. Recreational fishers often target Arctic char, as well as Arctic grayling and lake trout (Economic Development and Tourism of Northwest Territories 1990).

Fishing in the Judge Sissons Lake area is concentrated near the outlet of the lake, as well as in the lake's southeast arm. Residents of Baker Lake are known to occasionally partake in domestic fishing around Judge Sissons Lake; the Baker Lake Hunting and Trapping Organization owns a cabin on the lake's north shore. Although access to Judge Sissons Lake is limited during the open water period, recreational fishing by summer and winter campers has been reported. Siamese Lake, which is also located in the Aniguq River watershed, is also considered a traditional fishing area (IQ-BL16 2008[6]).

The site access Local Assessment Area (sa-LAA) for the Kiggavik Project overlaps portions of the Aniguq River, Baker Lake and Thelon River watersheds. Traditional fishing areas that overlap with the sa-LAA have been identified on Baker and Audra lakes, as well as the Aniguq and Thelon rivers (IQ-BL16 2008[7]; IQ-Riewe 1992[8]).

Fishing is one of the most common domestic and recreational uses for Baker Lake due its close proximity to the community of Baker Lake. Year-round traditional fishing areas were identified along north shore of Baker Lake (IQ-Riewe 1992[9]); the west shore of the lake was also identified as a traditional fishing area (IQ-BL16 2008). Fishing camps were common along the south shore of Baker Lake, although this area was not easy to access (IQ-Riewe 1992[10]).

Because the Thelon River is located near the community of Baker Lake and is part of the Canadian Heritage Rivers System, it is commonly used for recreational fishing (Economic Development and Tourism of Northwest Territories 1990). Arctic grayling and trophy sized lake trout and Arctic char are the targeted fish species (Economic Development and Tourism of Northwest Territories 1990).

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[6] IQ-BL16 2008: Elders also said that all of the little lakes in the region were fishing lakes.

[7] IQ-BL16 2008: The west shore of Baker Lake and Judge Sissons Lake were identified as fishing areas, as well as numerous fishing lakes in the Baker Lake region including areas close the Project lease area, such as Siamese Lake and the east shore of Aberdeen Lake.

[8] IQ-Riewe 1992: Important fishing sites include Tehek Lake, Whitehills Lake, Baker Lake, Parker Lake, Judge Sissons Lake, Bissett Lake, and the mouths of the Prince River and Kazan River.

[9] IQ-Riewe 1992: The area along the north shore of Baker Lake was heavily used all year [for fishing], and local residents often occupied weekend and seasonal camps.

[10] IQ-Riewe 1992: Even though the south shore of Baker Lake was not easily accessible, fishing camps were still common.

2 Principle Components of the Project Relevant to Fisheries

A detailed description of the proposed Project is provided in the EIS (Tier 2, Volume 2). Principal components of the Project considered relevant to fisheries include the following:

- the barge dock on the north shore of Baker Lake;
- site roads, including the Winter Road;
- freshwater diversions and site drainage systems;
- dewatering a portion of Andrew Lake;
- water withdrawal and discharge; and
- the optional All-Season Road.

The combined footprints of the Kiggavik site, Sissons site, access road between the Kiggavik and Sissons sites and the airstrip are expected to equal approximately 1,021 ha.

2.1 Details on Project Components

Project components and activities that may cause the death of fish and/or the permanent alteration or destruction of fish habitat are described in Section 3.0 of this CFOP. Information from the environmental and engineering teams for the Kiggavik Project and public engagement was used to identify Project components that have potential to result in serious harm to fish. Measures and standards that will be implemented to avoid or mitigate serious harm to fish are also discussed throughout Section 3.0. Residual serious harm to fish that is expected to occur as a result of Project construction, operation, closure and decommissioning, despite the implementation of avoidance and mitigation measures, is described for each of the Project components and phases (i.e., construction, operation and closure). If proposed mitigation measures, BMPs and monitoring are unable to eliminate or minimize any potential serious harm to fish habitat, contingency fisheries offsetting has been proposed and is discussed in Section 4.0

2.1.1 Baker Lake Dock Site

Project construction activities will commence at the proposed dock site in Baker Lake (Tier 2, Volume 2). A temporary spud barge dock will be installed to assist with offloading barges. The preferred site and layout of the dock were selected based on topography, bathymetry and proximity to existing infrastructure (Tier 2, Volume 2Section 4.4.4). The dock is anticipated to have a similar configuration to the Agnico-Eagle (Meadowbank) dock, which is also situated in Baker Lake (Tier 2, Volume 2, Section 10.3.5). The dock will be constructed by placing a clean, rock-fill approach along the shoreline and floating the barge at sufficient depth to permit barge docking. Steel piles (spuds) will be driven into the lake bottom to anchor the barge. The barge will retain the ability to move up and down along the steel piles to accommodate changes in water levels and the formation of winter ice without having to be moved or repositioned. The spud barge will be further secured using steel cabling anchored to the shore (Tier 2, Volume 2, Section 10.3.5). The temporary dock is designed to accommodate barges having up to 7,500 tonnes capacity (Tier 2, Volume 2, Section 20.1.9).

2.1.2 Winter Road and Site Access Roads

A Winter Road will be constructed during the first winter of the Project construction phase to connect the Baker Lake supply storage facility with the Kiggavik site (Tier 2, Volume 2). The Winter Road is the preferred option for the Project, based on Project needs and stakeholder input (EN-BL OH Nov 2010[11]). However, if it is determined that the Winter Road cannot adequately support the needs of the Project, an All-Season Road will be constructed during operations (EIS Volume 2, Section 12.3.2; Section 2.1.6).

The Winter Road will cross Baker Lake and other large ice-covered lakes. Some flooding will be required to prepare the road; overland sections will likely require flooding or placement of a granular base (Tier 2, Volume 2, Section 9.2). The road would be re-constructed every year by clearing the overland portions and flooding the over-ice portions (Tier 3, Technical Appendix 2M, Section 3.1.1).

Mine rock and borrow areas along the Baker Lake-Kiggavik site access route have been identified as potential sources of materials for roads and site pads. The ore haul road between the Kiggavik and Sissons mine sites, as well as the access roads to the water intake locations, treated effluent discharge points, and airstrip will require stream and watercourse crossings. No other temporary (i.e., for Project construction only) crossings have been identified.

Site roads, including the access road(s) between the Baker Lake supply storage facility and Kiggavik sites will be removed during Project closure and decommissioning, unless the community or a government agency chooses to take over ownership of the infrastructure. All stream crossing structures will be removed and stream substrates restored to conditions similar to those found in the pre-development streams.

[11] EN-BL OH Nov 2010: *I used to support the north all weather road but now I prefer the winter. The South is too shallow and the north all weather road crosses the Thelon in an area of a caribou crossing. I thought I would use the north all weather road, but when I think of the caribou and fish, I prefer the winter road.*

2.1.3 Freshwater Diversion Channels

Within the project footprint, a number of small ponds will be in-filled to facilitate construction at the Kiggavik and Sissons sites. These ponds freeze to the bottom each winter and do not contain permanent or seasonal fish communities. No fisheries offsetting will be required for in-filling of ponds that do not support fish.

The site footprints for the Project have been minimized and situated such that natural drainage areas and watershed boundaries will be maintained as much as possible. However, construction of some freshwater diversion channels will be required early in the Project construction phase to minimize the amount of water entering the construction and operational areas. Diversion channels will be created on the Mushroom/End Grid Stream and three tributaries to Pointer Lake at the Sissons and Kiggavik mine sites, respectively. The diversion channels will be constructed in one of three ways depending on topography and geotechnical conditions. These are as follows:

- Channel with invert at existing grade with built-up berms to contain the flow;
- Channel with excavation in overburden; and
- Channel with excavation in bedrock (Tier 2, Volume 2, Section 12.8.1).

2.1.3.1 Mushroom/End Grid Stream Diversion

During mine and infrastructure development at the Sissons mine site, 475 metres (m) of the downstream portion of the stream between Mushroom Lake and End Grid Lake (Mushroom/End Grid Stream) will be diverted around the mine area. The dewatered portion of stream channel will be filled to assist in developing mine infrastructure at the Sissons site. Mushroom and End Grid lakes will be reconnected via the freshwater diversion channel S1, which will flow around the east side of the Sissons mine site. A large rock ridge along the north side of End Grid Lake will necessitate excavation.

Arctic grayling (*Thymallus arcticus*), cisco (*Coregonus artedi*), lake trout (*Salvelinus namaycush*) and round whitefish (*Prosopium cylindraceum*) are present in Mushroom Lake, and Arctic grayling were captured in End Grid Lake (Tier 3, Volume 5, Appendix 5C). It is therefore assumed that these species could potentially migrate between the two lakes under flow conditions associated with the spring freshet. Fish are unlikely to be found at the proposed diversion location outside of the spring freshet period, and seasonal use of this area is likely limited to migration only. The shallow depth of the Mushroom/End Grid Stream (maximum depth of 0.2 m in the main channel) and other waterbodies in the Lower Lake sub-basin restricts overwintering habitat to Mushroom, Cigar, and Judge Sissons lakes (Tier 3, Volume 5, Appendix 5C).

With ice formation commonly reaching 2.0 m during winter, it is expected that Mushroom/End Grid Stream freezes to the substrate in winter. These conditions are not suitable to support fall-spawning lake trout, which require unfrozen substrates to support egg survival and successful hatching in spring. The section of Mushroom/End Grid Stream proposed for diversion is not expected to provide spawning habitat for Arctic grayling either, due to its shallow depth (maximum depth of 0.2 m in the main channel), distance downstream of Mushroom Lake (at least 500 m), braided channel and generally unsuitable substrate for spawning (primarily silt, with some cobble, gravel and boulder) (Tier 3, Volume 5, Appendix 5C). No Arctic grayling, or evidence of spawning, rearing or foraging activities, were observed in the proposed diversion area (Tier 3, Volume 5, Appendix 5C).

2.1.3.2 Kiggavik Site Stream Diversions

Three stream channels will be diverted to facilitate construction of the Kiggavik mine, mill and associated infrastructure. These include the middle section of the northeast inflow to Pointer Lake, the top section of a tributary to the northeast inflow of Pointer Lake, and the top section of the northwest inflow to Pointer Lake (Tier 3, Volume 3, Technical Appendix 2E). Fish have not been documented as being present or the proposed diversion will be located in the stream headwaters, upstream of documented fish communities (Tier 3, Volume 5, Appendix 5C).

Currently, low flows and shallow depths are effective barriers to fish passage through the stream sections that will be diverted (Tier 3, Volume 5, Appendix 5C). Flows outside the spring freshet period are generally low to negligible and these stream sections freeze to the bottom during winter (Tier 3, Volume 5, Appendix 5A; Tier 3, Volume 5, Appendix 5C). Therefore, the sections to be in-filled are considered non-fish-bearing. Ninespine stickleback (*Pungitius pungitius*) and slimy sculpin (*Cottus cognatus*) were captured in the northeast and northwest inflows, respectively, of Pointer Lake (Tier 3, Volume 5, Appendix 5C); however, the sections of these streams proposed for infilling are well upstream of the fish capture locations. The fish capture site in the northeast inflow stream to Pointer Lake is located within 400 m of Pointer Lake. The fish capture site in the upper northwest inflow stream to Pointer Lake was located within 10 m of Pointer Pond, the only water body along this drainage system having sufficient depth (i.e., 4.5 m deep) for overwintering fish. Intensive backpack electrofishing in the section of the northwest inflow stream located further upstream from Pointer Pond failed to capture any fish (Tier 3, Volume 5, Appendix 5C).

The tributary of the northeast inflow to Pointer Lake was considered non-fish-bearing because no fish were captured there during backpack electrofishing surveys completed in the spring of 2010 (Tier 3, Volume 5, Appendix 5C). In 2009, aquatic habitat assessment efforts revealed the upper section of this tributary was not connected to the northeast inflow of Pointer Lake; this would prevent fish passage to the upper reaches of the stream (Tier 3, Volume 5, Appendix 5C). Further details of the methods and results for fish capture studies completed for the Kiggavik Project are provided in Tier 3, Volume 5, Appendix 5C.

Because no fish have been documented in the stream sections proposed for diversion, and barriers to fish movement likely to prevent fish access (Tier 3, Volume 5, Appendix 5C), these areas are not expected to provide critical habitat in support of a CRA fishery. The closest CRA fishery is located in Judge Sissons Lake (Tier 2, Volume 3, Appendix 3B). Arctic grayling, lake trout, cisco and ninespine stickleback have been captured from Pointer Lake (BEAK 1987, 1990; 1992a, b; Tier 3, Volume 5, Appendix 5C); however, IQ indicates that Pointer Lake no longer contains fish and as a result, is no longer used for fishing (IQ-BL02 2008[12]). Movement of fishes between Pointer Lake and Judge Sissons Lake has been documented during the openwater season (Tier 3, Volume 5, Appendix 5C); however, fish and habitats within Pointer Lake could, in part, support the CRA fishery on Judge Sissons Lake.

2.1.4 Dewatering of Andrew Lake

The south west portion of the proposed Andrew Lake open pit extends into Andrew Lake and a dyke structure is required to allow this portion of the lake to be dewatered for the proposed pit development. The open pit will cover an area of about 44 ha on surface and is 275 m deep. The maximum dimensions at the pit rim are expected to be approximately 790 m north to south and 715 m east to west. Including overburden material, the pit has a total in-situ volume of approximately 38.4 Mm^3. The bottom of the Andrew Lake pit is expected to extend below the permafrost horizon, which is estimated to occur at 250 m below surface. Although Andrew Lake is a shallow lake, with a maximum depth of 1 m and average depth of 0.2 m, aquatics studies have indicated that small fish frequent the lake during the open water period and, therefore, the dyked area will be fished-out prior to dewatering. The fish-out will be done in consultation with the local communities and regulatory agencies. Approximately 135,000 m^2 (13.5 ha) of lake area, or approximately 30,000 m^3 of volume, will need to be dewatered to provide adequate buffer between the pit edge and the dyke.

In order to begin development of the Andrew Lake Pit, a dyke will be constructed across the east end of Andrew Lake and that portion of Andrew Lake dewatered. Construction of the dyke and dewatering the east section of Andrew Lake during the openwater period will result in increased turbidity and TSS levels in the water. The increases in turbidity/TSS released to the downstream environment will be maintained within acceptable levels by using a turbidity curtain to separate the dyke construction activity from the larger western portion of Andrew Lake. Water quality will be monitored during dyke construction and actions taken if turbidity/TSS levels approach an unacceptable, pre-determined threshold. If turbidity readings exceed the threshold level, all construction activities will stop until a more effective construction method can be instituted. Following dyke construction, the east portion of Andrew Lake will be dewatered by pumping it into the larger, remaining portion of Andrew Lake. Winter dyke construction is also being considered, which would

[12] IQ-BL02 2008: One of the Elders said that the rivers flowing into Pointer Lake have caused the fish there to die, and that the same will happen to Judge Sissons Lake when mining operations start to get close to the lake.

further mitigate the implications of TSS to fish. In this case construction would occur when the lake is frozen to the bottom and void of fish. No fish salvage would be required and no release of TSS would occur.

During the final closure phase, the water will be pumped from Judge Sissons Lake to flood the Andrew Lake Pit. Pumping is expected to completely fill the pit in four years if pumping takes place at a rate of 1 cubic metre per second (m^3/sec) during the open water period each year (mid-June through mid-September). This rate of pumping (1 m^3/sec) represents less than 3 percent (%) of the average annual peak flow. Once the Andrew Lake Pit is full, the water quality of the pit water will be assessed. If the water quality meets surface water quality objectives (i.e., the Saskatchewan Surface Water Quality Objectives [SSWQOs] and Canadian Water Quality Guidelines [CWQG]), then the dyke separating the Andrew Lake Pit and Andrew Lake could be breached to reconnect the two water bodies. If Andrew Lake Pit water quality does not meet SSWQO and CWQG, then the dyke separating the two waterbodies will be maintained.

Additional details on the Andrew Lake dewatering structure are included in the EIS Tier 3, Technical Appendix 2F (Conceptual Design for Andrew Lake Pit Dewatering Structure). Detailed fish habitat assessments were completed in 2013 to document fish presence/absence and fish habitat in Andrew Lake and surrounding area (Tier 3, Volume 5, Appendix 5C).

2.1.5 Water Withdrawal and Discharge

Water for domestic and industrial uses will be withdrawn from surface waterbodies. Potable water, as well as mine and mill process water, for the Kiggavik site will be withdrawn from Siamese Lake. Potable water and mine process water for the Sissons mine site will be withdrawn from Mushroom Lake (Tier 2, Volume 2). At the Kiggavik site, water is required for the following uses:

- Potable uses;
- Mill process and reagent preparation;
- Mine shop and wash bays;
- Dust suppression; and,
- Fire suppression

Some of these needs can be met using contact water rather than freshwater. Requirements for freshwater during mill operation are expected to range from 2,000 –8,000 m^3/day, depending on:

- The availability of permeate from the Kiggavik water treatment plant; and,
- The availability of site recycle water from the water storage pit.

The mill process will be the primary consumer of water and the use of recycled water will be maximized. In the extreme case where no permeate or stored site drainage is available for use in the mill, a maximum of 8,000 m^3/day of raw water would be required to operate the Kiggavik site. For the Sissions site, freshwater requirements are estimated at 60 m^3/day; water is required for the following uses:

- Potable uses;
- Technical water for underground drilling;
- Mine shop and wash bays;
- Dust suppression; and,
- Pit re-flooding (decommissioning).

2.1.5.1 Freshwater Intake

Kiggavik Site

The proposed freshwater pumping system for the Kiggavik site will primarily draw water from Siamese Lake. Siamese Lake is located approximately 8 km east of the site (Tier 2, Volume 2, Figure 9.5.1). Given average ice depths of 2 m, the screened intake will be located at a minimum depth of 4 m requiring the intake to be located approximately 400 m off-shore of Siamese Lake. The main pumping station will be located along the shore. The freshwater pipeline will be approximately 10 km long and will include allowances for elevation changes and snaking to reduce the risk of a pipeline break. The pipeline will be insulated, heat traced, and placed along a fill pad to prevent melting of the permafrost. A power line and maintenance road will be required in order to supply access and electricity to the heat trace and the pumping station. This road will also be used as the final port of the winter road between Baker Lake and Kiggavik.

The freshwater pipeline will discharge directly into the Raw Water Tank in the mill for use in the mill processes. A backflow preventer will be used to ensure water from the Raw Water Tank cannot enter the freshwater line. A separate line will be teed off prior to the tank to deliver freshwater to the potable water membrane treatment system and the mine shops. It is expected that the volume of freshwater drawn from the lake will vary based on permeate availability, seasonal variation, rate of tailings consolidation, and site activities. The system is designed for a maximum withdrawal rate of 8,000 m^3/day. No treatment of freshwater to be used in the mill or mine shops is required.

Potable water will be treated to meet Canadian Drinking Water Guidelines and the Nunavut Public Health Act. It is anticipated that a membrane treatment plant, using either microfiltration or ultrafiltration, followed by a chlorination stage, will be required in order to meet these standards. During construction and the latter stages of decommissioning, a portable UV treatment system may be used (Tier 2, Volume 2, Section 9.5.1).

Sissons Site

The proposed Sissons freshwater pumping system will draw water from Mushroom Lake, which is located approximately 2 km north of the site (Tier 2, Volume 2, Figure 9.6.1). Given winter ice depths of 2 m, the intake will be located at a minimum depth of 4 m requiring it to be located approximately 400 m off from Mushroom Lake shore. The intake will be screened in accordance with DFO guidelines. The main pumping station will be located along the shore.

The freshwater pipeline will be approximately 2 km long and will include allowances for elevation changes and snaking, to reduce the risk of a pipeline break. The pipeline will be insulated, heat traced, and placed along a fill pad to prevent melting of the permafrost. A power line and maintenance road will be required in order to supply access and electricity to the heat trace and the pumping station.

Freshwater will be pumped via an electrically heat-traced line to a storage and potable treatment system and then to the mine dry and kitchen facilities for potable use. Potable water will be treated in a separate membrane treatment system with no connection to any mine water or sewage streams. Freshwater requirements for the site are estimated at 60 m^3/day, consisting primarily of potable use.

Water Treatment and Discharge

Water treatment options and procedures are discussed in detail in EIS Tier 2, Volume 2 and in the Water Management Plan (Tier 3, Technical Appendix2I) For the purpose of the Conceptual Fisheries Offsetting Plan effluent discharge and effluent discharge locations with be assessed. The Water Treatment Plant (WTP) will have two effluent streams; Reverse Osmosis (RO) permeate and chemical WTP effluent. The RO permeate will either be recycled to the mill for use in mill process, or combined with the chemical WTP effluent in the effluent pumphouse for discharge to Judge Sissons Lake. Average total treated effluent discharge from the Kiggavik WTP will be approximately 2,707 m^3/day, while maximum flows are estimated at 3,000 m^3/day.

The treated effluent is pumped to the lined monitoring ponds (Tier 2, Volume 2, Figure 4.4-1), which serve as the final treated water quality checkpoint before discharge. A composite sample of the water pumped to the monitoring ponds will be taken using an autosampler for chemical analysis to confirm effluent quality prior to final discharge to the environment. Should the effluent quality of the monitoring pond not meet discharge criteria, the pond will be recycled to the TMF or WTP and the cause will be investigated to reduce the likelihood that additional monitoring ponds do not meet the discharge criteria.

Lined monitoring ponds will be constructed, each with 12 hour effluent storage capacity. Under normal operation, one pond will be filling, one pond will be discharging, and the other pond will be awaiting laboratory analysis to confirm discharge criteria have been met. The addition of a fourth monitoring pond may be considered in order to provide operational flexibility. Treated effluent not meeting discharge criteria will be recycled to the TMF or WTP for further treatment.

Once it has been confirmed discharge criteria have been met, the monitoring pond discharge will be pumped to the monitoring pond pumphouse, where it will be combined with any RO permeate overflow. An autosampler will collect a sample of the monitoring pond discharge for confirmation of the initial analysis and that the pond meets specifications. RO permeate will also be sampled to confirm it meets specifications. The monitoring pond discharge and RO permeate that is discharged will be combined in an effluent discharge tank and pumped to Judge Sissons Lake. Grab samples for pH measurement will also be taken to confirm the pH is suitable for discharge. An additional autosampler will collect a sample of the combined discharge to track the effluent discharged to Judge Sissons Lake.

Effluent will be discharged to Judge Sissons Lake on a year-round basis. Discharge flows will be transported via an insulated, single-walled, heat-traced pipeline approximately 12 km in length. The pipeline design includes a berm and unlined containment ponds located at low points along the corridor. The berm will be designed such that the pipeline can be crossed by wildlife.

AREVA has experience operating effluent discharge lines during Canadian winter conditions. AREVA's McClean Lake Operation in Northern Saskatchewan has two effluent discharge pipelines from its Water Treatment Plants. The water treatment plants have operated both year-round and on a batch basis and effluent has been piped during all weather conditions, including northern winters. These lines are insulated and heat-traced. The discharge pipelines are approximately 5km and 7km in length. The pipelines have been operated successfully for 10 to 15 years without any major issues.

Containment ponds will be located at the low points of the pipeline to hold water in the event of a pipeline leakage or breakage, or if the pipeline needs to be drained. The containment ponds will be designed for at least two pipe volumes of the section of pipe that could potentially drain into the pond.

Discharge of treated effluent into Judge Sissons Lake will be accomplished using a diffuser system to promote treated effluent mixing. The diffuser will be located approximately 500 m from the shoreline of Judge Sissons Lake where sufficient water depth exists. The diffuser will consist of a perforated section of pipe.

Detailed fish habitat assessments were completed in 2013 to document fish habitat at the sites of the two proposed diffuser locations (Tier 3, Volume 5, Appendix 5C). The aquatic habitat assessment was limited to the northern portion of Judge Sissons Lake because no potential Project-related effects to aquatic habitat are anticipated in the southern portion of the lake. Given that water flows from the south and west portions of Judge Sissons Lake to the Aniguq River outlet in the northeast end of the lake (Tier 3, Volume 5, Appendix 5A), and the proposed treated effluent discharge locations are in the northern portion of the lake (Tier 2, Volume 5), any potential effects to aquatic habitat from the physical footprint of the diffusers or the discharge of treated effluent are likely to be restricted to the northern portion of Judge Sissons Lake.

2.1.6 All-Season Road Option

The proposed All-Season Road (Tier 2, Volume 2, Figure 10.4-2) is 114 km in length from the Baker Lake dock site to the Kiggavik site. The road corridor has been sighted to avoid low lying and ice rich areas. The final road alignment within the corridor will be determined prior to construction (if the all-season road is required), in order to best consider construction and operational needs and environmental protection measures. There are up to 14 bridges (less than 50 m in length) proposed along the route and one major river crossing (Thelon River). At the Thelon River crossing, a cable ferry is proposed to provide summer access across the river. The remainder of the water crossings can be accommodated with culverts or small bridges. The road will be 10 m wide, built with Run-of-Quarry (ROQ) rock embankment (fill). There will be no earth cuts along the alignment; the only cut sections will be through rock, which will serve as quarry material. Material for the rock embankment and road surfacing will be derived from rock quarries developed along the road.

Of all the watercourses proposed to be crossed by proposed Project roads, the Thelon River is the only one that flows year round and supports fall-spawning fish species. Recreational also occurs on the Thelon River (Economic Development and Tourism of Northwest Territories 1990); refer to Tier 3, Technical Appendix 9A, Attachment D for a discussion of the Thelon River as a river in the Canadian Heritage Rivers System. All of the remaining streams crossed by proposed Project roads are on streams that cease to flow by the time freeze-up occurs in fall; many of these streams also freeze solid to the bottom during winter. Some of the streams support spring-spawning fish species on a seasonal basis, while the remaining streams do not support fish in any known capacity. Any fall-spawning fish species that use these streams during the spring or summer apparently use them for foraging purposes only.

Fish habitat assessments and fishing efforts were not completed at all the stream crossings on the optional All-Season Road located between the Thelon River and Baker Lake. The potential for large-bodied fish to pass through these streams was assessed based on fish observed or captured at upstream and downstream locations, as well as upstream and downstream connectivity. To be conservative, culverts were designed for fish passage at known fish bearing streams, and whenever the presence of fish, or the use of a stream by fish, was uncertain.

3 Summary of Mitigation Measures

A number of mitigation measures and Project design features for project components listed in Section 2.0 will be implemented to minimize changes to water quality, sediment quality, aquatic organisms, and fish habitat quantity and quality. Activities associated with the project components were also assessed in terms of the Pathways of Effects (DFO 2010a, internet site; Attachment A) for potential impacts to fish and fish habitat. Table 3-1 summarizes associated mitigation measures, monitoring programs and further measures required to minimize effects to the aquatic environment. Plans developed for the Project which include avoidance and mitigation measures in relation to the aquatic environment are as follows:

- Waste Rock Management and Project Site Drainage Plans (Tier 2, Volume 2);
- Explosives Management Plan (Tier 3, Technical Appendix 2C)
- Water Management Plan (Tier 3, Technical Appendix 2I);
- Road Management Plan (Tier 3, Technical Appendix 2M);
- Preliminary Decommissioning Plan (Tier 3, Technical Appendix 2R);
- Environnemental Management Plan (EMP) (Tier 3, Technical Appendix 2T);
- Hazardous Materials Management Plan (Tier 3, Technical Appendix 2U);
- Aquatic Effects Monitoring Plan (AEMP) (Tier 3, Technical Appendix 5M);
- Erosion and Sediment Control Plan, based on industry standard Best Management Practices (BMPs) defined in numerous established guidelines and policies, regulatory requirements, and use of adaptive management monitoring and mitigation strategies (Tier 3, Technical Appendix 5O);
- Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B); and,
- Emergency Response Plan (Tier 3, Technical Appendix 10C).

Some avoidance and mitigation measures apply to the whole Project site (i.e., general mitigation measures) or multiple Project components and activities, rather than single Project components. These avoidance and mitigation measures are:

- Project planning;
- shoreline re-vegetation and stabilization;
- construction of in-water works (i.e., Baker Lake Dock, Road Construction, Freshwater Diversion Channels) will be completed in accordance with the conditions outlined in The Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a);
- an environmental monitor will be on site during in-water work to verify that compliance with construction specifications and Project approvals is achieved (Tier 3, Technical Appendix 5O);
- in-water works will be isolated from flowing water and adjacent lake or river habitats to reduce downstream or off-site effects (Tier 3, Technical Appendix 5O);

- a turbidity/total suspended solids (TSS) regression will be developed and a Turbidity Monitoring Program will be implemented during in-water works (Tier 3, Technical Appendix 5O);
- construction water pump intakes will be screened as per DFO's "Freshwater Intake End-of-Pipe Fish Screen Guideline" to prevent entrainment of fish (DFO 1995);
- water will be discharged to watercourses in a manner that does not cause erosion or other damage to adjacent areas (Tier 3, Technical Appendix 2I);
- runoff from areas unaffected by the Project will be directed away from construction areas and allowed to discharge through natural channels (Tier 2, Volume 2);
- DFO In-Water Construction Timing Windows will be followed for the Project (Tier 2, Volume 5);
- any materials used for shoreline stabilization will be clean and free of fine sediments and contaminants (Tier 3, Technical Appendix 5O);
- surface runoff will be diverted around and away from waste rock disposal areas as much as possible (Tier 2, Volume 2);
- the site will be properly graded and will be surrounded by ditches and berms to capture runoff from the waste rock disposal areas (Tier 2, Volume 2);
- waste rock disposal areas will be placed in locations that can be modified to control run-on and run-off, if possible (Tier 2, Volume 2);
- runoff from the waste rock disposal areas will be directed to settling ponds prior to discharge; water quality will be confirmed before release to the environment (Tier 2, Volume 2);
- wastewaters released from settling ponds will meet applicable water quality guidelines (i.e., Canadian Council of Ministers of the Environment [CCME]) at the end of the mixing zone (Tier 3, Technical Appendix 2I; Tier 3, Technical Appendix 5M) ;
- excavated material will be stored away from watercourses or lakes (Tier 2, Volume 2);
- construction equipment will be regularly maintained (Tier 3, Technical Appendix 2U);
- construction machinery, equipment, and vehicles will not be stored, refuelled, or repaired near waterbodies (Tier 3, Technical Appendix 2U);
- fuel storage containers will be regularly inspected for leaks or damage and replaced when necessary (Tier 3, Technical Appendix 2U);
- reagents and fuel Enviro-Tanks (if applicable) will be located in larger, double-walled containers (Tier 3, Technical Appendix 2U);
- spill response material (e.g., sorbent pads) will be stored on-site in designated areas and in vehicles (Tier 3, Technical Appendix 2U);
- contaminated (impacted) soils will be removed and disposed of in a waste management facility (Tier 3, Technical Appendix 2U); and,
- commitment to drain, dry field equipment prior to use in Project areas (mitigate introduction of aquatic invasive species).

If proposed mitigation measures, BMPs and monitoring (Table 3-1) are unable to minimize or eliminate any potential serious harm to fish habitat, contingency fisheries offsetting has been proposed in Section 4.0

Table 3-1 Summary of Mitigation Measures and Monitoring Activities in Relation to Fisheries and Oceans Pathways of Effects

Project Activities (a)	Pathway of Effects (b)	Mitigation Measures	Monitoring and Additional Measures to Mitigate Effects
Baker Lake Dock	**Land-based activities:** • vegetation clearing; • excavation; • grading; and, • use of industrial equipment. **In-water activities:** • removal of aquatic vegetation; • organic debris management; • placement of material or structures in water; and, • structure removal.	• Expected to be small spatial scale and temporary (Tier 2, Volume 2, Section 10.3.6); • Construction to occur outside spring spawning and rearing periods (Tier 2, Volume 5, Section 11.5); • Water Management Plan (Tier 3, Technical Appendix 2I); • Marine Transportation Plan (Tier 3, Technical Appendix 2J); • Environmental Management Plan (Tier 3, Technical Appendix 2T); • Hazardous Materials Management Plan (Tier 3, Appendix 2U); • Conceptual Fisheries Offsetting Plan (Tier 3, Technical Appendix 5L); • Construction to follow BMP's (Tier 3, Technical Appendix 5O); • Conceptual Sediment and Erosion Control Plan (Tier 3, Technical Appendix 5O); • Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B); • Emergency Response Plan (Tier 3, Technical Appendix 10C).	• Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site. (Tier 3, Technical Appendix 2I, Section 6.1); • Fuel and hazardous materials will be stored within secondary containment berms. Runoff from within the berms may be passed through a passive filter prior to discharge to remove any organics or other contaminants (Tier 3, Technical Appendix 2I, Section 6.1); • A containment boom will be placed between the tanker and the bow and stern of the barge as a precautionary measure to contain any fuel should a spill occur (Tier 3, Technical Appendix 2J, Section 4.2); • Fuel loading and offloading procedures (Tier 3, Technical Appendix 3J, Section 4.2); • The Baker Lake dock site will use appropriate fuel transfer equipment and be equipped with Bulk Storage Spills Kits (Tier 3, Technical Appendix 2U, Section 3.3.2).; • Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements (Tier 3, Technical Appendix 2U, Section 3.3.3); • Any incidents involving hazardous materials will be investigated and communicated to employees and regulators through an internal reporting system. Spills will be cleaned up in a timely manner and the area surrounding the spill will be checked to ensure all contamination is removed(Tier 3,Appendix 2U, Section 1.4.3); • Contingency Conceptual Fisheries Offsetting (Tier 3, Technical Appendix 5L); • Turbidity, water quality, fish salvage if necessary, erosion and sediment control monitoring (Tier 3, Technical Appendix 5O); • Installation of turbidity curtain (Tier 3, Technical Appendix 5O); • After a spill response, monitoring the spill area will be done to ensure all contaminated material has been removed (Tier 3, Appendix 10B).

Project Activities [(a)]	Pathway of Effects [(b)]	Mitigation Measures	Monitoring and Additional Measures to Mitigate Effects
Winter Road and Site Access Roads	**Land-based activities:** • vegetation clearing; • cleaning or maintenance of bridges or other structures; • excavation; • grading; and, • use of industrial equipment. **In-water activities:** • removal of aquatic vegetation; • organic debris management; • fish passage issues; • placement of material or structures in water; • structure removal; • water extraction; and, • change in timing duration and frequency of flow.	• Water Management Plan (Tier 3, Technical Appendix 2I); • Roads Management Plan (Tier 3, Technical Appendix 2M); • Environmental Management Plan (Tier 3, Technical Appendix 2T); • Hazardous Materials Management Plan (Tier 3, Technical Appendix 2U); • Conceptual Fisheries Offsettting Plan (Tier 3, Technical Appendix 5L); • Aquatic Effects Monitoring Plan (Tier 3, Technical Appendix 5M); • construction to follow BMP's (Tier 3,Appendix 5O); • Construction to occur outside spawning and rearing periods (Tier 3, Volume 5, Section 11.5,Tier 3, Technical Appendix 5O); • Conceptual Sediment and Erosion Control Plan (Tier 3, Technical Appendix 5O); • Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B); • Emergency Response Plan (Tier 3, Technical Appendix 10C).	• No more than 10% of the under-ice volume will be withdrawn from a lake during one ice covered season (DFO 2010b). Approaches along shorelines will be built up using ice ramps to reduce the potential for erosion or sediment transport. (Tier 3, Technical Appendix 2I, Section 6.3.1); • Prior to the start of construction activities for the winter road, actual ground temperatures will be monitored (Tier 3, Technical Appendix 2M, Section 4.1.5); • Roads and stream crossings will be inspected regularly for signs of degradation and required maintenance (Tier 3, Technical Appendix 2M, Section 7.1); • Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements are met (Tier 3, Appendix 2U, Section 7.1); • Any incidents involving hazardous materials will be investigated and communicated to employees and regulators through an internal reporting system. Spills will be cleaned up in a timely manner and the area surrounding the spill will be checked to ensure all contamination is removed(Tier 3, Technical Appendix 2U, Section 1.4.3)(Tier 3, Technical Appendix 10B); • Contingency Conceptual Fisheries Offsetting (Tier 3, Technical Appendix 5L); • Monitoring of locations prone to ice jamming (e.g., culvert crossings along the Kiggavik-Sissons haul road) and removal of ice jams, if necessary, would be completed to ensure that potential ice blockages at stream crossings do not cause the overlying road to wash out. (Tier 3, Technical Appendix 5M, Section 6.5); • Water crossing structures will be monitored so that maintenance activities can be tailored to reduce any potential erosion and maintain water passage (Tier 3,Appendix 5O); • In-water work will be minimized, however if these activities mobilize notable sediment, a turbidity curtain will be installed to contain sediment, fish will be salvaged within the confined areas, and turbidity in the stream will be monitored (Tier 3, Technical Appendix 5O); • During Project operations culvert monitoring will be carried out to confirm fish passage if fish are present and verify that erosion and sediment control measures are functioning as intended(Tier 3, Appendix 5O).

Project Activities (a)	Pathway of Effects (b)	Mitigation Measures	Monitoring and Additional Measures to Mitigate Effects
Freshwater Diversion Channels	**Land-based activities:** • vegetation clearing; • excavation; • use of explosives; • grading; and, • use of industrial equipment. **In-water activities:** • removal of aquatic vegetation; • organic debris management; • fish passage issues; • placement of material or structures in water, • structure removal; • water extraction; and, • change in timing, duration and frequency of flow.	• Explosives Management Plan (Tier 3, Technical Appendix 2C); • Environmental Management Plan (Tier 3, Technical Appendix 2T); Hazardous Materials Management Plan(Tier 3, Technical Appendix 2U); • Conceptual Fisheries Offsetting Plan (Tier 3, Technical Appendix 5L); • Aquatic Effects Monitoring Plan (Tier 3, Technical Appendix 5M); • Construction to occur outside spawning and rearing periods (Tier 2, Volume 5, Section 11.5,Tier 3, Technical Appendix 5O); • Construction to follow BMP's (Tier 3, Appendix 5O); • Conceptual Sediment and Erosion Control Plan (Tier 3, Technical Appendix 5O) ; • Spill Contingency and Landfarm Management (Tier 3,Appendix 10B); • Emergency Response Plan(Tier 3, Technical Appendix 10C).	• Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements are met (Tier 3, Technical Appendix 2U, Section 7.1); • Any incidents involving hazardous materials will be investigated and communicated to employees and regulators through an internal reporting system. Spills will be cleaned up in a timely manner and the area surrounding the spill will be checked to ensure all contamination is removed (Tier 3, Technical Appendix 2U, Section 1.4.3; Tier 3, Technical Appendix 10B); • Contingency Conceptual Fisheries offsetting (Tier 3, Technical Appendix 5L); • Water quality monitoring in freshwater diversion channels during the first year following construction. Four times during open water season of the first year following construction (Tier 3, Technical Appendix 5M); • Sediment quality monitoring in lakes adjacent to and downstream of the Mine LAA (Tier 3, Technical Appendix 5M); • Monitoring of sediment quality in Judge Sissons Lake (Tier 3, Technical Appendix 5M); • Monitoring of benthic invertebrate communities in exposure areas of Judge Sissons Lake and in reference area(s) (Tier 3, Technical Appendix 5M); • Water crossing structures will be monitored so that maintenance activities can be tailored to reduce any potential erosion and maintain water passage (Tier 3, Technical Appendix 5O); • In-water work will be minimized, however if these activities mobilize notable sediment, a turbidity curtain will be installed to contain sediment, fish will be salvaged within the confined areas, and turbidity in the stream will be monitored (Tier 3, Technical Appendix 5O).
Dewatering of Andrew Lake	**Land-based activities:** • vegetation clearing; • excavation; • grading; and, • use of industrial equipment. **In-water activities:** • removal of aquatic vegetation; • organic debris management; • fish passage issues; • placement of material or structures in water; • structure removal; • water extraction; and, • change in timing, duration and frequency of flow.	• Explosives Management Plan (Tier 3, Technical Appendix 2C); • Environmental Management Plan (Tier 3, Technical Appendix 2T); Hazardous Materials Management Plan (Tier 3, Technical Appendix 2U); • Conceptual Fisheries Offsetting Plan (Tier 3, Technical Appendix 5L); • Aquatic Effects Monitoring Plan (Tier 3, Technical Appendix 5M); • Construction to occur outside spawning and rearing periods (Tier 2, Volume 5, Section 11.5,Tier 3, Technical Appendix 5O); • Construction to follow BMP's (Tier 3, Technical Appendix 5O); • Conceptual Sediment and Erosion Control Plan (Tier 3, Technical Appendix 5O) ; • Spill Contingency and Landfarm Management (Tier 3, Appendix 10B); • Emergency Response Plan (Tier 3, Technical Appendix 10C).	• Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements are met (Tier 3, Technical Appendix 2U, Section 7.1); • Any incidents involving hazardous materials will be investigated and communicated to employees and regulators through an internal reporting system. Spills will be cleaned up in a timely manner and the area surrounding the spill will be checked to ensure all contamination is removed(Tier 3, Technical Appendix 2U) (Tier 3, Technical Appendix 10B); • Contingency Conceptual Fisheries Offsetting (Tier 3, Technical Appendix 5L); • Monitoring to calibrate and refine the ground vibration and instantaneous pressure change models (Tier 3, Technical Appendices 2B and 2C) will be completed to ensure blasting activities do not harm fish populations. (Tier 3, Technical Appendix 5M). • Water crossing structures will be monitored so that maintenance activities can be tailored to reduce any potential erosion and maintain water passage (Tier 3,Appendix 5O); • In-water work will be minimized, however if these activities mobilize notable sediment, a turbidity curtain will be installed to contain sediment, fish will be salvaged within the confined areas, and turbidity in the stream will be monitored (Tier 3, Appendix 5O).

Project Activities (a)	Pathway of Effects (b)	Mitigation Measures	Monitoring and Additional Measures to Mitigate Effects
Water Withdrawal and Discharge	**Land-based activities:** • use of industrial equipment. **In-water activities:** • removal of aquatic vegetation; • organic debris management; • placement of material or structures in water; • structure removal; • waste water management; and • water extraction.	• Water Management Plan (Tier 3, Technical Appendix 2I); • Environmental Management Plan (Tier 3, Technical Appendix 2T); • Hazardous Materials Management Plan(Tier 3, Technical Appendix 2U); • Conceptual Fisheries Offsetting Plan (Tier 3, Technical Appendix 5L); • Aquatic Effects Monitoring Plan (Tier 3, Technical Appendix 5M); • Construction to occur outside spawning and rearing periods (Tier 2, Volume 5, Section 11.5,Tier 3, Technical Appendix 5O); • Construction to follow BMP's (Tier 3, Technical Appendix 5O); • Conceptual Sediment and Erosion Control Plan (Tier 3, Technical Appendix 5O); • Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B); • Emergency Response Plan (Tier 3, Technical Appendix 10C).	• The proposed water treatment process for the Sissons site has been selected to meet MMER and site-specific effluent criteria and, also, to maintain the annual contaminant mass load of discharges to Judge Sissons Lake below a potential threshold of concern based on aquatic life criteria(Tier 3, Technical Appendix 2I).; • Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements (Tier 3, Appendix 2U, Section 7.1); • Any incidents involving hazardous materials will be investigated and communicated to employees and regulators through an internal reporting system. Spills will be cleaned up in a timely manner and the area surrounding the spill will be checked to ensure all contamination is removed (Tier 3, Appendix 2U); • Water quality will be monitored in the receiving environment to verify effects predictions and as part of the required monitoring under MMER. Water quality in each section of Judge Sissons Lake receiving treated effluent (exposure areas), as well as at the outlet of Judge Sissons Lake, will be monitored on a seasonal basis to verify effects predictions related to changes in water quality for a period of one to two years (Tier 3, Technical Appendix 5M); • Water quality in lakes and streams adjacent to and downstream of the Mine site LAA will be monitored to confirm that metals and radionuclide concentrations, TSS and acid deposition, as well as lake acidification are not increasing above predicted or acceptable levels due to air emissions and the deposition of dust from Project related activities (Tier 3, Technical Appendix 5M).; • Monitoring of sediment quality in Judge Sissons Lake every (Tier 3, Technical Appendix 5M); • Sediment quality monitoring in lakes adjacent to and downstream of the Mine LAA (Tier 3, Technical Appendix 5M); • Sub-lethal toxicity testing of effluent Twice each calendar year for the first three years to fulfill EEM program (Tier 3, Technical Appendix 5M); • Monitoring of fish growth, reproduction, condition, and survival in exposure areas of Judge Sissons Lake as well as in reference areas (Tier 3, Technical Appendix 5M); • Monitoring of mercury concentrations and other COPCs in fish tissues in exposure areas of Judge Sissons Lake as well as in reference areas (Tier 3, Technical Appendix 5M); • Contingency Conceptual Fisheries Offsetting (Tier 3, Technical Appendix 5L); • Water crossing structures will be monitored so that maintenance activities can be tailored to reduce any potential erosion and maintain water passage (Tier 3,Appendix 5O); • In-water work will be minimized, however if these activities mobilize notable sediment, a turbidity curtain will be installed to contain sediment, fish will be salvaged within the confined areas, and turbidity in the stream will be monitored (Tier 3, Technical Appendix 5O); • After a spill response, monitoring the spill area will be done to ensure all contaminated material has been removed (Tier 3, Technical Appendix 10B).

Project Activities (a)	Pathway of Effects (b)	Mitigation Measures	Monitoring and Additional Measures to Mitigate Effects
All-Weather Road	**Land-based activities:** • vegetation clearing; • cleaning or maintenance of bridges or other structures; • excavation; • grading; and, • use of industrial equipment. **In-water activities:** • removal of aquatic vegetation; • organic debris management; • fish passage issues; • placement of material or structures in water; • structure removal; • water extraction; and, • change in timing, duration and frequency of flow.	• Water Management Plan (Tier 3, Technical Appendix 2I); • Roads Management Plan (Tier 3, Technical Appendix 2M); • Environmental Management Plan (Tier 3, Technical Appendix 2T); • Hazardous Materials Management Plan (Tier 3, Technical Appendix 2U); • Conceptual Fisheries Offsetting Plan (Tier 3, Technical Appendix 5L); • construction to follow BMP's (Tier 3,Appendix 5O); • Construction to occur outside spawning and rearing periods (Tier 3, Volume 5, Section 11.5,Tier 3, Technical Appendix 5O); • Conceptual Sediment and Erosion Control Plan (Tier 3, Technical Appendix 5O) ; • Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B); • Emergency Response (Tier 3, Appendix 10C).	• Water for preparation of the winter access road will be withdrawn from lakes, no more than 10% of the under-ice volume (DFO 2010b) will be withdrawn from a lake during one ice covered season(Tier 3, Technical Appendix 2I, Section 6.3.1).; • Prior to the start of construction activities for the winter road, actual ground temperatures will be monitored (Tier 3, Technical Appendix 2M, Section 4.1.5).; • Roads and stream crossings will be inspected regularly for signs of degradation and maintenance requirements are met (Tier 3, Technical Appendix 2M, Section 7.1).; • During Project operations culvert monitoring will be carried out to confirm fish passage if fish are present and verify that erosion and sediment control measures are functioning as intended(Tier 3, Appendix 5O).; • Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements (Tier 3, Technical Appendix 2U, Section 7.1).; Contingency Conceptual Fisheries Offsetting (Tier 3, Technical Appendix 5L); • Monitoring of locations prone to ice jamming (i.e., culvert crossings along the Kiggavik-Sissons haul road) and removal of ice jams, if necessary, would be completed to ensure that potential ice blockages at stream crossings do not cause the overlying road to wash out. (Tier 3, Technical Appendix 5M, Section 6.5); • Water crossing structures will be monitored so that maintenance activities can be tailored to reduce any potential erosion and maintain water passage (Tier 3,Appendix 5O); • In-water work will be minimized, however if these activities mobilize notable sediment, a turbidity curtain will be installed to contain sediment, fish will be salvaged within the confined areas, and turbidity in the stream will be monitored (Tier 3, Technical Appendix 5O); • Any incidents involving hazardous materials will be investigated and communicated to employees and regulators through an internal reporting system. Spills will be cleaned up in a timely manner and the area surrounding the spill will be checked to ensure all contamination is removed (Tier 3, Technical Appendix 2U; Tier 3, Technical Appendix 10B).

(a)Detailed description on projects activities provided in Tier 2, Volume 2
(b)Provided in Attachment A

3.1 Baker Lake Dock Site

The approach and steel piles of the proposed temporary spud barge dock is expected to cover an area of approximately 100 m^2. A section of road to connect the dock facility to the existing road network will be required. Baker Lake supports a CRA fishery and potential effects to fish and fish habitat from the dock and associated barge traffic were issues of concern identified during stakeholder engagement (EN-CH NIRB May 2010).

In addition to assessments completed for the EIS, activities associated with dock construction and decommissioning were also assessed in terms of the Pathways of Effects (DFO 2010a, internet site: Attachment A) for potential impacts to fish and fish habitat. The Pathways of Effects relevant to the barge dock in Baker Lake include vegetation clearing, excavation, grading, use of industrial equipment, removal of aquatic vegetation, organic debris management, placement of material or structures in water, and structure removal.

In-water and shoreline structures associated with the Baker Lake dock will be removed during Project closure. Disturbed areas will be restored to pre-Project conditions as much as possible to re-establish pre-development drainage areas and flow directions.

3.1.1 Land-based Activities

Vegetation clearing, excavation, grading and use of industrial equipment are land-based activities anticipated to occur during the construction of the dock facility (Table 3-1). Implementation of the proposed mitigation measures, BMPs and environmental monitoring during construction is expected to minimize potential effects to fish habitat, such that use of the area by fish will not be inhibited. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Excavation and grading activities are likely to occur during the construction of the dock facility as well as during the construction of the connecting road to the supplies and materials storage area. Best Management Practices (BMPs) will be incorporated into construction activities. Erosion and sediment control measures will be used when working near water (Tier 3, Volume 5, Appendix 5O). Excavation activities are not expected to alter groundwater flows. Riparian vegetation is likely to be disturbed during construction activities; however, incidental impacts are expected to be of small spatial scale and temporary in duration. Change in water temperature, habitat structure and cover, sediment concentrations, and nutrient concentrations associated with land-based construction and operations activities is expected to be negligible.

Industrial equipment used during the construction of the temporary spud dock will be mobile and will be removed from the area once construction is complete. Therefore, the “Use of mobile industrial equipment" Pathways of Effects is considered applicable to the assessment of residual serious harm to fish (Attachment A). The use of industrial equipment to construct the dock is expected to be of small spatial scale and temporary in duration. Construction activities are to follow standard protocols and best management practices (BMP's) (Tier 3, Technical Appendix 5O). Use of oil, grease and fuel in mobile equipment will be managed under the Hazardous Materials Management (Tier 3, Technical Appendix 2U), Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B) and Emergency Response (Tier 3, Technical Appendix 10C) Plans developed for the Project. A number of mitigation and avoidance measures described in these plans are expected to minimize potential serious harm to fish that could result from effects pathways identified under "Oil, grease and fuel leaks from equipment" (Attachment A).

3.1.2 In-water Activities

In-water activities include the removal of aquatic vegetation, organic debris management and placement and removal of material or structures in water. Implementation of the proposed mitigation measures, BMPs and monitoring during construction is expected to minimize potential effects to fish habitat, such that use of the area by fish will not be inhibited. Mitigation measures, environmental monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Incidental removal of aquatic vegetation may result from in-water works. Vegetation removal is not intentional, therefore impacts are expected to be of small spatial scale and temporary in duration. "Change in light penetration and nutrient inputs "Pathways of Effects are unlikely to occur. Removal of in-water organic debris, changes in bank stability and exposed soils result in any residual serious harm to fish are unlikely to occur. Change in Pathway of Effects "water temperature, habitat structure and cover, sediment concentration, nutrient concentrations, aquatic food supply and contaminant concentrations" (Attachment A) are expected to be negligible to non-existent. Erosion and sediment control measures and BMPs (Tier 3, Volume 5, Appendix 5O) will limit the potential for deposition of eroded soils into the aquatic environment.

Placement and removal of the steel spud barge piles may result in minor fish habitat alterations. The addition of fill to construct an approach to the barge dock may alter the slope and stability of the shoreline however it is anticipated that the amount of fill required to facilitate construction and operation of the dock will have a very small footprint (Tier 2, Volume 2, Section 10.3.5). Minor disturbance of sediments during construction activities is expected, however erosion and sediment control measures and BMPs (Tier 3, Volume 5, Appendix 5O) will be implemented to isolate sediment releases close to their sources. Changes in water temperature, sediment concentration, nutrient concentrations, aquatic food supply and contaminant concentrations are expected to be negligible. Change in shoreline morphometry and aquatic vegetation is also expected to be minimal.

Limited fish habitat disturbance is anticipated during the placement and removal of the steel piles and will be temporary in duration. Construction activities will be scheduled to occur outside spring spawning and rearing period (Tier 3, Volume 5, Section 11.5), therefore no associated serious harm to fish is anticipated. Changes in Pathway of Effects related to “total gas pressure, salinity, and water temperature” (Attachment A) are expected to be non-existent. Pathway of Effects related to “incidental entrapment, impingement or mortality of resident species” (Attachment A) may occur incidentally during construction activities, however every effort will be made to prevent this occurring. Minor change in habitat structure and cover is anticipated, however the overall impact to the CRA fisheries is expected to be negligible.

3.1.3 Conclusion

Proposed Project activities during the construction, operations and closure phases of the Baker Lake dock facility are not anticipated to be of sufficient magnitude, extent or duration to affect the ongoing maintenance or productivity of CRA fisheries. Any changes to fish habitat are expected to be of small spatial scale and temporary in duration, therefore no loss of unique or critical habitat is expected.

3.2 Winter Road and Site Access Roads

The initial winter road will be from Baker Lake to the Pointer Lake airstrip. This initial road would be 99 km in length, approximately, half of which is over land. Normal widths of the road across lakes will be between 48 m and 55 m (Tier 2, Volume 2). Water for preparation of the winter access road will be withdrawn from lakes of substantial volume along the route. Approaches along shorelines will be built up using ice ramps to reduce the potential for erosion or sediment transport.

A 19.6 km all-season road is required to connect mining operations at the Sissons mine site (End Grid and Andrew Lake area) to the main Kiggavik mine/mill site (Tier 3, Technical Appendix 2G). A number of other site roads will be required, including:

- Kiggavik site to Judge Sissons Lake, along the treated mill effluent discharge pipeline alignment. This road passes the airstrip and therefore it includes airstrip access;
- Sissons site to Judge Sissons Lake, along the treated mill effluent discharge pipeline alignment;
- Sissons site to Mushroom Lake along the proposed freshwater withdrawal pipeline alignment; and,
- Access from Kiggavik site to Siamese Lake is along the final portion of the Baker Lake winter road route (Tier 2, Volume 2).

In addition to assessments completed for the EIS, activities associated with road construction and decommissioning were assessed in terms of the Pathways of Effects (DFO 2010a, internet site;

Attachment A) for potential impacts to fish and fish habitat (Table 3-1). The Pathways of Effects relevant to the winter road and all-season site access roads include vegetation clearing, cleaning or maintenance of bridges or other structures, excavation , grading, use of industrial equipment, removal of aquatic vegetation, organic debris management, fish passage issues, placement of material or structures in water, structure removal, water extraction, change in timing, duration and frequency of flow.

In-water and shoreline structures associated with winter road and all-season site access roads will be removed during Project closure. Disturbed areas will be restored to pre-Project conditions as much as possible to re-establish pre-development drainage areas and flow directions.

3.2.1 Land-based Activities

Vegetation clearing, cleaning or maintenance of bridges or other structures, excavation, grading, and use of industrial equipment are land-based activities likely to occur during the construction of the winter road and site access roads (Table 3-1). Implementation of the proposed mitigation measures, BMPs and environmental monitoring during construction is expected to minimize potential effects to fish habitat, such that use of the area by fish will not be inhibited. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Excavation and grading activities will occur during the installation of culverts or coffer dams at stream crossings as well as during the construction of the road. Best Management Practices (BMPs) will be incorporated into stream crossing designs (Tier 3, Volume 5, Appendix 5O). Culverts will be installed in the dry and/or outside DFO's restricted activity timing windows. Work areas will be isolated from flowing water by placing cofferdams at the upstream and downstream ends of the work areas. Erosion and sediment control measures will be implemented during stream crossing installation (Tier 3, Volume 5, Appendix 5O). Excavation activities are not expected to alter groundwater flows. Riparian vegetation is likely to be disturbed during construction activities; however, incidental impacts are expected to be of small spatial scale and temporary in duration. Changes in water temperature, habitat structure and cover, sediment concentrations, and nutrient concentrations are expected to be negligible.

Mobile industrial equipment used will be removed from the area once construction is complete. Construction activities will follow standard protocols and BMP's (Tier 3, Technical Appendix 5O). Use of oil, grease and fuel in mobile equipment will be managed under the Hazardous Materials Management (Tier 3, Technical Appendix 2U), Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B) and Emergency Response (Tier 3, Technical Appendix 10C) plans developed for the Project. Mitigation and avoidance measures described in these plans are expected to minimize potential serious harm to fish that could result from effects pathways identified under "Oil, grease and fuel leaks from equipment" (Attachment A).

Maintenance of roads, culverts and bridges will be required throughout the life of the project. Pathway of Effects for cleaning or maintenance of bridges or other structures communicates change in sediment concentrations and change in contaminant concentrations as potential effects. Construction activities will follow standard protocols and BMP's (Tier 3, Technical Appendix 5O). Use of oil, grease and fuel in mobile equipment will be managed under the Hazardous Materials Management (Tier 3, Technical Appendix 2U), Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B) and Emergency Response (Tier 3, Technical Appendix 10C) plans that were developed for the Project. A Conceptual Erosion and Sediment Control Plan for the Project is included in EIS Tier 3, Technical Appendix 5O. Mitigation and avoidance measures described in these plans are expected to minimize potential serious harm to fish to negligible levels.

3.2.2 In-water Activities

In-water activities include the following Pathways of Effects: removal of aquatic vegetation, organic debris management, fish passage issues, placement and removal of material or structures in water, water extraction, and change in timing, duration and frequency of flow (Table 3-1). Implementation of proposed mitigation measures, BMPs and environmental monitoring during construction is expected to minimize potential effects to fish habitat, such that use of the areas by fish will not be inhibited. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Incidental removal of aquatic vegetation may occur as a result of in-water works, however impacts are expected to be of small spatial scale and temporary in duration. "Change in light penetration and nutrient inputs" Pathways of Effects are un-likely to occur. Any removal of in-stream organic debris, or changes in bank stability and exposed soils, are unlikely to result in residual serious harm to fish supporting CRA fisheries. Changes in Pathway of Effects "water temperature, habitat structure and cover, sediment concentration, nutrient concentrations, aquatic food supply, and contaminant concentrations" (Attachment A) are expected to be negligible to non-existent. Sediment and erosion control measures and BMPs (Tier 3, Volume 5, Appendix 5O) will reduce the potential for eroded soils and control deposition of eroded soil to the aquatic environment.

Placement and removal of material or structures in water, and change in timing, duration and frequency of flow are activities likely to occur during culvert, coffer dam and bridge installation. Installation at most stream crossings will be completed during summer and most culverts will be installed in the dry. Cofferdams will be placed at the upstream and downstream ends of the work area to isolate crossing installation from flowing waters. In these cases, water will be pumped around the work area and released downstream. Small rip rap energy dissipaters will be constructed at the pump outlet to minimize erosion of the channel bottom. Pump intakes will be fitted with an appropriately-sized screen, as required by the DFO End-of-Pipe Fish Screen Guidelines (DFO 1995). If flows are too large to be effectively managed by pumping, a temporary bypass channel may be constructed to isolate the work area from flow. AREVA is confident that all stream crossings can be constructed within DFO's timing windows for in-water works. The Project is located in Fish Timing Zone 2, where in-water construction activities are not permitted from May 1 to July 15 to protect spring-spawning fish and fish habitat during the sensitive spawning and incubation periods (DFO 2013a; internet site). For waterbodies where fall-spawning species occur, in-water work is not permitted between August 15 to June 30. If both spring- and fall-spawning species are present. the in-water work exclusion period is from August 15 to the following July 15. In streams that are not fish-bearing, construction will proceed throughout the summer months, as determined by the construction schedule. The appropriate timing windows will be selected for each stream crossing based on the results of the fish inventory surveys completed between 2008 and 2010 (for streams that were flowing) and the historical data (Tier 3, Technical Appendix 5C). Most sampled streams contained spring spawning species only. Changes in food supply, sediment concentrations, nutrient concentrations, contaminant concentrations, and migrations patterns is expected to be negligible. Change in habitat structure and cover may occur during construction activities, however are anticipated to be temporary in duration and small in size.

Fish passage issues are not anticipated during construction however if issues do arise they will likely occur during culvert, coffer dam and bridge installation. All culverts will be designed to pass 1:100 year peak discharge flows. Culverts on streams used by fish, or assumed to be used by fish, are designed to meet velocity-based fish passage criteria during a 1:10 year 3-day delay flow. These culverts are designed with a large end area to limit flow constriction and support fish passage. The culverts are also larger than what is typically required for conveyance of a 1:100 year flow. Plans for monitoring fish passage at stream crossings are incorporated into the Aquatic Effects Monitoring Plan (Tier 3, Technical Appendix 5M). Visual inspections will be carried out at all stream crossings (including those on non-fish-bearing streams) before the start of spring runoff to confirm that culverts are not blocked by ice or debris. Monitoring of fish passage will focus on crossings of fish-bearing streams where culvert installation is proposed (Tier 3, Technical Appendix 5C). Because bridges will be built above the ordinary high water mark and are not anticipated to interfere with fish passage, no monitoring of fish passage is planned at watercourses crossed by bridges (Tier 3, Technical Appendix 5M).

Water extraction for the construction of the winter road will follow all applicable withdrawal rates recommended by DFO guidelines for protection of fish habitat. Specifically, no more than 10% of the under-ice volume will be withdrawn from a lake during one ice covered season (DFO 2010b). Pump intakes will be fitted with an appropriately-sized screen, as required by the DFO End-of-Pipe Fish Screen Guidelines (DFO 1995).

3.2.3 Conclusion

Proposed Project activities during the construction, operations and closure phases of the winter road and all-season site access roads are not anticipated to be of sufficient magnitude, extent or duration to affect the ongoing productivity of CRA fisheries. Any changes to fish habitat are expected to be of small spatial scale and temporary in duration. No loss of unique or critical habitat is expected.

3.3 Freshwater Diversion Channels

Freshwater diversion channels will influence Mushroom/End Grid Stream include; Mushroom and End Grid lakes, the middle section of the northeast inflow to Pointer Lake, the top section of a tributary to the northeast inflow of Pointer Lake, and the top section of the northwest inflow to Pointer Lake (Pointer Lake tributaries) (Tier 3, Volume 3, Technical Appendix 2E). Mushroom/End Grid Stream and Mushroom and End Grid lakes, are not considered traditional fishing areas (Figure 1). However, fish that use these areas on a seasonal basis also access habitats in Judge Sissons Lake during winter. Judge Sissons Lake is considered a traditional fishing area. Therefore, fish and seasonal-use habitats identified in Mushroom/End Grid Stream may potentially contribute to a CRA fishery. The stream sections proposed for stream diversion at the Kiggavik site do not contain fish habitat or fish communities that contribute to the productivity of a fishery.

Permanent diversion of the middle and lower sections of Mushroom – End Grid Stream around the proposed Sissons mine site infrastructure would likely result in loss of seasonal fish passage during the spring freshet between End Grid and Mushroom lakes (Tier 3, Volume 3, Technical Appendix 2E). As part of mitigating flow effects in Mushroom-End Grid Stream, a flow diversion channel is proposed to carry flows around the Sissons Mine Site and return them to End Grid Lake and the rest of the Lower Lake drainage system. In order to mitigate the potential loss of fish passage between Mushroom and End Grid lakes, and maintain the productivity of this drainage system for use by existing and future CRA fisheries, the diversion channel will be designed and constructed to facilitate fish passage. This proposed mitigation is anticipated to fully maintain the productivity of affected CRA fisheries.

In order to enhance the channel's use by fish, the diversion channel will be designed to provide more diversified fish habitat than is present in the current natural channel. This includes concentrating water flows in a single channel to prolong the duration of runoff flows having sufficient depth for fish to safely and effectively pass. This applies to both upstream spawning migrants and young-of-the-year fish drifting downstream to overwintering habitat. In addition, placement of boulder structures within the diversion channel will improve fish passage conditions, and resting and rearing areas will be constructed within the new stream channel to enhance its value to fish supporting local CRA fisheries, resulting in an enhancement to local CRA fisheries.

Follow-up monitoring will be carried out after diversion channel construction to confirm that flow and channel conditions are suitable for fish passage, and that fish are able to ascend the newly constructed diversion channel if they wish.

In addition to assessments completed for the EIS, activities associated with freshwater diversion channels at the Mushroom/End Grid stream diversion and Kiggavik Site stream diversions were assessed in terms of the Pathways of Effects (DFO 2010a, internet site; Attachment A) for potential impacts to fish and fish habitat (Table 3-1). The Pathways of Effects relevant to the freshwater diversion channels include vegetation clearing, excavation, use of explosives, grading, use of industrial equipment, removal of aquatic vegetation, organic debris management, fish passage issues, placement of material or structures in water, structure removal, water extraction, change in timing, duration and frequency of flow .

In-water and shoreline structures associated with the freshwater diversion channels will be removed during Project closure. Disturbed areas will be restored to pre-Project conditions as much as possible to re-establish pre-development drainage areas and flow directions.

3.3.1 Land-based Activities

Vegetation clearing, excavation, use of explosives, grading, and use of industrial equipment are land-based activities expected to occur during construction of the freshwater diversion channels (Table 3-1). Implementation of proposed mitigation measures, BMPs and environmental monitoring during construction is expected to minimize potential effects to fish habitat, such that use of the area by fish will not be inhibited. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Vegetation clearing may occur as an incidental disturbance during construction activities, however impacts are expected to be of small spatial scale and temporary in duration. “Change in water temperature, habitat structure and cover, sediment concentrations and nutrient concentrations” Pathways of Effects (Attachment A) are expected to be negligible to non-existent.

Excavation and grading activities will occur during construction of the freshwater diversion channels. During construction of the stream diversion, excavation depths will be minimized, and a minimum channel invert gradient of 0.2 percent (%) will be adopted to facilitate drainage (Tier 2, Volume 2). Erosion control measures (Tier 3, Technical Appendix 5O) will be implemented to isolate sediment and soil releases close to their sources. Measures may include the use of silt fences, check dams and revegetation. Riprap armouring and geo-textile may be used to stabilize channel bottoms and slopes, if required (Tier 3, Technical Appendix 2E). These measures are expected to minimize effects associated with the “Removal of topsoil”, “Bank stability and exposed soils” and “Change in slope or drainage” Pathways of Effects (Attachment A). No residual serious harm to fish is expected to result from these Pathways of Effects. Because the Project area is characterized by low levels of rainfall (NRCAN 2009; internet site), and groundwater inflows are expected to be negligible, it is anticipated that excavation areas will not require dewatering during construction. Therefore Pathways of Effects associated with dewatering (Attachment A) are interrupted, and no associated serious harm to fish is anticipated. No interaction between groundwater flows, surface water and excavation is expected to occur as part of diversion channel construction. Therefore, “alteration of groundwater flows to surface water” Pathways of Effects do not apply to excavation activities.

The use of explosives to facilitate the construction of the diversion channel between the upstream portion of the Mushroom/End Grid stream and End Grid Lake may be required and will be determined at the Fisheries Authorization stage. In addition, BMPs to reduce or mitigate effects on fish will be determined and presented at that stage. The may include blasting and diversion channel construction during portions of the year when no fish are present in Mushroom/End Grid stream or during winter when the stream is frozen to the substrate. No blasting or in-water construction will occur during the spring closed in-water work timing window. Smaller charges will be used that do not produce, or is likely to produce, an instantaneous pressure charge (i.e. overpressure) greater than 50 kPa in the swimbladder of a fish (Tier 2, Volume 2). Mitigation measures are expected to reduce “change in nutrient, contaminant and sediment concentrations and lethal or sublethal effects on fish” Pathways of Effects (Attachment A) to negligible levels.

Mobile industrial equipment will be removed from the area once construction is complete. Construction activities will follow standard protocols and BMP’s (Tier 3, Technical Appendix 5O). Use of oil, grease and fuel in mobile equipment will be managed under the Hazardous Materials Management (Tier 3, Technical Appendix 2U), Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B) and Emergency Response (Tier 3, Technical Appendix 10C) plans that developed for the Project. Mitigation and avoidance measures described in these plans are expected to minimize potential serious harm to fish that could result from effects pathways identified under “Oil, grease and fuel leaks from equipment” (Attachment A).

Due to timing construction to avoid the presence of fish/eggs/ova within the streams, the “potential mortality of fish/eggs/ova from equipment” Pathway of Effects is not expected to result in residual serious harm to fish (Attachment A). Construction activities will be completed outside the spring closed in-water work timing window, when fish are unlikely to be found in the area (Tier 2, Volume 5, Section 11; Tier 3, Volume 5, Appendix 5C). Therefore, operation of mobile industrial equipment is not anticipated to result in fish mortality at the diversion locations.

3.3.2 In-water Activities

In-water activities include the removal of aquatic vegetation, organic debris management, fish passage issues, placement and removal of material or structures in water, and change in timing, duration and frequency of flow (Attachment A) (Table 3-1). Implementation of proposed mitigation measures, BMPs and environmental monitoring during construction is expected to minimize potential effects to fish habitat, such that use of the areas by fish will not be inhibited. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Removal of aquatic vegetation during construction activities will result in a change of habitat structure and cover. Changes in bank stability and exposed soils will be mitigated so that they are unlikely to result in any residual serious harm to fish. Erosion and sediment control measures and BMPs (Tier 3, Volume 5, Appendix 5O) will limit the potential for deposition of eroded soil in the aquatic environment. Changes in "water temperature, sediment concentration, nutrient concentrations, aquatic food supply and contaminant concentrations" Pathway of Effects (Attachment A) are expected to be negligible to non-existent.

The middle and lower portion of the Mushroom/End Grid Stream that will be diverted to allow for construction of the Sissons mine site is currently used for fish passage during the spring freshet only (Tier 3, Volume 5, Appendix 5C). Flows after spring freshet are too shallow for fish to pass. Maintenance of fish passage was a consideration in the diversion design (Tier 3, Volume 3, Technical Appendix 2E, Section 5.1), and will be achieved by constructing a diversion channel between the upper section of the Mushroom/End Grid Stream and End Grid Lake. It is believed that the constructed section of the diversion channel does offer an opportunity to improve fish passage with an engineered design that slows velocities and offers more diversified stream habitat along with resting areas. The anticipated decrease in flow velocity is expected to help minimize effects associated with "attraction flows/flow barriers" (Attachment A). It is anticipated that a cross-drainage structure consisting of a corrugated steel pipe (CSP) will be required for the road crossing on diversion channel S1; however, the CSP will be designed to meet fish passage criteria and not create a velocity barrier.

The stream diversions will likely be constructed during late summer or fall, after fish have left the stream system to return to overwintering lakes (Tier 2, Volume 5, Section 11). Because fish will not be in the stream during this period, construction will not obstruct fish passage. In spring, when flows in the stream are sufficiently large to support fish passage, fish will be able to move upstream and downstream via the S1 diversion channel. If diversion construction must take place when fish are still the system, fish barriers will be installed in the stream and appropriate non-lethal fish capture methods (i.e., electrofishing, seining) will be used to salvage fish from the in-water work areas. This will reduce incidental entrainment, impingement, or mortality of fish in the stream (Attachment A). Captured fish will be live-transferred to Mushroom Lake, the closest over-wintering lake in the watershed. Therefore, the "obstruction" Pathways of Effects (Attachment A) will not apply to stream diversion and are therefore not anticipated to result in residual serious harm to fish. The Mushroom and End Grid lakes will be re-connected via the freshwater diversion channel S1 (Tier 3, Volume 2, Technical Appendix 2E), no inter-basin transfer of fish species will occur (Attachment A).

Construction of the diversion channels on the Pointer Lake tributary streams is not linked to fish passage. Fish were not found during the fish surveys of the Pointer Lake tributary streams that are proposed for diversion; existing barriers to fish movement likely prevent fish access to the proposed construction area (Tier 3, Volume 5, Appendix 5C). Construction design and proposed mitigation measures are expected to reduce flow alteration Pathway of Effects to levels that will not result in residual serious harm to fish. The "Changes in water chemistry and water temperature", Pathways of

Effects (Attachment A), as well as their applicable sub-pathways (e.g., "Changes in thermal cues or temperature barriers) are not expected to apply to the construction of diversion channels.

Placement of fill in the natural stream channels will result in a "complete constriction of flow" Pathway of Effects, water will need to be re-directed into the freshwater diversion channels, and then finally into End Grid Lake and Pointer Lake respectively (Tier 2, Volume 2). Changes to the timing, duration and frequency of flow Pathway of Effects may result (Attachment A). Dewatering and in-filling (Tier 2, Volume 2) of the natural channel could affect the timing, duration and frequency of flows between Mushroom, End Grid and Pointer lakes. However, it is anticipated that measures associated with the construction and operation of the diversion channels will minimize effects to fish and fish habitat. Dewatering and in-filling activities are expected to occur outside the spring freshet period (i.e., in late summer or fall). This is expected to mitigate potential effects to fish migration (Attachment A). In late summer and fall, water depths within the downstream section of Mushroom/End Grid Stream and the three Pointer Lake tributaries are too shallow to support fish migration. In winter, these section freezes to the bottom (Tier 3, Volume 5, Appendix 5C). It is unlikely that fish displacement or stranding will occur as a result of construction and dewatering activities. Because the diversion channels has been designed to support fish passage (Tier 2, Volume 2; Tier 3, Volume 3, Technical Appendix 2E), it is anticipated that fish will be able to access traditional areas during the spring freshet period immediately following construction.

If diversion work cannot take place after fish have left the system for over-wintering areas, fish barriers will be installed in the stream and appropriate non-lethal fish capture methods (i.e., electrofishing, seining) will be used to capture fish from the in-water work areas. Therefore, migration patterns and access to habitats are not expected to change relative to current conditions. Subsequently, no residual serious harm to fish is expected to result from "Dewatering", "Displacement or stranding of fish" or a "Change in migration/access to habitats" (Attachment A).

"Scouring of channel beds" (Attachment A) was identified as a potential issue that could occur in the diversion channels due to the re-routing of flow. However, if peak flow velocities within the newly constructed channel exceed soil material resistance, geotextile and an upper layer of riprap armouring will be placed on the channel bottom and side slopes (Tier 3, Volume 3, Technical Appendix 2E). Hydraulic models will be used to determine the appropriate median diameter of the riprap to resist the flow velocity; lift thickness will be equal to approximately 1.5 times the median particle diameter (Tier 3, Volume 3, Technical Appendix 2E). These measures will minimize the amount of scouring and sediment transport that could occur in the newly constructed diversion channel (Nishi-Khon/SNC-Lavalin 1999). Therefore, no residual serious harm to fish is expected to result from the "Scouring of channel beds" Pathways of Effects (Attachment A).

The "Change in water temperature", "Change in contaminant concentrations" and "Change in nutrient concentrations" Pathways of Effects (Attachment A) were assessed. The Effects Assessment for Water Quality (Tier 2, Volume 5, Section 8) indicates that no long-term or large scale changes to surface water quality are expected to result from construction of freshwater diversion channels, and no residual environmental effects are anticipated. Subsequently, residual serious harm to fish is unlikely to occur.

Where possible, in-water and shoreline structures associated with the diversions will be removed during Project closure, pre-development drainage areas and flow directions re-established. The abandoned section of diversion channels will be backfilled and graded to blend in with the surrounding landscape (Tier 3, Volume 3, Technical Appendix 2R). Because pre-development flow conditions will be restored as much as possible, the "change in flow regime" and "change in channel morphology or shoreline morphometry" Pathways of Effects are not likely to be associated with any measurable serious harm to fish.

3.3.3 Conclusion

Proposed Project activities during the construction, operations and closure phases of the freshwater diversion channels facility are not anticipated to be of sufficient magnitude, extent or duration to affect the ongoing maintenance or productivity of CRA fisheries. Any changes to fish habitat are expected to be of small spatial scale and temporary in duration, therefore no loss of unique or critical habitat is expected.

3.4 Dewatering of Andrew Lake

During mine development at the Sissons site, the north-east portion of Andrew Lake will be bermed-off and dewatered to provide access to the associated ore deposit. Approximately 135,000 m^2 (13.5 ha) of lake area, or approximately 30,000 m^3 of volume, will need to be dewatered to provide adequate buffer between the pit edge and the dyke. The 650 m long berm across the northeast end of Andrew Lake will require that 0.065 ha of riprap be installed along the lakeward edge to protect it from wave and water erosion. Andrew Lake is a shallow lake, with a maximum depth of 1 m and average depth of 0.2 m, aquatics studies have indicated that small fish frequent the lake and, therefore, the dyked area will be fished-out prior to dewatering. Construction of the berm at Andrew Lake and dewatering the north-east end of the lake will result in the loss of approximately 13.5 ha of shallow (less than 1.0 m deep), seasonal use (open-water season) fish rearing and foraging habitat. Fish that use this habitat are thought to originate from and contribute to the CRA fishery in Judge Sissons Lake.

Andrew Lake does not support fish overwintering as it freezes to the bottom during winter. Andrew Lake is reported to support a number of fish species during the open water season, including Arctic grayling, burbot, cisco, and round whitefish (Table 1-1). Andrew Lake does not contain suitable substrates for Arctic grayling spawning, however suitable spawning areas have been documented in the inflow stream above Andrew Lake, as well as in the outlet stream just downstream of Andrew Lake. The presence of burbot, cisco, and round whitefish (all winter or fall spawning species) in

Andrew Lake during the brief open-water season must be attributable to use of the lake for foraging purposes, likely on juvenile Arctic grayling. Due to the presence of these predatory species in Andrew Lake, it is unlikely that it is an important rearing area for Arctic grayling.

Because the Arctic grayling spawning areas in the stream upstream and downstream of Andrew Lake will be protected from Project disturbance through avoidance (upstream spawning area) and mitigation (downstream spawning area), the overall effect to the Arctic grayling population in Judge Sissons Lake is considered to be negligible, and no residual serious harm to fish will occur.

The dewatering of Andrew Lake was assessed in terms of the Pathways of Effects (DFO 2010a, internet site; Attachment A) for potential impacts to fish and fish habitat (Table 3-1). The Pathways of Effects relevant to the dewatering of Andrew Lake include: vegetation clearing, excavation, grading, use of industrial equipment, removal of aquatic vegetation, organic debris management, placement of material or structures in water, water extraction, change in timing, duration and frequency of flow.

In-water and shoreline structures associated with dewatering of Andrew Lake will be removed during Project closure. During the final closure phase, water will be pumped from Judge Sissons Lake to flood the Andrew Lake Pit.

3.4.1 Land-based Activities

Vegetation clearing, excavation, grading, and use of industrial equipment are activities anticipated to occur during the dewatering of Andrew Lake (Table 3-1). Implementation of the proposed mitigation measures, BMPs and monitoring during construction is expected to minimize potential effects to fish. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Vegetation clearing during construction activities is expected to alter riparian vegetation, remove organic structure and change habitat structure and cover (Attachment A). Changes in water temperature, habitat sediment concentrations, and nutrient concentrations" Pathways of Effects (Attachment A) are expected to be negligible to non-existent with BMP's and mitigation measures in place (Table 3-1), and are not likely to be associated with any measurable serious harm to fish.

Excavation activities for the construction of the dyke involves removing rockfill and lakebed soils from the embankment crest to an approximate depth of 1 m below lakebed and exposing competent foundation soils for the till zone along the alignment(Tier 2, Volume 2). The excavation would have a minimum base width of 5 m (Tier 2, Volume 2). "Creation of trench" Pathway of Effects (Attachment A) and dewatering a portion of Andrew Lake will impact water temperature and habitat structure and cover (Attachment A). Best management practices and erosion control measures (Tier 3, Technical Appendix 5O) will be implemented to isolate sediment and soil releases close to their sources therefore change to sediment concentrations should be negligible.

Mobile industrial equipment will be removed from the area once construction is complete. Construction activities will follow standard protocols and BMP's (Tier 3, Technical Appendix 5O). Use of oil, grease and fuel in mobile equipment will be managed under the Hazardous Materials Management (Tier 3, Technical Appendix 2U), Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B) and Emergency Response (Tier 3, Technical Appendix 10C) plans developed for the Project. Mitigation and avoidance measures described in these plans are expected to minimize potential serious harm to fish that could result from effects pathways identified under "Oil, grease and fuel leaks from equipment" (Attachment A). Therefore, it is anticipated that any spills or leaks will be managed before impacts to fish habitat and fish health can occur.

3.4.2 In-water Activities

In-water activities include the removal of aquatic vegetation, and placement of material or structures in water, water extraction and change in timing, duration and frequency of flow (Table 3-1; Attachment A). Implementation of the proposed mitigation measures, BMPs and environmental monitoring during construction is expected to minimize potential effects to fish. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Incidental removal of aquatic vegetation during construction activities may occur and result in a change of habitat structure and cover. Changes in bank stability and exposed soils are unlikely to result in residual serious harm to fish. Sediment and erosion control measures and BMPs (Tier 3, Volume 5, Appendix 5O) will limit the potential deposition of eroded soil in aquatic environment. Changes in "water temperature, sediment concentration, nutrient concentrations, aquatic food supply and contaminant concentrations" Pathway of Effects (Attachment A) are expected to be negligible to non-existent.

The construction of the dyke will create an obstruction in Andrew Lake preventing fish movement to the portion of the lake required for mining activities. Fish salvage will be carried out prior to dewatering in order to minimize the potential for fish losses due to stranding. Fish salvaged from the isolated area on the northeast portion of Andrew Lake will be transferred to the western portion of the lake. Changes in water chemistry, water temperature", and "Flow alteration" Pathways of Effects (Attachment A), as well as their applicable sub-pathways (e.g., "Changes in thermal cues or temperature barriers) are not expected to result in residual serious harm to fish. Implementation of BMP's, mitigation measures and environmental monitoring (Table 3-1) is expected to reduce fish passage issues.

Construction of a dyke in Andrew Lake involves placement of clean rock and till in Andrew Lake. This will result in the complete restriction of flow between the northeast portion and the western portion of Andrew Lake. Dewatering of the northeastern portion of Andrew Lake will "displace fish, change access to habitat and food supply" Pathways of Effects (Attachment A) Andrew Lake pit will be dewatered at a rate such that effects to water quality are minimized, along with implementation of mitigation measures (Table 3-1). Change to water temperature, contaminant concentrations, nutrient concentrations, and sediment concentrations Pathways of Effects (Attachment A) are expected to be negligible.

Andrew Lake Pit area will be dewatered after the spring spawning and fry rearing periods are complete (mid-July to end of August). Pump intakes will be fitted with an appropriately-sized screen, as required by the DFO End-of-Pipe Fish Screen Guidelines (DFO 1995). If flows are too large to be effectively managed by pumping, a temporary bypass channel may be constructed to isolate the work area from flow. Subsequently, residual serious harm to fish is unlikely to occur. Winter dyke construction is also being considered, which would further mitigate the implications of TSS to fish. In this case construction would occur when the lake is frozen to the bottom and void of fish. No fish salvage would be required and no release of TSS would occur.

3.4.3 Conclusion

Proposed Project activities during the construction, operations and closure phases of the dewatering of Andrew Lake are not anticipated to be of sufficient magnitude, extent or duration to affect the ongoing maintenance or productivity of CRA fisheries. Any changes to fish habitat are expected to be of small spatial scale and temporary in duration, therefore no loss of unique or critical habitat is expected.

The use of explosives is necessary for the mining activities near Andrew Lake. To ensure that blasting activities do not harm fish populations, management plans for blasting near water and use of explosives near water have been developed (Technical Appendix 2B and 2C) and the effects of blasting on fish abundance and distribution were assessed in Tier 2, Volume 5, Section 11. Following application of mitigation measures, it was concluded that there would be no residual effects on fish abundance and distribution associated with blasting. The mitigation measures associated with blasting are briefly summarized below.

Blasting near Andrew Lake will be planned during the frozen water period when Andrew Lake and its inflow and outflow streams do not support fish populations, or during times of year when egg incubation is not occurring. Smaller explosive charges will be used near fish habitats that do not produce, or are not likely to produce, an instantaneous pressure charge (i.e. overpressure) greater than 50kPa in the swimbladder of a fish. This is less than the 100 kPa IPC threshold however DFO has asked a threshold of 50 kPA be used, see DFO letter Tier 3, Technical Appendix 2B Drilling and Blasting Design, Appendix C. The charge sizes to be used near Andrew Lake during the open water season are to reduce the blasting setback distance to less than 50 meters (the width of the dyke). In addition to these measures, a fish exclusion barrier net will be installed annually in Andrew Lake to prevent fish from entering the area of the lake adjacent to Andrew Pit. Although mitigation is being used and the ICP threshold being used is half the regular value, monitoring to calibrate and refine the ground vibration and instantaneous pressure change models developed during the EA process will be completed to ensure blasting activities do not harm fish populations.

3.5 Water Withdrawal and Discharge

Water for domestic and industrial uses will be withdrawn from surface waterbodies. Potable water, as well as mine and mill process water, for the Kiggavik site will be withdrawn from Siamese Lake. Potable water and mine process water for the Sissons mine site will be withdrawn from Mushroom Lake (Tier 2, Volume 2). Siamese Lake was identified as a traditional fishing area in the Traditional Land Use Study for the Project; fishing is not reported to occur on Mushroom Lake.

In addition to assessments completed for the EIS (Tier 2, Volume 5, Section 6 and 10), activities associated with water withdrawal and discharge were assessed in terms of the Pathways of Effects (DFO 2010a, internet site; Attachment A) for potential impacts to fish and fish habitat (Table 3-1). The Pathways of Effects relevant to water withdrawal and discharge are use of industrial equipment, removal of aquatic vegetation, organic debris management, placement of material or structures in water, structure removal, wastewater management and water extraction.

In-water and shoreline structures associated with water withdrawal and discharge will be removed during Project closure. Disturbed areas will be restored as much as possible to pre-Project conditions to re-establish pre-development drainage areas and flow directions.

3.5.1 Land-based Activities

Mobile industrial equipment will be removed from the area once operations are complete. Construction activities will follow standard protocols and BMP’s (Tier 3, Technical Appendix 5O). Use of oil, grease and fuel in mobile equipment will be managed under the Hazardous Materials Management (Tier 3, Technical Appendix 2U), Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B) and Emergency Response (Tier 3, Technical Appendix 10C) plans that were developed for the Project. Mitigation and avoidance measures described in these plans are expected to minimize potential serious harm to fish that could result from effects pathways identified under “Oil, grease and fuel leaks from equipment” (Attachment A).

3.5.2 In-water Activities

In-water activities include the removal of aquatic vegetation, organic debris management, placement and removal of material or structures in water, wastewater management and water extraction (Attachment A) (Table 3-1). Implementation of proposed mitigation measures, BMPs and environmental monitoring during construction is expected to minimize potential effects to fish habitat, such that use of the area by fish will not be inhibited. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Incidental removal of aquatic vegetation may occur as a result of in-water works, however impacts are expected to be of small spatial scale and temporary in duration. Any removal of in-stream organic debris, or changes in bank stability and exposed soils, are unlikely to result in residual serious harm to fish. Changes in Pathway of Effects “water temperature, habitat structure and cover, sediment concentration, nutrient concentrations, aquatic food supply and contaminant concentrations” (Attachment A) are expected to be negligible to non-existent. Sediment and erosion control measures and BMPs (Tier 3, Volume 5, Appendix 5O) will reduce the potential for eroded soils and control the deposition of eroded soil to the aquatic environment.

Wastewater management is described in detail in the Water Management Plan (Tier 3, Technical Appendix 2I) “Thermal loading, nutrient loading, input of contaminants and pathogens, disease, vectors, exotics “Pathways of Effects were incorporated in the development of the Water Management Plan (Tier 3, Technical Appendix 2I). Preliminary contingency measures for discharge during upset conditions have been developed (Tier 3, Technical Appendix 2I). Along with BMP’s, and mitigation measures, extensive environmental monitoring of the treated effluent and discharge location will occur throughout the duration of operations. Monitoring activities are discussed in detail in the Aquatic Effects Monitoring Plan (Tier 3, Technical Appendix 5M). Monitoring will be completed according to the schedules set out in the Metal Mining Effluent Regulations (Government of Canada 2012) and the Metal Mining EEM Guidance Document (Environment Canada 2012) and will extend for the duration that the Mine operation is subject to the MMER. Potential alteration to surface water chemistry from the treated effluent is not expected to affect fish and fish habitat.

Installing the water intakes in water depths of about 5 m is expected to provide adequate clearance below the bottom of ice and above the lake bed to allow for efficient operations. To improve stability, each intake will be installed on a gravel pad at the bottom of the lake. The pipeline from the shore to the intake structures will be buried at the shoreline to a depth of 2.5 m below the low water mark to minimize the effects of ice. This will be accomplished through excavation of the shoreline or mounding with suitably sized rock (or a combination of the two) to protect the pipeline. The remainder of the pipeline will be weighted with concrete weights and lie directly on the lake bed. Water will be drawn from a depth of at least 3 m below surface and pumped to the site through a heat-traced line (Tier 3, Technical Appendix 2I). DFO procedures for water withdrawal from ice-covered waterbodies in the Northwest Territories and Nunavut will be followed (DFO 2010b). Specifically, no more than 10% of the under-ice volume will be withdrawn from a lake during one ice covered season (DFO 2010b; Tier 3, Technical Appendix 2I). Pump intakes will be fitted with an appropriately-sized screen, as required by the DFO End-of-Pipe Fish Screen Guidelines (DFO 1995). Both the Siamese and Mushroom Lake intakes will be located approximately 400 m offshore with the main pumping station for each intake located along the shore (Tier 2, Volume 2).

Disturbance of sediments during water intake structure installation and removal is likely to occur, however sediment and erosion control measures and BMPs (Tier 3, Volume 5, Appendix 5O) will limit the potential deposition of eroded soil in the aquatic environment. “Changes in water temperature, sediment concentration, nutrient concentrations, aquatic food supply and contaminant concentrations” Pathways of Effects are expected to negligible. Changes in shoreline morphometry and aquatic vegetation are also expected to be minimal in area. Change in habitat structure and cover may occur during construction activities, however changes are anticipated to be temporary in duration and minimal in area.

3.5.3 Conclusion

During construction, operations and closure phases of Project, water withdrawal and discharge activities are not anticipated to be of sufficient magnitude, extent or duration to affect the ongoing productivity of CRA fisheries. Any changes to fish habitat are expected to be of small spatial scale and temporary in duration, therefore no loss of unique or critical habitat is expected.

3.6 All-Season Road Option

The proposed All-Season Road (Tier 2, Volume 2, Figure 10.4-2) is 114 km in length from the Baker Lake dock site to the Kiggavik site. The road has been sighted to avoid low lying and ice rich areas. The final alignment within the corridor will be determined prior to construction (if the all-season road is required), in order to best consider construction and operational needs and environmental protective measures. There are up to 14 bridges (less than 50 meters in length) proposed along the route and one major river crossing (Thelon River). At the Thelon River crossing, it is proposed to use a cable ferry in the summer to cross the River. The remainder of the water crossings can be accommodated with culverts or small bridges. The road will be 10 meters wide, built with Run-of-Quarry (ROQ) rock embankment (fill). There will be no earth cuts along the alignment, and the only cut sections will be through rock, which will serve as quarry material. Material for the rock embankment and road surfacing will be derived from rock quarries developed along the road.

Should the All-Season Road option be required (see Section 2.1.2 above), a cable ferry will be used for crossing the Thelon River (EIS Volume 2, Section 10.4.4). The Thelon River near the proposed, optional cable ferry crossing is characterized as run habitat with moderately steep to very steep shoreline slopes. The rough natural shoreline on each river bank will need to be smoothed to create ferry landing sites (i.e., aprons) safe for loading and offloading trucks and other vehicles (EIS Volume 5, Section 10.2.2). The estimated dimensions of each apron are 30 m long along the shoreline and 10 m wide, extending into the water, for a total area of 0.03 ha each. It is anticipated that a total of approximately 0.3 ha of fish habitat at the ferry crossing location may be destroyed and another 0.3 ha permanently altered (Volume 5, Section 10.2.2).

In addition to assessments completed for the EIS, activities associated with road construction and decommissioning were assessed in terms of the Pathways of Effects (DFO 2010a, internet site, Attachment A) for potential impacts to fish and fish habitat (Table 3-1). The Pathways of Effects relevant to the all-season road include: vegetation clearing, cleaning or maintenance of bridges or other structures, excavation, grading, use of industrial equipment, removal of aquatic vegetation, organic debris management, fish passage issues, placement of material or structures in water, structure removal, water extraction, change in timing, duration and frequency of flow.

In-water and shoreline structures associated with the all-season road will be removed during Project closure. Disturbed areas will be restored to pre-Project conditions as much as possible.

3.6.1 Land-based Activities

Vegetation clearing, cleaning or maintenance of bridges or other structures, excavation, grading and use of industrial equipment activities are anticipated to occur during construction and operation of the proposed all-season road (Table 3-1). Implementation of the proposed mitigation measures, BMPs and environmental monitoring during construction is expected to minimize potential effects to fish habitat, such that use of the area by fish will not be inhibited. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Excavation and grading activities will occur during the installation of culverts, coffer dams and the cable ferry crossing as well as during the construction of the proposed all-season road. Best Management Practices (BMPs) will be incorporated into stream crossing designs (Tier 3, Volume 5, Appendix 5O). Culverts will be installed in the dry and outside DFO's restricted activity timing windows. Work areas will be isolated from flowing water by placing cofferdams at the upstream and downstream ends of the work areas. Erosion and sediment control measures will be used during installation (Tier 3, Volume 5, Appendix 5O). Excavation activities are not expected to alter groundwater flows. Riparian vegetation is likely to be disturbed during construction activities however incidental impacts are expected to be of small spatial scale and temporary in duration. "Changes in water temperature, habitat structure and cover, sediment concentrations and nutrient concentrations" Pathways of Effects (Attachment A) is expected to be negligible.

Industrial equipment will be mobile and will be removed from the area once construction is complete. Construction activities will follow standard protocols and BMP's (Tier 3, Technical Appendix 5O). Use of oil, grease and fuel in mobile equipment will be managed under the Hazardous Materials Management (Tier 3, Technical Appendix 2U), Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B) and Emergency Response (Tier 3, Technical Appendix 10C) plans developed for the Project. Mitigation and avoidance measures described in these plans are expected to minimize potential serious harm to fish that could result from effects pathways identified under "Oil, grease and fuel leaks from equipment" (Attachment A).

Maintenance of roads, culverts and bridges will be required throughout the life of the project. Pathway of Effect for cleaning or maintenance of bridges or other structures lists change in sediment concentration and change in contaminant concentrations as potential effects. Construction activities will follow standard protocols and BMP's (Tier 3, Technical Appendix 5O). Use of oil, grease and fuel in mobile equipment will be managed under the Hazardous Materials Management (Tier 3, Technical Appendix 2U), Spill Contingency and Landfarm Management (Tier 3, Technical Appendix 10B) and Emergency Response (Tier 3, Technical Appendix 10C) plans that were developed for the Project. Mitigation and avoidance measures described in these plans are expected to minimize potential serious harm to fish.

3.6.2 In-water Activities

In-water activities include the following Pathways of Effects: removal of aquatic vegetation, organic debris management, fish passage issues, placement and removal of material or structures in water, and change in timing, duration and frequency of flow (Table 3-1), Implementation of proposed mitigation measures, BMPs and environmental monitoring during construction is expected to minimize potential effects to fish habitat, such that use of the areas by fish will not be inhibited. Mitigation measures, monitoring and additional measures to mitigate effects to the aquatic environment are summarized in Table 3-1.

Incidental removal of aquatic vegetation may occur as a result of in-water works, however impacts are expected to be of small spatial scale and temporary in duration. "Change in light penetration and nutrient inputs: Pathways of Effects are unlikely to occur. Removal of in-water organic debris, or changes in bank stability and exposed soils, are not expected to result in any residual serious harm to fish. Change in Pathway of Effects "water temperature, habitat structure and cover, sediment concentration, nutrient concentrations, aquatic food supply and contaminant concentrations" (Attachment A) is expected to be negligible to non-existent. Erosion and sediment control measures and BMPs (Tier 3, Volume 5, Appendix 5O) will limit potential deposition of eroded soil to the aquatic environment.

Placement and removal of material or structures in water and change in timing, duration and frequency of flow are activities may occur during culvert, coffer dam, bridge and cable ferry crossing installation. Installation at most stream crossings will be completed in summer. Culverts will be installed in the dry; cofferdams will be placed at the upstream and downstream ends of the work area to isolate the work from flowing water. Water will be pumped around the work area and released downstream. Small rip rap energy dissipaters will be constructed at the pump outlet to minimize erosion of the channel bottom. Pump intakes will be fitted with an appropriate screen, as required by the DFO End-of-Pipe Fish Screen Guidelines (DFO 1995). If flows are too large to be effectively managed by pumping, a temporary bypass channel may be constructed to isolate the work area from flow. Changes in food supply, sediment concentrations, nutrient concentrations contaminant concentrations and migrations patterns are expected to be negligible to non-existent. Change in habitat structure and cover may occur during construction activities, however are anticipated to be temporary in duration and minimal in area.

AREVA is confident that all stream crossings can be constructed within DFO's timing windows for in-water works (DFO 2013a, internet site). The Project is located in Fish Timing Zone 2, where in-water construction activities are not permitted from May 1 to July 15 to protect spring-spawning fish and fish habitat during the sensitive spawning and incubation periods (DFO 2013a; internet site). For streams or waterbodies where fall-spawning species occur, in-water works are not permitted between August 15 to June 30. If both spring- and fall-spawning species are present, the in-water work exclusion period is from August 15 to the following July 15. In streams that are not fish-bearing, construction will proceed throughout the summer months, as determined by the construction schedule. The appropriate timing windows will be selected for each stream crossing based on the results of the fish inventory surveys completed between 2008 and 2010 (for streams that were flowing) and the historical data (Tier 3, Technical Appendix 5C). Most sampled streams contained spring spawning species; the Thelon River contains both spring and fall spawning species.

Three types of stream crossings are required (culverts, bridges, and an optional ferry crossing) if the proposed All-Season Road is constructed. It is not anticipate that fish passage issues will occur during construction. For stream crossings where movement of large-bodied fish is apparent, crossing structures will be designed and installed to accommodate fish passage. All culverts that will be installed for the Project will be sized to pass a 1:100 year peak discharge. Culverts on streams used by fish, or assumed to be used by fish will be designed to pass a 1:10 year 3-day delay flow and meet velocity-based fish passage criteria. Culverts are designed with a large end area that limits flow constriction and supports fish passage; they are also larger than what is typically required for conveyance of a 1:100 year flow. Plans for monitoring fish passage at stream crossings are incorporated into the Aquatic Effects Monitoring Plan (Tier 3, Technical Appendix 5M).

Visual inspections of all stream crossings (including those on non-fish-bearing streams) will be carried out before the start of spring runoff to confirm that culverts are not blocked by ice or debris. Monitoring of fish passage will focus on crossings of fish-bearing streams where culvert installation is proposed (Tier 3, Technical Appendix 5C). Because bridges will be built above the ordinary high water mark and are not anticipated to interfere with fish passage, no monitoring of fish passage is planned at watercourses crossed by bridges (Tier 3, Technical Appendix 5M). Similarly, no fish passage monitoring is planned at the proposed, optional ferry crossing on the Thelon River (km 174.8 of the All-Season Road) because the aprons and ferry are not expected to interfere with fish passage (Tier 3, Technical Appendix 5M).

3.6.1 Conclusion

Proposed Project activities during the construction, operations, and closure phases of the all-season road option are not anticipated to be of sufficient magnitude, extent or duration to affect the ongoing productivity of CRA fisheries. Any changes to fish habitat are expected to be of small spatial scale and temporary in duration, therefore no loss of unique or critical habitat is expected.

4 Fisheries Offsetting

Wherever possible during the design of the Kiggavik Project, efforts have been made to avoid disturbing areas of sensitive or critical fish habitat, and mitigation measures have been incorporated to prevent Project effects to fish and/or fish habitat, or reduce Project effects to negligible levels. Also, occasionally when designing mitigation measures it has been possible to enhance fish habitat, such as planning for concentration of flows and inclusion of resting pools in the proposed S1 diversion channel between Mushroom and End Grid Lakes. Proposed avoidance and mitigation measures for minimizing effects to fish and fish habitat are described in Tier 2, Volume 5, and in Section 3 of this document (Tier 3, Technical Appendix 5L). These measures are expected to reduce residual serious harm to fish to negligible levels. AREVA is confident that by incorporating appropriate mitigation measures into the Project design and confirming effectiveness of mitigation by establishing directed monitoring programs, construction and operation of the Kiggavik Project will not result in any residual serious harm to the sustainability and productivity of CRA fisheries in the Kiggavik and Baker Lake areas. As such, no fisheries offsetting measures are proposed for the Kiggavik Project.

Although no residual serious harm to fish is anticipated from the Kiggavik Project, the concept of fisheries offsetting and potential locations of offsetting opportunities were discussed with members of the Baker Lake fishing community in June 2014. These discussions were undertaken as a contingency for the Project, in case mitigation effectiveness monitoring following Project implementation shows that mitigation measures are not working as designed or aren't functioning as effectively as anticipated, and potential serious harm to fish may result. In this event, proposed offsetting would be developed in consultation with DFO, and would be focused on maintaining or improving the productivity of CRA fisheries within the vicinity of the community of Baker Lake, as fishing in the Kiggavik area is predominantly carried out by residents of that community. The offsetting discussion with Baker Lake community members was documented and suggested potential opportunities for offsetting recorded; the meeting summary and offsetting opportunity location information is included as Attachment B of the CFOP.

5 Monitoring

Plans to monitor aquatic life, including fish habitat, fish populations and water quality, are described in detail in the Aquatic Effects Monitoring Plan (Tier 3, Technical Appendix 5M). Monitoring will be required to confirm predictions made in the EIS.

5.1 Baker Lake Dock Site

Proposed environmental monitoring activities during the Project construction and closure phases include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;
- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys will be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O); and
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O).

No environmental monitoring is required during the operations phase, however crews will be observant of potential environmental issues or concerns.

5.2 Winter Road and Site Access Roads

Proposed environmental monitoring activities during the Project construction phase include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter and these data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;

- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys can be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O);
- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain or coffer dam will be installed to contain sediment, fish will be salvaged within the confined work areas, and turbidity in the stream will be monitored (Tier 3, Technical Appendix 5O); and
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O).

Proposed environmental monitoring activities during the Project operations phase include:

- Roads and stream crossings will be inspected regularly for signs of degradation and required maintenance (Tier 3, Technical Appendix 2M, Section 7.1);
- Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements are met (Tier 3, Technical Appendix 2U, Section 7.1);
- Monitoring of locations prone to ice jamming (e.g., culvert crossings along the Kiggavik-Sissons haul road) and removal of ice jams, if necessary, would be completed to ensure that potential ice blockages at stream crossings do not cause the overlying road to wash out (Tier 3, Technical Appendix 5M, Section 6.5);
- Water crossing structures will be monitored so that maintenance activities can be tailored to reduce any potential erosion and maintain water passage (Tier 3, Technical Appendix 5O);
- Culvert monitoring will be carried out to confirm fish passage if fish are present and verify that erosion and sediment control measures are functioning as intended(Tier 3, Appendix 5O); and
- Air and dust emission levels, and dust deposition will be monitored on a regular basis near both the Kiggavik and Sissons mining operations, and adjacent to the ore haul road between the two sites to determine whether actual levels are similar to predicted levels.

Proposed environmental monitoring activities during the Project closure phase include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter, and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;
- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site. (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys can be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O);
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O); and
- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain or coffer dam will be installed to contain sediment, fish will be salvaged within the confined work areas, and turbidity in the stream will be monitored (Tier 3, Technical Appendix 5O).

5.3 Freshwater Diversion Channels

Proposed environmental monitoring activities during the Project construction phase include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter, and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;
- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys will be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O);

- Water quality monitoring during the open water season in freshwater diversion channels during the first year following construction (Tier 3, Technical Appendix 5M.);
- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain or coffer dam will be installed to contain sediment, fish will be salvaged within the confined work areas, and turbidity in the stream will be monitored (Tier 3, Technical Appendix 5O);
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O); and
- Fish passage monitoring will be completed by visual inspections and observations (Tier 3, Technical Appendix 5O).

Proposed environmental monitoring activities during the Project operations phase include:

- Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements are met(Tier 3, Technical Appendix 2U, Section 7.1);
- Water crossing structures will be monitored so that maintenance activities can be tailored to reduce any potential erosion and maintain water passage (Tier 3, Technical Appendix 5O); and
- Fish passage and utilization monitoring will be completed by visual inspections and observations (Tier 3, Technical Appendix 5O).

Proposed environmental monitoring activities during the Project closure phase include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter, and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;
- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site. (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys will be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O);
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O); and

- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain or coffer dam will be installed to contain sediment, fish will be salvaged within the confined work areas, and turbidity will be monitored (Tier 3, Technical Appendix 5O).

5.4 Dewatering of Andrew Lake

Proposed environmental monitoring activities during the Project construction phase include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;
- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys will be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O);
- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain or coffer dam will be installed to contain sediment, fish will be salvaged within the confined work areas, and turbidity will be monitored (Tier 3, Technical Appendix 5O);
- Work near fish bearing waters will comply with DFO’s Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O); and
- Fish salvage programs will be completed once construction areas have been contained within turbidity curtains. Salvaged fish will be released outside the contained area prior to construction commencing (Tier 3, Technical Appendix 5O).

Proposed environmental monitoring activities during the Project operations phase include:

- Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements are met (Tier 3, Technical Appendix 2U, Section 7.1);
- Monitoring to calibrate and refine the ground vibration and instantaneous pressure change models developed during the EA process will be completed to ensure blasting activities do not harm fish populations (Tier 3, Technical Appendix 5M).

Proposed environmental monitoring activities during the Project closure phase include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;
- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys will be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O); and
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O).
- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain or coffer dam will be installed to contain sediment, fish will be salvaged within the confined areas, and turbidity will be monitored (Tier 3, Technical Appendix 5O); and
- Water quality monitoring of the reflooded Andrew Lake Pit will be carried out to determine if and when the dyke separating Andrew Lake from the reflooded mine pit should be breached and the two waterbodies connected. If water quality is good then the two water bodies could be connected. If water quality is poor or unsuitable for fish, the waterbodies will remain unconnected (Tier 2, Volume 5).

5.5 Water Withdrawal and Discharge

Proposed environmental monitoring activities during the Project construction phase include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;
- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);

- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys will be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O);
- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain will be installed to contain sediment, fish will be salvaged within the confined areas, and turbidity will be monitored (Tier 3, Technical Appendix 5O); and
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O).

Proposed environmental monitoring activities during the Project operations phase include:

- Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements are met (Tier 3, Technical Appendix 2U, Section 7.1);
- Water quality will be monitored in the receiving environment to verify effects predictions and as part of the required monitoring under MMER. Water quality in each section of Judge Sissons Lake receiving treated effluent (exposure areas), as well as at the outlet of Judge Sissons Lake, will be monitored on a seasonal basis to verify effects predictions related to changes in water quality for a period of one to two years (Tier 3, Technical Appendix 5M);
- Water quality in lakes and streams adjacent to and downstream of the Mine site LAA will be monitored to confirm that metals and radionuclide concentrations, TSS and acid deposition, as well as lake acidification are not increasing above predicted or acceptable levels due to air emissions and the deposition of dust from Project related activities (Tier 3, Technical Appendix 5M);
- Monitoring of sediment quality in Judge Sissons Lake (Tier 3, Technical Appendix 5M);
- Sub-lethal toxicity testing of effluent Twice each calendar year for the first three years to fulfill EEM program (Tier 3, Technical Appendix 5M);
- Monitoring every 3 years once the Mine is subject to MMER of fish growth, reproduction, condition, and survival in exposure areas of Judge Sissons Lake as well as in reference areas (Tier 3, Technical Appendix 5M); and
- Monitoring of mercury concentrations and other COPCs every 3 years once the Mine is subject to MMER in fish tissues in exposure areas of Judge Sissons Lake as well as in reference areas (Tier 3, Technical Appendix 5M).

Proposed environmental monitoring activities during the Project closure phase include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix

5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;

- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys will be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O);
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O); and
- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain or will be installed to contain sediment, fish will be salvaged within the confined work areas, and turbidity will be monitored (Tier 3, Technical Appendix 5O).

5.6 All-Season Road Option

Proposed environmental monitoring activities during the Project construction phase include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;
- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys will be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O);
- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain or coffer dam will be installed to contain sediment, fish will be salvaged within the confined work areas, and turbidity in the stream will be monitored (Tier 3, Technical Appendix 5O); and
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O).

Proposed environmental monitoring activities during the Project operations phase would include:

- Roads and stream crossings will be inspected regularly for signs of degradation and required maintenance (Tier 2, Technical Appendix 2M, Section 7.1);
- Routine inspections (inspections will be logged) of applicable facilities will be performed to ensure conformance requirements are met (Tier 3, Technical Appendix 2U, Section 7.1);
- Monitoring of locations prone to ice jamming (e.g., culvert crossings along the All-Season Road) and removal of ice jams, if necessary, would be completed to ensure that potential ice blockages at stream crossings do not cause the overlying road to wash out (Tier 3, Technical Appendix 5M, Section 6.5);
- Water crossing structures will be monitored so that maintenance activities can be tailored to reduce any potential erosion and maintain water passage (Tier 3, Technical Appendix 5O); and
- Culvert monitoring will be carried out to confirm fish passage if fish are present and verify that erosion and sediment control measures are functioning as intended (Tier 3, Appendix 5O).

Proposed environmental monitoring activities during the closure phase would include:

- Turbidity Monitoring: turbidity will be measured using a turbidity meter and the data correlated with lab tested total suspended solids (TSS). Turbidity/TSS measurements higher than acceptable levels will result in cessation of in-water construction until ways to complete the project with reduced levels of disturbance can be developed. See Tier 3, Technical Appendix 5O Attachment B for a discussion on acceptable levels of turbidity/TSS during the monitoring program;
- Berms or silt fences may be utilized to control any excess runoff and potential sediment transport from the site (Tier 3, Technical Appendix 2I, Section 6.1);
- Installation of turbidity curtain if required (Tier 3, Technical Appendix 5O);
- Erosion: visual inspections will be completed to identify areas susceptible to erosion, or areas where erosion may be occurring. Results from these surveys will be used to plan maintenance or further sediment or water control activities (Tier 3, Technical Appendix 5O);
- Work near fish bearing waters will comply with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013a), and will not take place during relevant fish spawning periods (Tier 3, Technical Appendix 5O).
- In-water work will be minimized, however if these activities mobilize noticeable sediment, a turbidity curtain or coffer dam will be installed to contain sediment, fish will be salvaged within the confined work areas, and turbidity in the stream will be monitored (Tier 3, Technical Appendix 5O); and
- Fish passage monitoring will be completed by visual inspections and observations (Tier 3, Technical Appendix 5O).

6 Conclusions

Proposed avoidance and mitigation measures for minimizing Project effects to fish and fish habitat are expected to reduce residual serious harm to fish to negligible levels. AREVA is confident that by incorporating appropriate mitigation measures into the Project design and confirming effectiveness of mitigation by establishing directed monitoring programs, construction and operation of the Kiggavik Project will not result in any residual serious harm to the sustainability and productivity of CRA fisheries in the Kiggavik and Baker Lake areas.

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Attachment A Fisheries and Oceans Canada Pathways of Effects

Structure removal

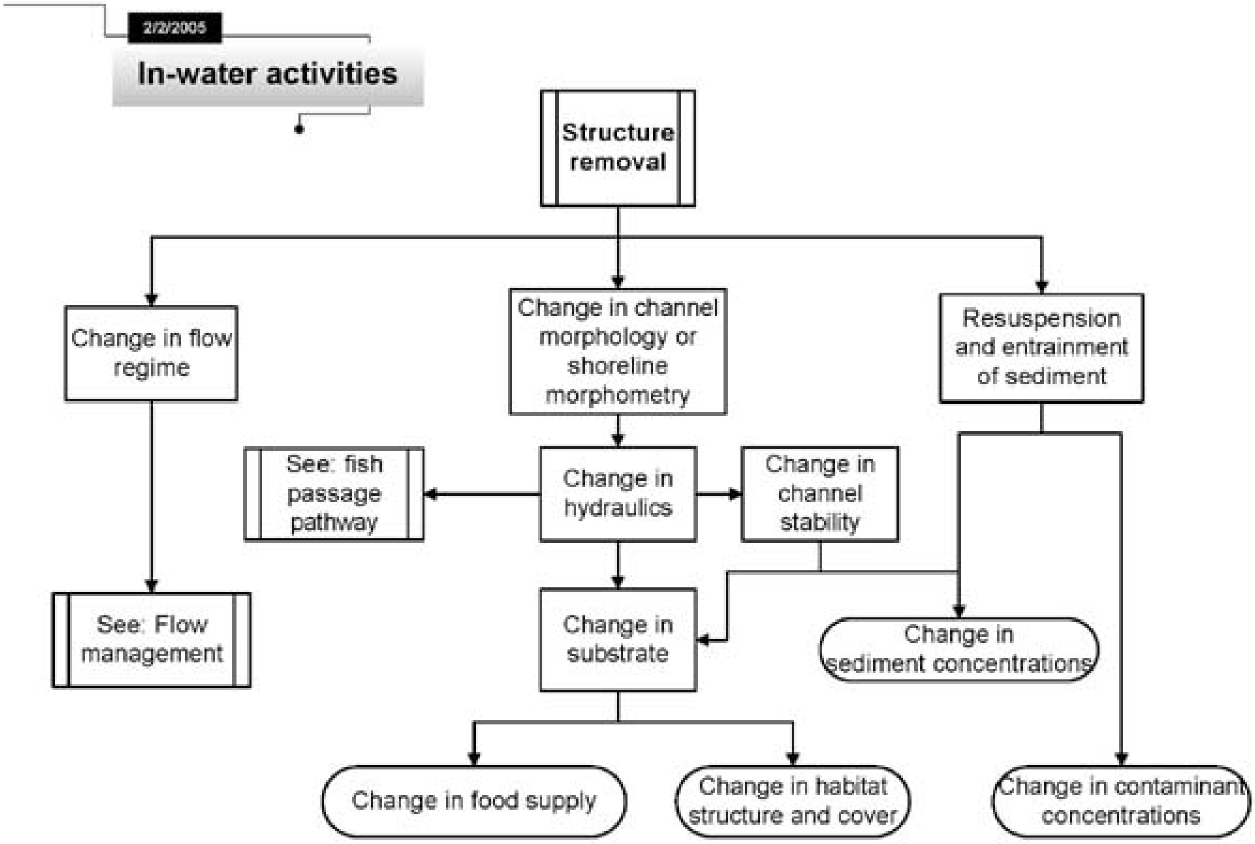
In-Water Activities

- Placement of marine finfish aquaculture site
- Addition or removal of aquatic vegetation
- Organic debris management
- Dredging
- Fish passage issues
- Placement of material or structures in water
- Marine seismic surveys
- Structure removal
- Wastewater management
- Water extraction
- Change in timing, duration and frequency of flow

The removal of non-natural in-water structures such as rip-rap, docks, bridges, or dams. They may be removed manually or with mechanical equipment.

NOTE:

Pathways of Effects diagrams have been developed by Fisheries and Oceans Canada as a tool to communicate potential effects of development proposals on fish and fish habitat and were developed through extensive consultation. It is expected that these diagrams will be updated to describe new activities and stressors as required.



Effects

Change in sediment concentrations: Increased erosion of stream bank soils and rocks result in an excess of fragmented organic and inorganic material which is transported by water, wind, ice, and gravity. These sediments, which contain nutrifying elements and can capture or absorb contaminants, are suspended or else settle and collect in waterways affecting physical processes, structural attributes, and ecological conditions such as water clarity (by reducing visibility and sunlight and damaging fish gills) and reducing the availability and quality of spawning/ rearing habitat (through infilling)

Change in food supply: The aquatic food supply must be plentiful and diverse to sustain the productivity of a watershed. An increase or decrease in the quantity or composition of the food supply, beginning with plants and organic debris that fall into a waterway, can alter the structure of the aquatic community

Change in habitat structure and cover: The addition of in-stream organic structure and the deposition of eroded soil can affect the capacity of a watercourse to maintain a dispersed and diverse community of aquatic organisms by restricting habitat connectivity and the opportunities for organisms to use, colonize, and move between existing aquatic environments. The removal of in-stream and riparian vegetation can reduce channel stability, cover and protection from predators and physical disturbances, and the availability of diverse and stable habitats.

Change in contaminant concentrations: An increase in concentrations of toxins and pollutants in sediments and waters can breach the range of chemical parameters that support healthy aquatic communities, seriously affecting fish and fish habitat. The ecological effects can range from direct fatality to organisms, alteration of the ecosystem structure through changes in the abundance, composition, and diversity of communities and habitats, and persistence and progressive accumulation in sediments or biological tissues (bioaccumulation, biomagnification). Deformities, alterations in growth, reproductive success, and competitive abilities can result

Marine seismic surveys

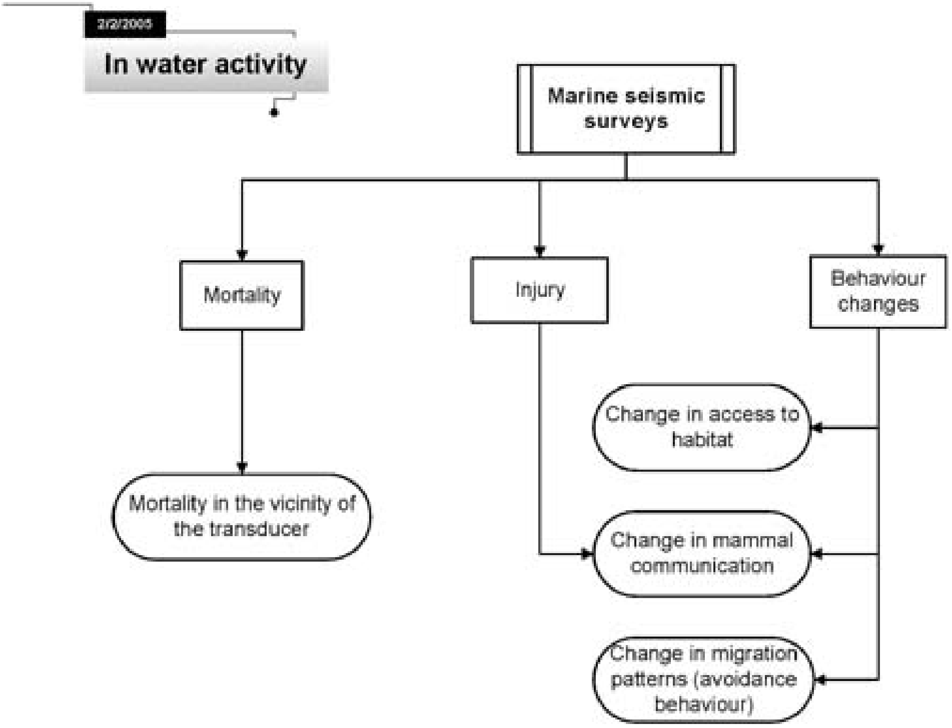
In-Water Activities

- Placement of marine finfish aquaculture site
- Addition or removal of aquatic vegetation
- Organic debris management
- Dredging
- Fish passage issues
- Placement of material or structures in water
- Marine seismic surveys
- Structure removal
- Wastewater management
- Water extraction
- Change in timing, duration and frequency of flow

The undertaking of a marine seismic survey to determine the presence and/or structure of underground rock formations and often to determine the location of oil and gas wells. Energy or sound waves are passed into the rock and the reflected signals are recorded and analyzed. Large-scale surveys are conducted using a towed array of 'airguns' (cylinders of compressed air) which are discharged simultaneously to generate a pressure pulse which travels downwards into the earth.

NOTE:

Pathways of Effects diagrams have been developed by Fisheries and Oceans Canada as a tool to communicate potential effects of development proposals on fish and fish habitat and were developed through extensive consultation. It is expected that these diagrams will be updated to describe new activities and stressors as required.



Effects

Mortality in the vicinity of the transducer: Seismic work can affect fish and shellfish populations immediately after the sound waves have been discharged as well as afterwards. Fish, especially eggs and larvae, can be killed during and catch rates may drop immediately after a seismic survey

Change in access to habitat/ migration: An alteration in water depth, flow, and/or substrate size causing a disruption in access to fish habitats essential for various life processes within given fish populations such as spawning and rearing

Change in mammal communication: Marine mammals use sound to communicate and, in some cases, echolocate. The airguns used in seismic surveys generate sound at frequencies that overlap with those used by whales and dolphins and this acoustic disturbance has the potential to interfere with their natural functions, such as feeding, social interactions (including breeding) and navigation, as well as having the potential to cause physical harm

Change in migration patterns: Dams may affect fish populations by preventing normal migration between feeding, rearing, and spawning areas and excessive flow and high water velocities can create migration barriers

Date modified: 2010-03-02

Livestock grazing

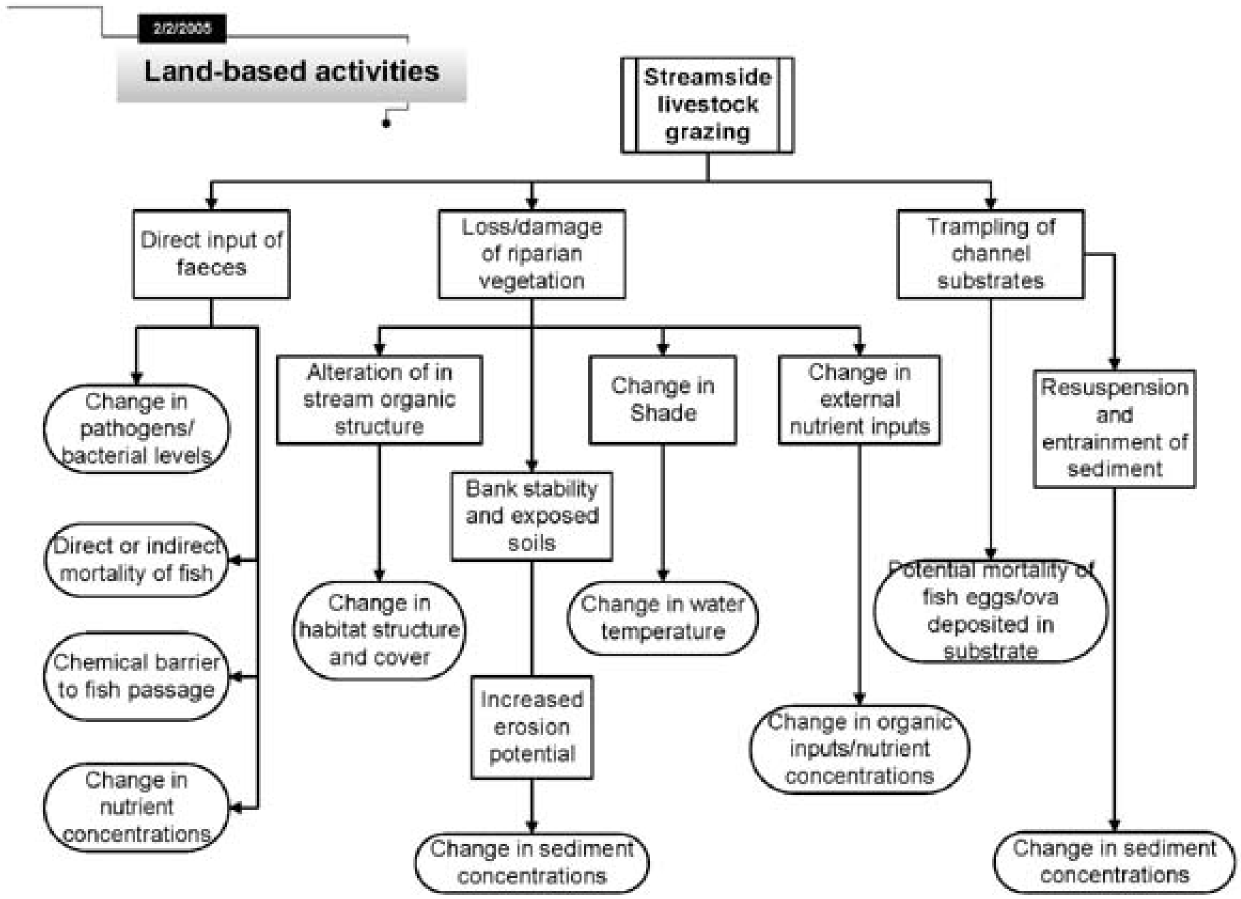
Land-Based Activities

- Vegetation Clearing
- Cleaning or maintenance of bridges or other structures
- Excavation
- Use of explosives
- Grading
- Use of industrial equipment
- Streamside livestock grazing
- Riparian Planting

The practice of allowing livestock to access riparian areas in and around a watercourse can result in consumption of riparian vegetation, direct input of faeces into the watercourse and trampling of the banks and bed of a watercourse.

NOTE:

Pathways of Effects diagrams have been developed by Fisheries and Oceans Canada as a tool to communicate potential effects of development proposals on fish and fish habitat and were developed through extensive consultation. It is expected that these diagrams will be updated to describe new activities and stressors as required.



Effects

Change in pathogens/ bacterial levels: Contamination of water with the fecal matter of livestock animals can lead to an increase in micro-organisms, such as fecal coli form bacteria. Water may also be contaminated by pathogens or disease producing bacteria or viruses which can exist in fecal material. Fecal coli form adds excess organic material to the water and the decay of this material depletes the water of oxygen, killing fish and other aquatic organisms

Direct or indirect mortality of fish: Unpolluted and adequate stream flow is required by fish to maintain habitat accessibility, water temperature, and dissolved oxygen levels. Irresponsible water extraction can result in the dewatering of downstream areas, obstruction of fish passage, and entrainment or impingement of fish on pump screens

Chemical barrier to fish passage: Chemicals associated with animal waste may accumulate to such high levels that render certain areas of a given watercourse inhabitable to fish and other aquatic organisms

Change in nutrient concentrations: Some activities may cause an increase in nutrifying elements such as nitrogen and phosphorus and mineral compounds such as ammonia, nitrates, nitrites, orthophosphates. This leads to 'eutrophication', thick growths of aquatic plants (especially algae) that block light needed by aquatic vegetation, either by clouding the water column or coating the vegetation itself. When the algae die, they settle to the bottom and are consumed by bacteria during the decomposition process. This process consumes oxygen, depleting it from bottom waters. The resulting low dissolved oxygen concentrations drive fish from their preferred habitat and can cause other organisms to die

Change in habitat structure and cover: The addition of in-stream organic structure and the deposition of eroded soil can affect the capacity of a watercourse to maintain a dispersed and diverse community of aquatic organisms by restricting habitat connectivity and the opportunities for organisms to use, colonize, and move between existing aquatic environments. The removal of in-stream and riparian vegetation can reduce channel stability, cover and protection from predators and physical disturbances, and the availability of diverse and stable habitats.

Change in water temperature: Water temperature directly affects many of the physical, biological, and chemical characteristics of a waterway. In elevated temperatures, many coldwater fish, such as trout and salmon, could experience reduced reproductive activity or direct mortality, including egg mortality. High temperatures also encourage the microbial breakdown of organic matter, leading to a depletion of dissolved oxygen in the water body

Potential mortality of fish/ eggs/ ova from equipment: Direct injury or mortality of fish (eggs, larvae, invertebrates, etc.) from physical disruption from equipment or livestock

Change in sediment concentrations: Increased erosion of stream bank soils and rocks result in an excess of fragmented organic and inorganic material which is transported by water, wind, ice, and gravity. These sediments, which contain nutrifying elements and can capture or absorb contaminants, are suspended or else settle and collect in waterways affecting physical processes, structural attributes, and ecological conditions such as water clarity (by reducing visibility and sunlight and damaging fish gills) and reducing the availability and quality of spawning/ rearing habitat (through infilling)

Date modified: 2010-03-02

Fisheries and Oceans Canada

Grading

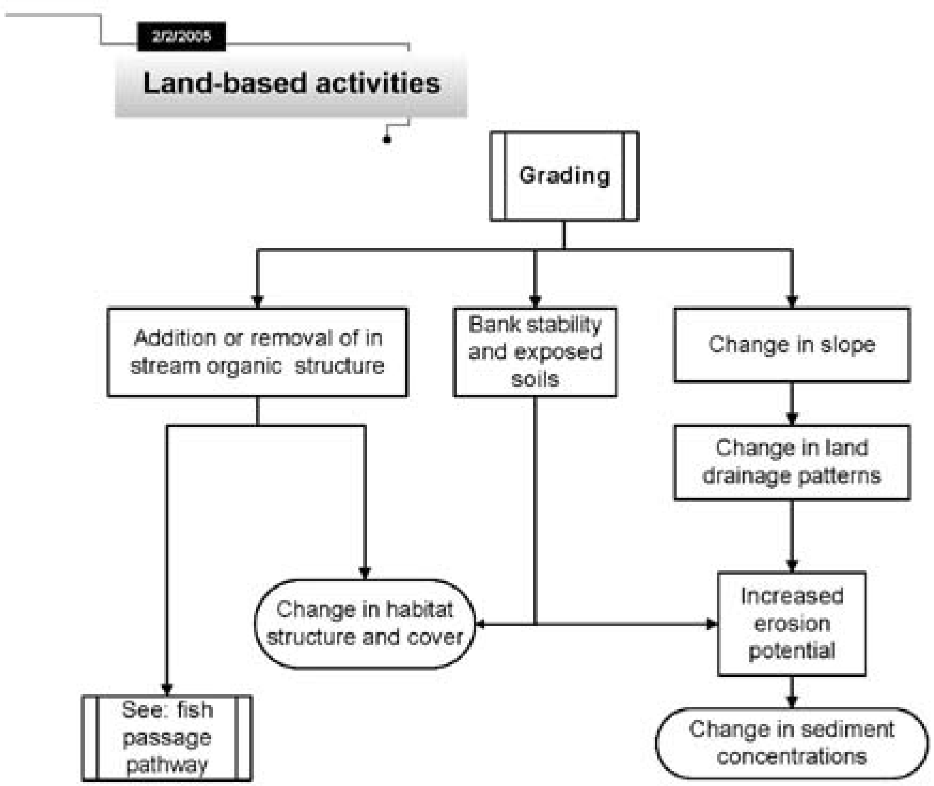
Land-Based Activities

- Vegetation Clearing
- Cleaning or maintenance of bridges or other structures
- Excavation
- Use of explosives
- Grading
- Use of industrial equipment
- Streamside livestock grazing
- Riparian Planting

The process of altering a land surface or adjusting the landscape slope for drainage. This may be achieved through manual or mechanical compaction, cutting, filling, or smoothing operations in order to meet a designated form and function. It does not include excavation or dredging.

NOTE:

Pathways of Effects diagrams have been developed by Fisheries and Oceans Canada as a tool to communicate potential effects of development proposals on fish and fish habitat and were developed through extensive consultation. It is expected that these diagrams will be updated to describe new activities and stressors as required.



Effects

Change in habitat structure and cover: The addition of in-stream organic structure and the deposition of eroded soil can affect the capacity of a watercourse to maintain a dispersed and diverse community of aquatic organisms by restricting habitat connectivity and the opportunities for organisms to use, colonize, and move between existing aquatic environments. The removal of in-stream and riparian vegetation can reduce channel stability, cover and protection from predators and physical disturbances, and the availability of diverse and stable habitats.

Change in sediment concentrations: Increased erosion of stream bank soils and rocks result in an excess of fragmented organic and inorganic material which is transported by water, wind, ice, and gravity. These sediments, which contain nutrifying elements and can capture or absorb contaminants, are suspended or else settle and collect in waterways affecting physical processes, structural attributes, and ecological conditions such as water clarity (by reducing visibility and sunlight and damaging fish gills) and reducing the availability and quality of spawning/ rearing habitat (through infilling)

Date modified: 2010-03-02

Fisheries and Oceans Canada

Excavation

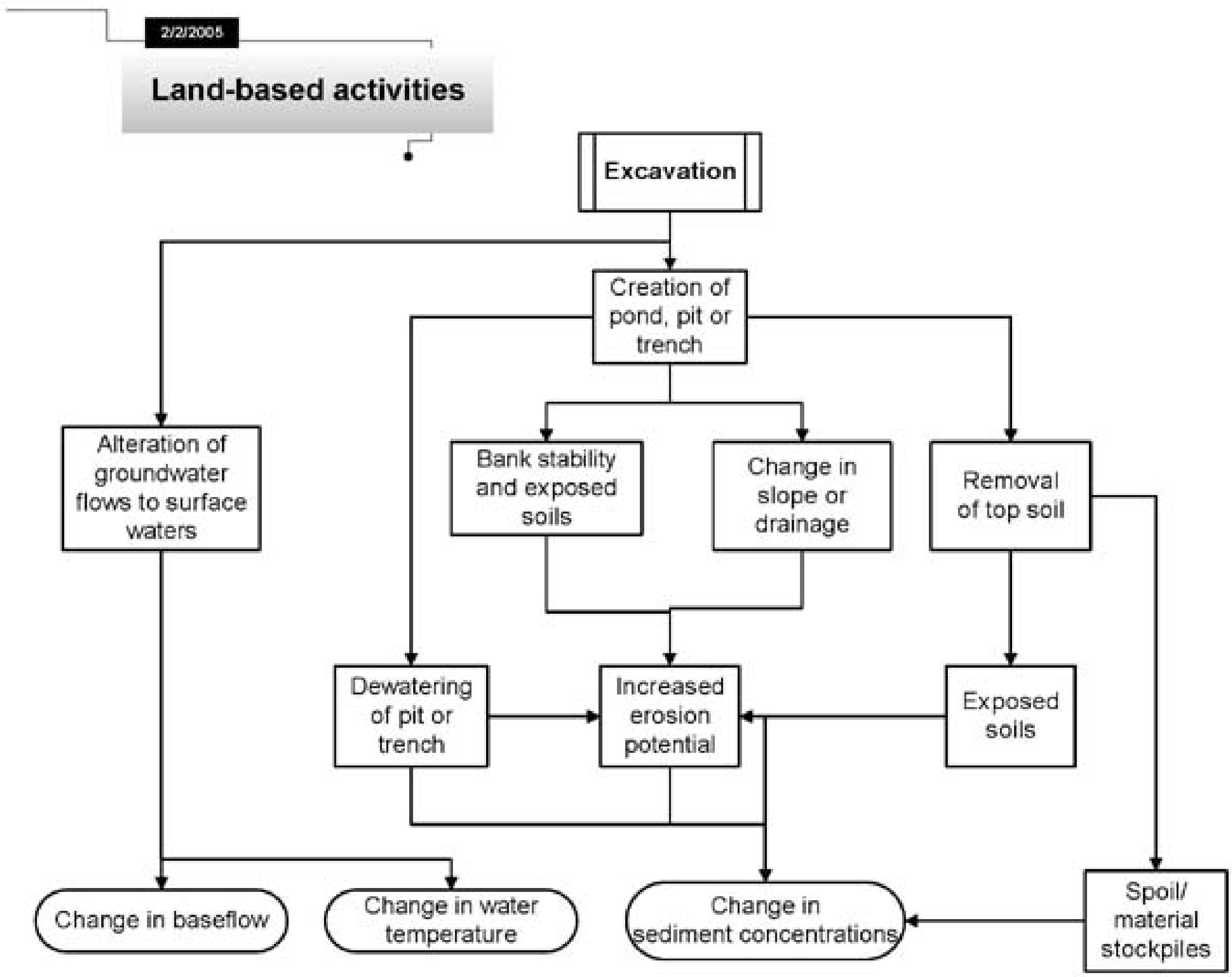
Land-Based Activities

- Vegetation Clearing
- Cleaning or maintenance of bridges or other structures
- Excavation
- Use of explosives
- Grading
- Use of industrial equipment
- Streamside livestock grazing
- Riparian Planting

The process of removing soil and rock from the land. It does not include grading or dredging. This is achieved through mechanical cutting, digging, or scooping which leaves a cut, cavity, trench, or depression in the land surface.

NOTE:

Pathways of Effects diagrams have been developed by Fisheries and Oceans Canada as a tool to communicate potential effects of development proposals on fish and fish habitat and were developed through extensive consultation. It is expected that these diagrams will be updated to describe new activities and stressors as required.



Effects

Change in base flow: An alteration in the quantity of groundwater flowing into springs, streams, rivers, lakes and wetlands caused by a change in land use and land surface characteristics

Change in water temperature: Water temperature directly affects many of the physical, biological, and chemical characteristics of a waterway. In elevated temperatures, many coldwater fish, such as trout and salmon, could experience reduced reproductive activity or direct mortality, including egg mortality. High temperatures also encourage the microbial breakdown of organic matter, leading to a depletion of dissolved oxygen in the water body

Change in sediment concentrations: Increased erosion of stream bank soils and rocks result in an excess of fragmented organic and inorganic material which is transported by water, wind, ice, and gravity. These sediments, which contain nutrifying elements and can capture or absorb contaminants, are suspended or else settle and collect in waterways affecting physical processes, structural attributes, and ecological conditions such as water clarity (by reducing visibility and sunlight and damaging fish gills) and reducing the availability and quality of spawning/ rearing habitat (through infilling)

Date modified: 2010-03-02

Fisheries and Oceans Canada

Placement of material or structures in water

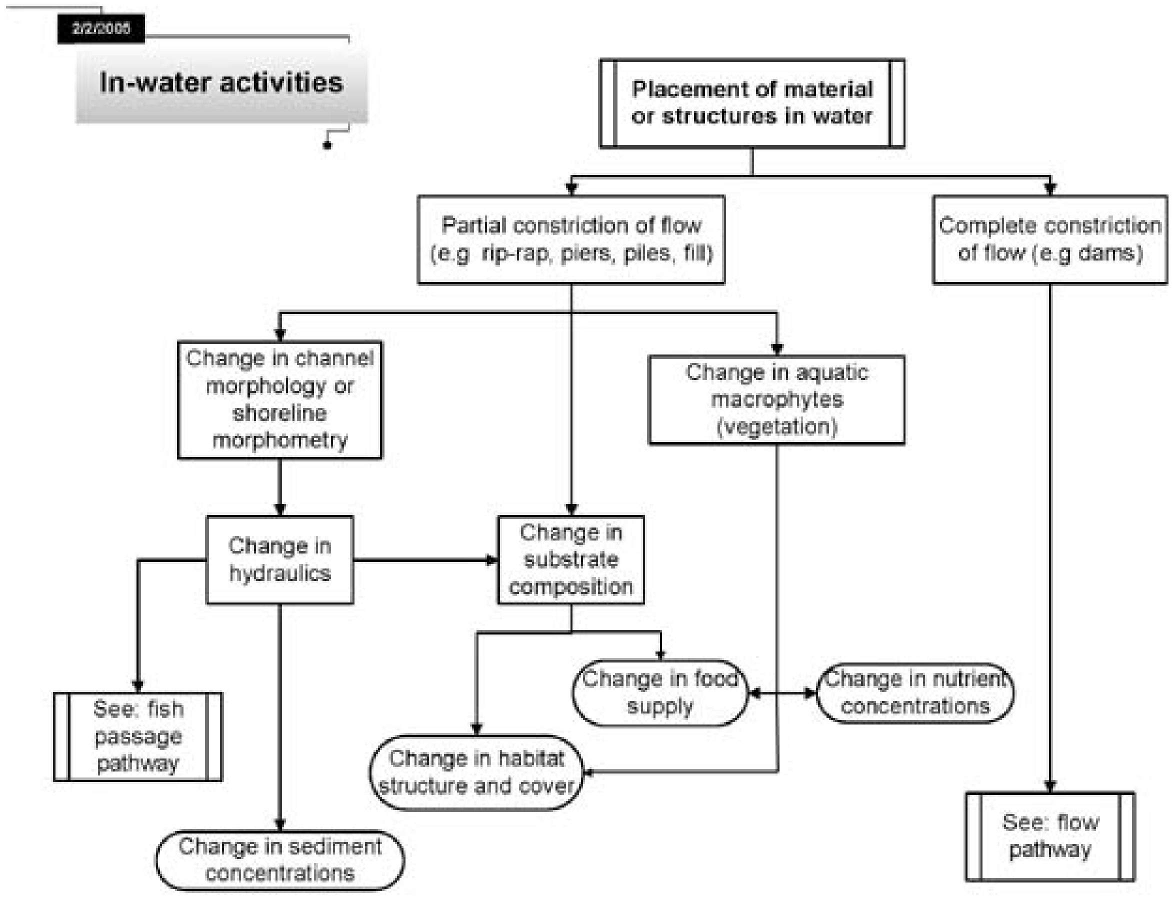
In-Water Activities

- Placement of marine finfish aquaculture site
- Addition or removal of aquatic vegetation
- Organic debris management
- Dredging
- Fish passage issues
- Placement of material or structures in water
- Marine seismic surveys
- Structure removal
- Wastewater management
- Water extraction
- Change in timing, duration and frequency of flow

The placement of material or structures such as rip-rap, piers, piles, infill material, rafts, dams or other structures that either fully or partially obstruct flow on the bed or banks of a water body/ watercourse.

NOTE:

Pathways of Effects diagrams have been developed by Fisheries and Oceans Canada as a tool to communicate potential effects of development proposals on fish and fish habitat and were developed through extensive consultation. It is expected that these diagrams will be updated to describe new activities and stressors as required.



Effects

Change in food supply: The aquatic food supply must be plentiful and diverse to sustain the productivity of a watershed. An increase or decrease in the quantity or composition of the food supply, beginning with plants and organic debris that fall into a waterway, can alter the structure of the aquatic community

Change in habitat structure and cover: The addition of in-stream organic structure and the deposition of eroded soil can affect the capacity of a watercourse to maintain a dispersed and diverse community of aquatic organisms by restricting habitat connectivity and the opportunities for organisms to use, colonize, and move between existing aquatic environments. The removal of in-stream and riparian vegetation can reduce channel stability, cover and protection from predators and physical disturbances, and the availability of diverse and stable habitats.

Change in sediment concentrations: Increased erosion of stream bank soils and rocks result in an excess of fragmented organic and inorganic material which is transported by water, wind, ice, and gravity. These sediments, which contain nutrifying elements and can capture or absorb contaminants, are suspended or else settle and collect in waterways affecting physical processes, structural attributes, and ecological conditions such as water clarity (by reducing visibility and sunlight and damaging fish gills) and reducing the availability and quality of spawning/ rearing habitat (through infilling)

Change in nutrient concentrations: Some activities may cause an increase in nutrifying elements such as nitrogen and phosphorus and mineral compounds such as ammonia, nitrates, nitrites, orthophosphates. This leads to 'eutrophication', thick growths of aquatic plants (especially algae) that block light needed by aquatic vegetation, either by clouding the water column or coating the vegetation itself. When the algae die, they settle to the bottom and are consumed by bacteria during the decomposition process. This process consumes oxygen, depleting it from bottom waters. The resulting low dissolved oxygen concentrations drive fish from their preferred habitat and can cause other organisms to die

Date modified: 2010-03-02

Riparian planting

Land-Based Activities

- Vegetation Clearing
- Cleaning or maintenance of bridges or other structures
- Excavation
- Use of explosives
- Grading
- Use of industrial equipment
- Streamside livestock grazing
- Riparian Planting

Planting terrestrial vegetation adjacent to a water body/ watercourse. This may involve the use of fertilizers, site preparation methods, and the introduction of native and non-native plant species.

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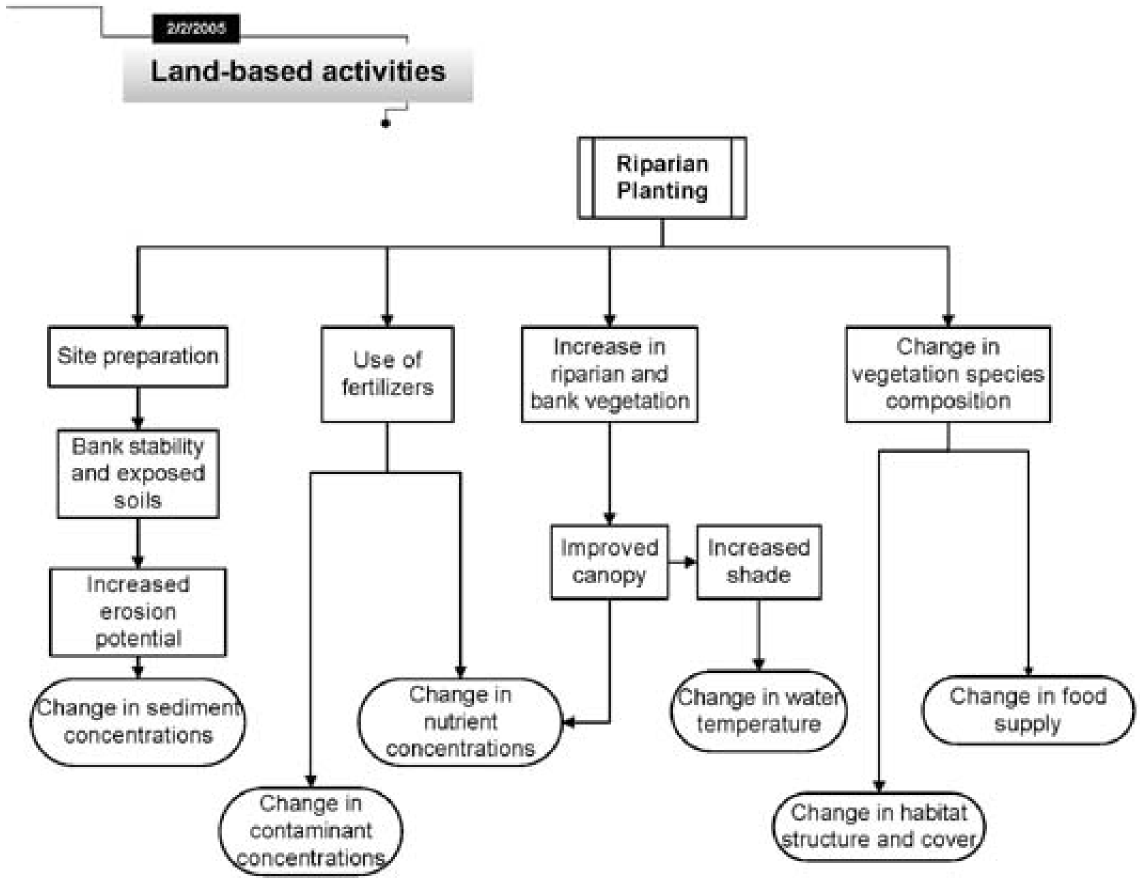

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Change in water temperature: Water temperature directly affects many of the physical, biological, and chemical characteristics of a waterway. In elevated temperatures, many coldwater fish, such as trout and salmon, could experience reduced reproductive activity or direct mortality, including egg mortality. High temperatures also encourage the microbial breakdown of organic matter, leading to a depletion of dissolved oxygen in the water body

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Change in contaminant concentrations: An increase in concentrations of toxins and pollutants in sediments and waters can breach the range of chemical parameters that support healthy aquatic communities, seriously affecting fish and fish habitat. The ecological effects can range from direct fatality to organisms, alteration of the ecosystem structure through changes in the abundance, composition, and diversity of communities and habitats, and persistence and progressive accumulation in sediments or biological tissues (bioaccumulation, biomagnification). Deformities, alterations in growth, reproductive success, and competitive abilities can result

Date modified: 2010-03-02

Change in timing, duration and frequency of flow

In-Water Activities

- Placement of marine finfish aquaculture site
- Addition or removal of aquatic vegetation
- Organic debris management
- Dredging
- Fish passage issues
- Placement of material or structures in water
- Marine seismic surveys
- Structure removal
- Wastewater management
- Water extraction
- Change in timing, duration and frequency of flow

Any activities that result in changes in the timing, duration, and/or frequency of water flow. Causes include water extraction, operation of hydroelectric facilities, installation of culverts, stream bank erosion and sediment deposit, underwater soil erosion, and the construction of temporary or permanent dams.

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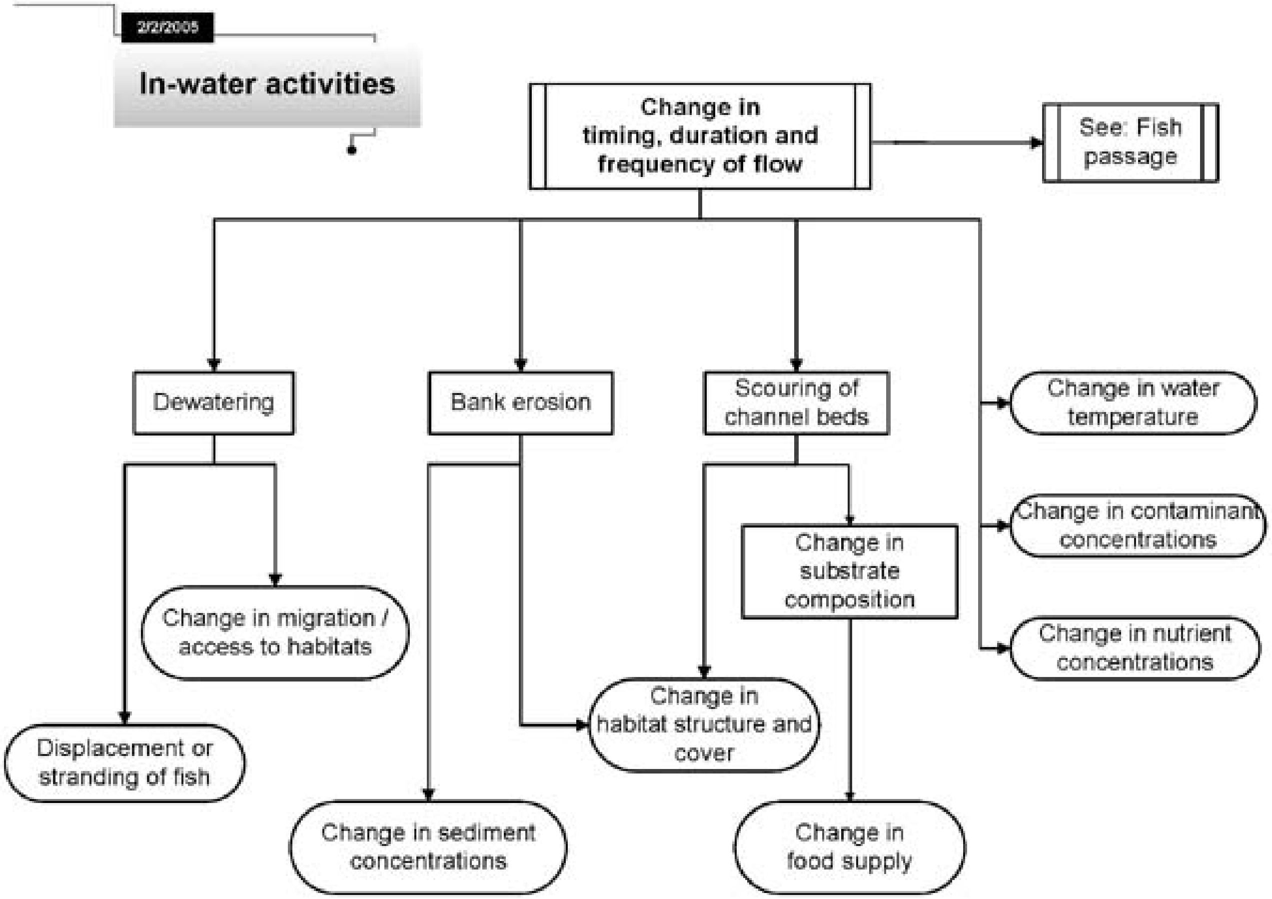

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Change in migration patterns: Dams may affect fish populations by preventing normal migration between feeding, rearing, and spawning areas and excessive flow and high water velocities can create migration barriers

Displacement or stranding of fish: Excessive flow and high water velocities can displace fish from habitat and create migration barriers. Reduced flow can result in the stranding of fish

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Date modified: 2010-03-02

Fish passage issues

In-Water Activities

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- Structure removal
- Wastewater management
- Water extraction
- Change in timing, duration and frequency of flow

Activities that cause physical or physiological impediments to fish movement or migration.

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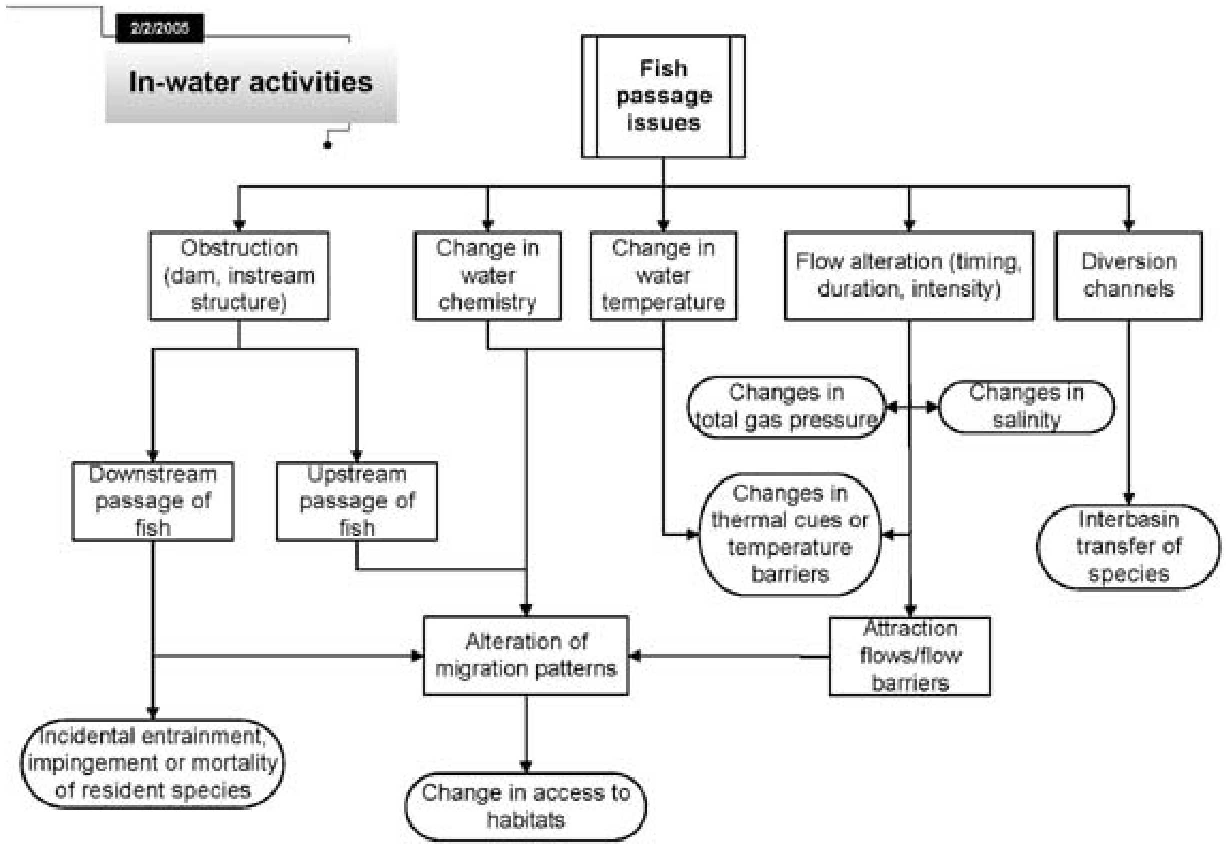

Effects

Change in total gas pressure: Dissolved gases may become supersaturated when air gets trapped in water and submerged to sufficient depth (e.g., at the base of spillways associated with hydroelectric facilities). Total gas pressure above certain levels may subject organisms to injury or mortality.

Change in salinity: Increased volume freshwater flows into estuaries at certain times can decrease salinity levels which can affect the diversity and abundance of sensitive sea grass and also affect the distribution of some fish species. Alternatively, fish eggs, larvae may not tolerate higher salinities of the marine environment that may result from decreased freshwater flows. The quantity and seasonal timing of freshwater flows are critical at sensitive stages (e.g., larval, hatching).

Change in thermal cues or temperature barriers: Temperature often serves as a behavioural cue for fish. Anadromous fish, such as salmon, and shellfish, need temperature to trigger reproductive behaviour. Thermal pollution resulting in higher temperatures can cause a shift in the timing of reproduction and changes in the community structure

Interbasin transfer of species: Diversion channels can promote the interbasin transfer of water which can promote insurgence of invasive species or other non-native aquatic organisms

Incidental entrainment impingement or mortality of resident species: Fish may become entrained through intakes, turbines, spillways, etc. or impinged at screens and can result in injury or mortality.

Change in access to habitat/ migration: An alteration in water depth, flow, and/or substrate size causing a disruption in access to fish habitats essential for various life processes within given fish populations such as spawning and rearing

Placement of marine finfish aquaculture site

In-Water Activities

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Aquaculture is the farming of aquatic organisms in water. It implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, and protection from predators and disease. It also implies individual or corporate ownership of the stock being farmed.

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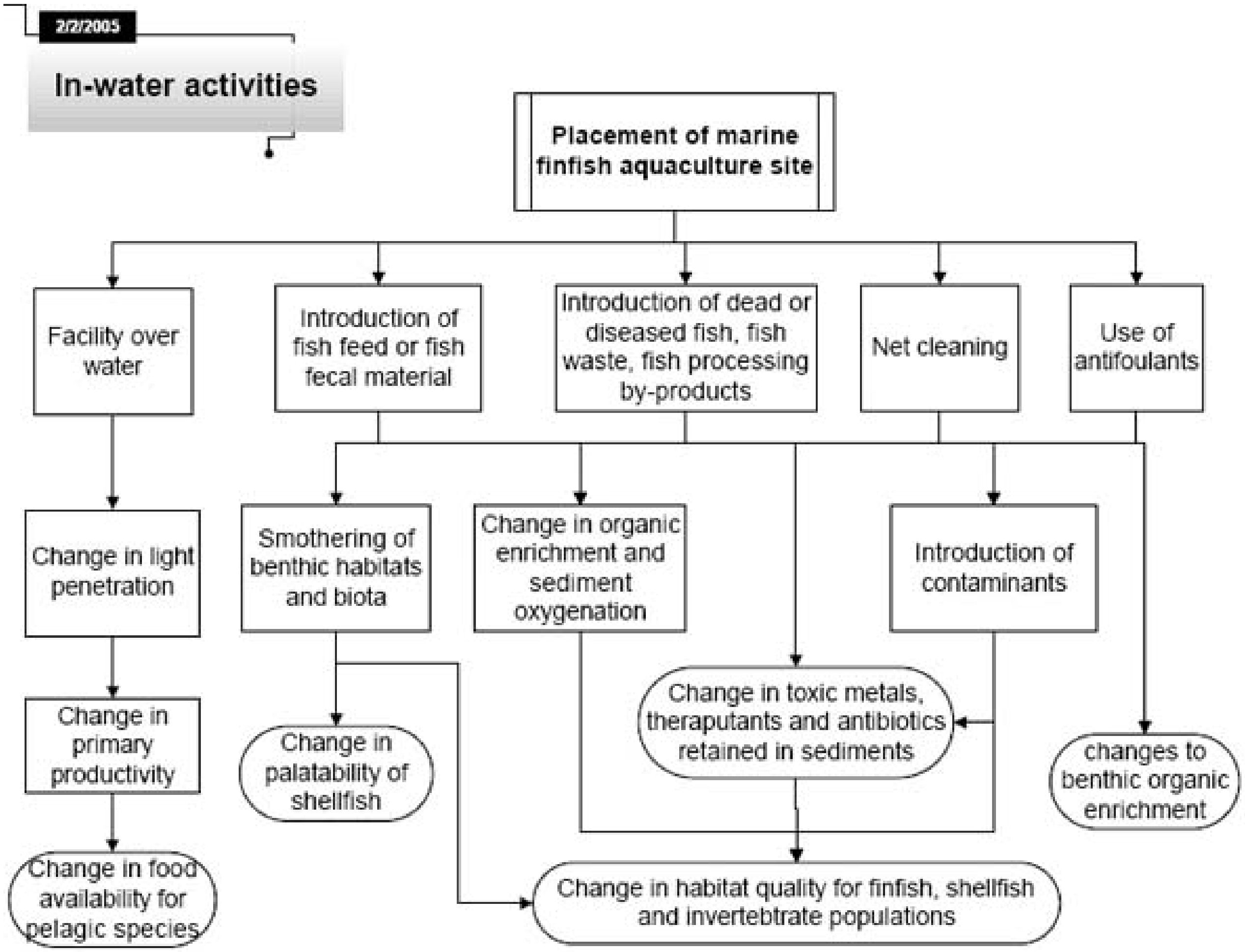

Effects

Change in palatability of shellfish: Proximity to an open-water aquaculture facility can affect the taste, odour and texture of shellfish cultures.

Change in toxic metals, theraputants, and antibiotics retained in sediments: Extraneous fish feed, fish waste, antibiotics and other contaminants from aquaculture sits enters water column and settles into the substrate and contaminates sediments.

Change in habitat quality for finfish, shellfish, and invertebrate populations: Extraneous fish feed, fish waste, antibiotics and other contaminants enters water column and is ingested by pelagic fish species and by shellfish and invertebrate populations when this matter settles on the bed of the water body. The accumulation of this matter can affect the complexity of the bed and the abundance/diversity of plant life.

Change in benthic organic enrichment: Marine fish farms are a source of dissolved and suspended organic matter which originates as fish faeces, excess fish feed, and net-cleaning wastes. The ecological effects include sedimentation, stratification, and transportation of the organic matter which can produce chemical and physical alterations, such as increased metabolism by aerobic bacteria, leading to hypoxia, anoxia, structural changes in the food web, and death of the most susceptible aerobic life forms

Change in food availability for pelagic species : Fish farms in water can decrease the availability for food in the water column, which smaller pelagic fish species rely on as primary food source.

Date modified: 2010-03-02

Fisheries and Oceans Canada

Dredging

In-Water Activities

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- Structure removal
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- Water extraction
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The physical removal of materials including rocks, bottom sediments, plants, debris, sand, and refuse from the bed of a water body/watercourse for the purpose of excavating, cleaning, deepening, widening, or lengthening the watercourse. This requires the use of a dredge machine working from the bank, in the water or floating on water.

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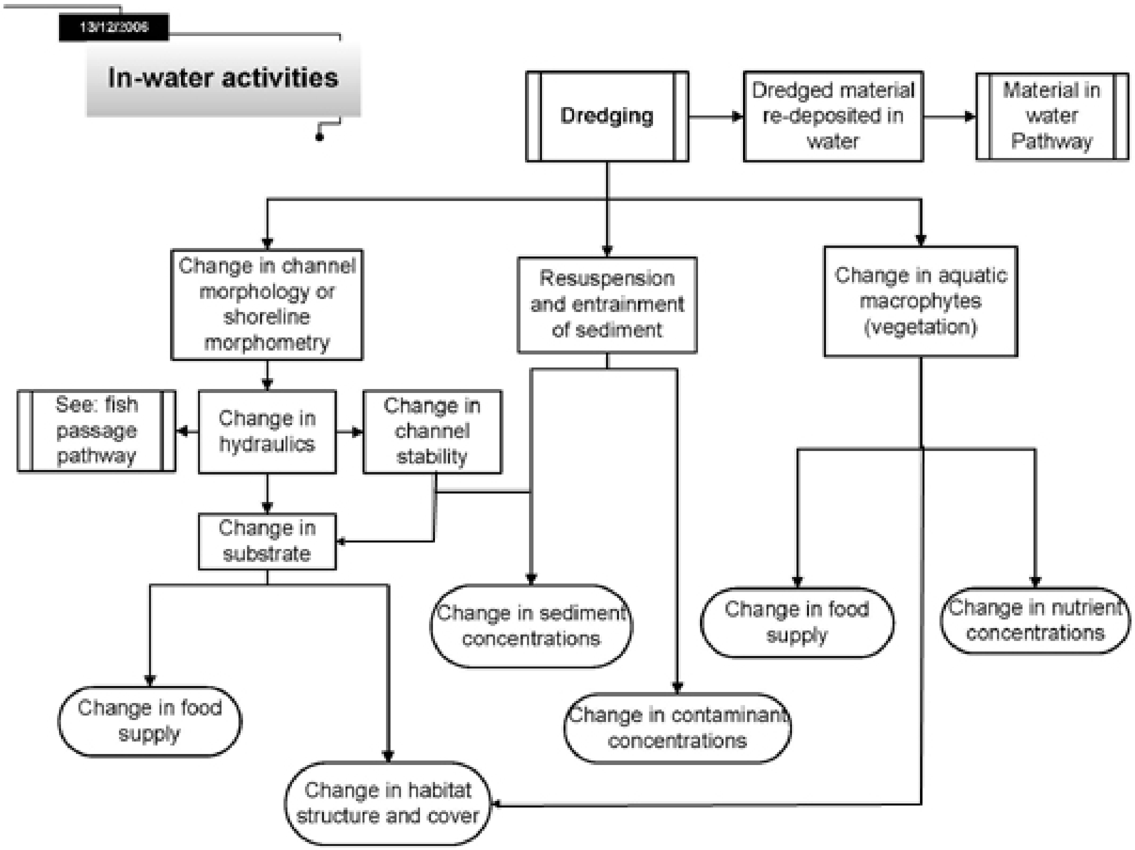

Effects

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Organic debris management

In-Water Activities

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- Water extraction
- Change in timing, duration and frequency of flow

The collection and removal of organic debris such as logs, for the purposes of maintenance and navigation. This may be achieved by hand or with mechanical equipment.

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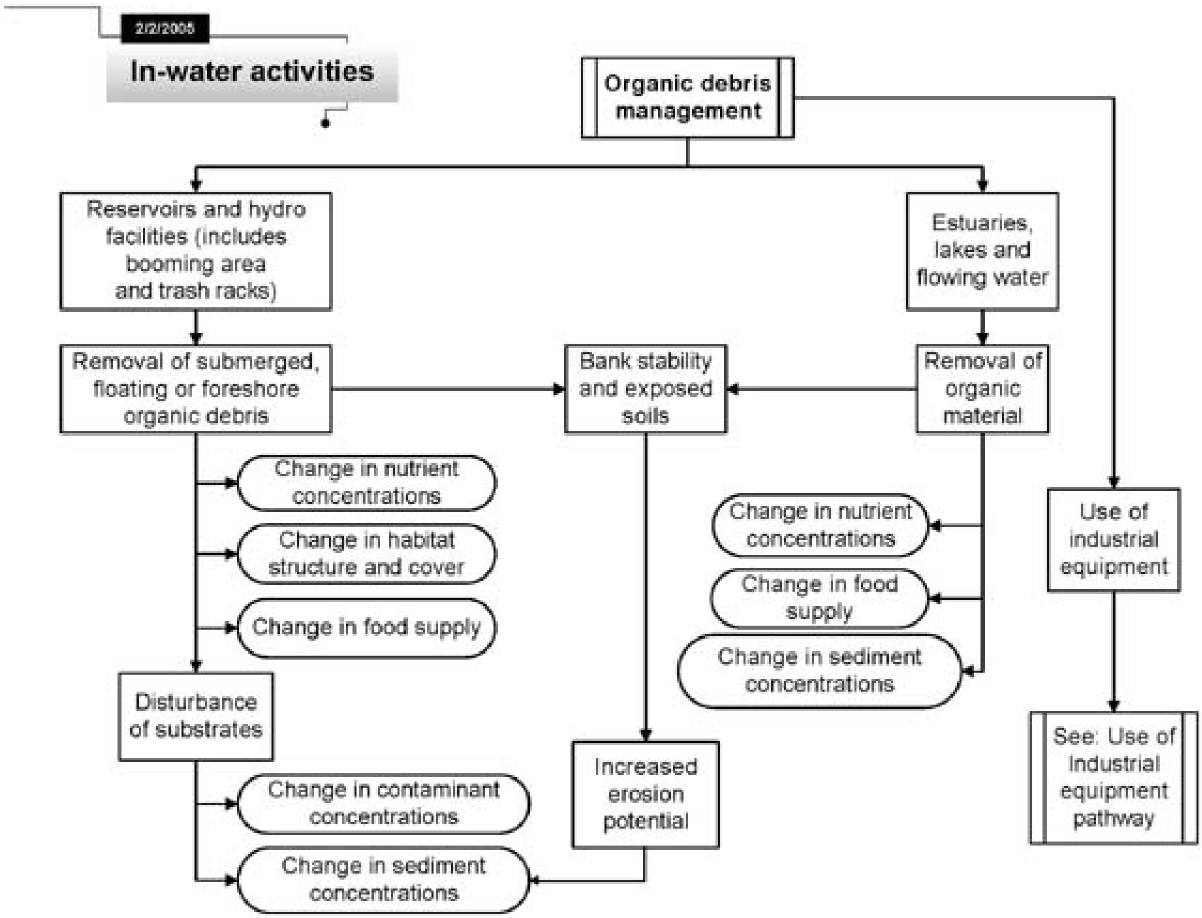

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Addition or removal of aquatic vegetation

In-Water Activities

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The addition or removal of aquatic vegetation. This may be achieved by hand, with herbicides, or with mechanical equipment.

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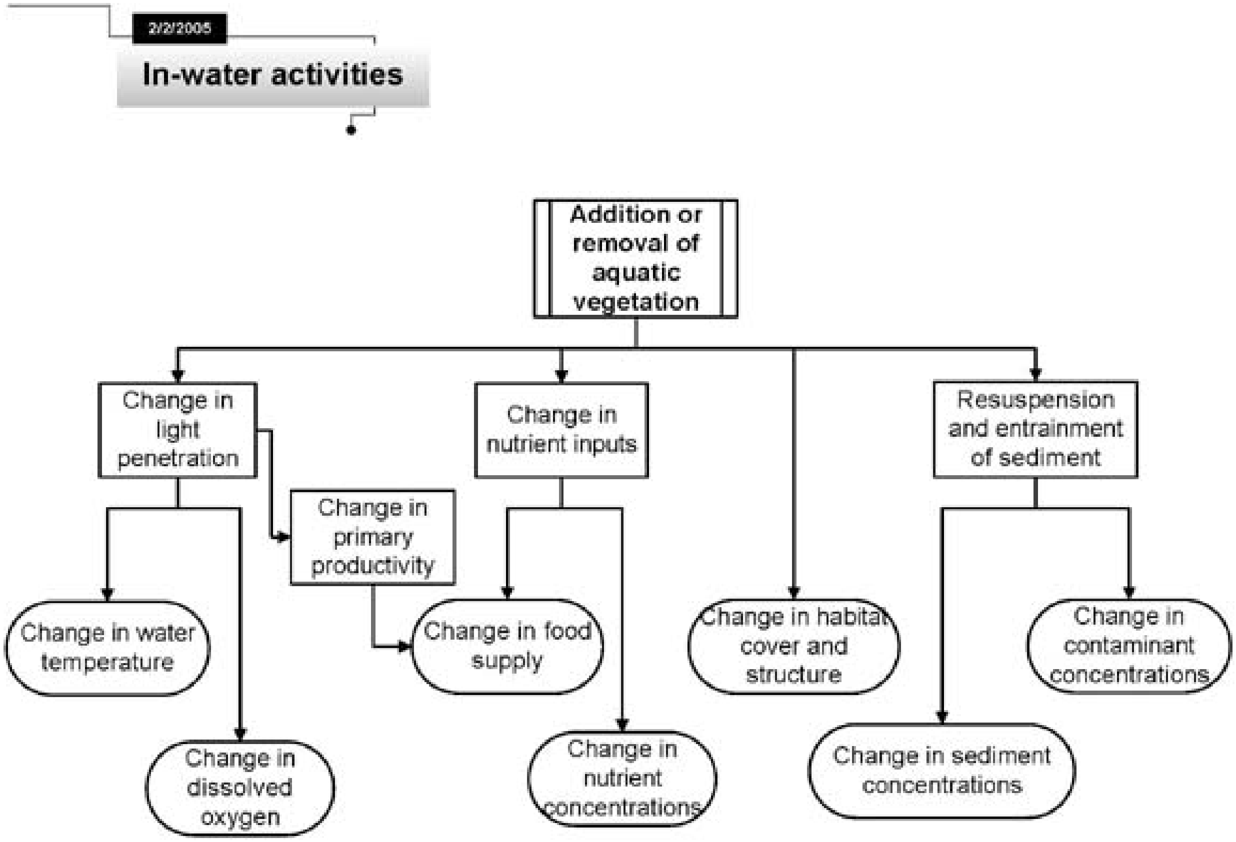

Effects

Change in water temperature: Water temperature directly affects many of the physical, biological, and chemical characteristics of a waterway. In elevated temperatures, many coldwater fish, such as trout and salmon, could experience reduced reproductive activity or direct mortality, including egg mortality. High temperatures also encourage the microbial breakdown of organic matter, leading to a depletion of dissolved oxygen in the water body

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Change in dissolved oxygen: Adequate concentrations of oxygen dissolved in water are necessary for the life of fish and other aquatic organisms. Dissolved oxygen is affected by a number of different factors, including temperature, biological activity, and turbulence

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Fisheries and Oceans Canada

Water extraction

In-Water Activities

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- Addition or removal of aquatic vegetation
- Organic debris management
- Dredging
- Fish passage issues
- Placement of material or structures in water
- Marine seismic surveys
- Structure removal
- Wastewater management
- Water extraction
- Change in timing, duration and frequency of flow

Water-taking from groundwater sources, lakes, and rivers for a variety of purposes such as municipal drinking water supplies, irrigation of agricultural lands and golf courses, and industrial functions such as nuclear facilities, pulp mills, mining, and hydroelectric power generation. A distinction may be drawn between "consumptive" (water not returned to the watershed, as in water bottling and beverage manufacturing) and "non-consumptive" (such as municipal drinking water supplies) water-taking activities. This is achieved primarily through pumping.

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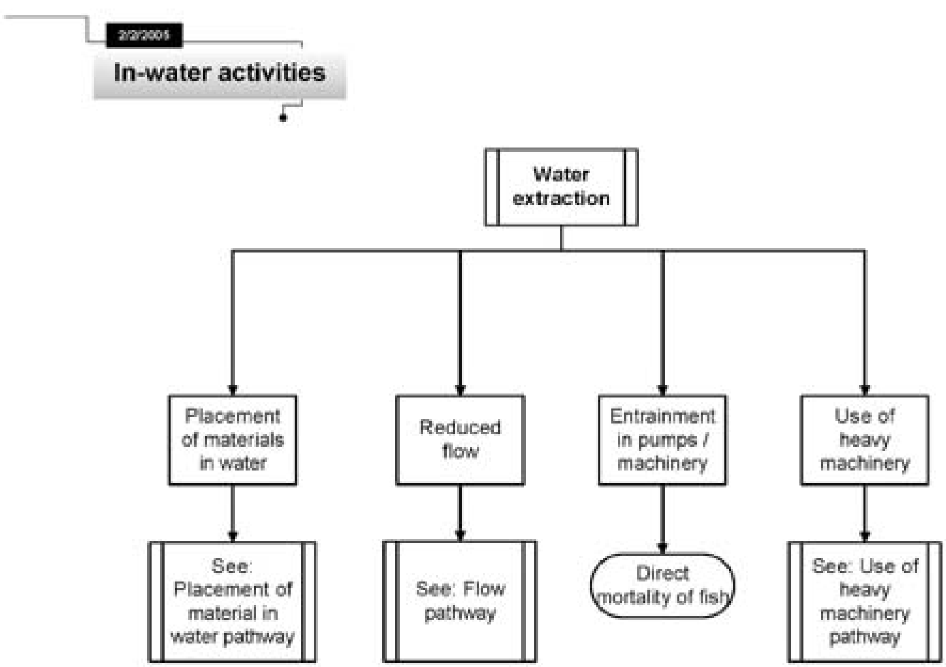

Effects

Direct or indirect mortality of fish: Unpolluted and adequate stream flow is required by fish to maintain habitat accessibility, water temperature, and dissolved oxygen levels. Irresponsible water extraction can result in the dewatering of downstream areas, obstruction of fish passage, and entrainment or impingement of fish on pump screens

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Wastewater management

In-Water Activities

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- Change in timing, duration and frequency of flow

Construction, maintenance, operation and decommissioning of facilities that produce and release wastewater that may contain biological or chemical contaminants or that may be of significantly different temperature from the receiving environment. Examples include residential, industrial, or municipal discharges.

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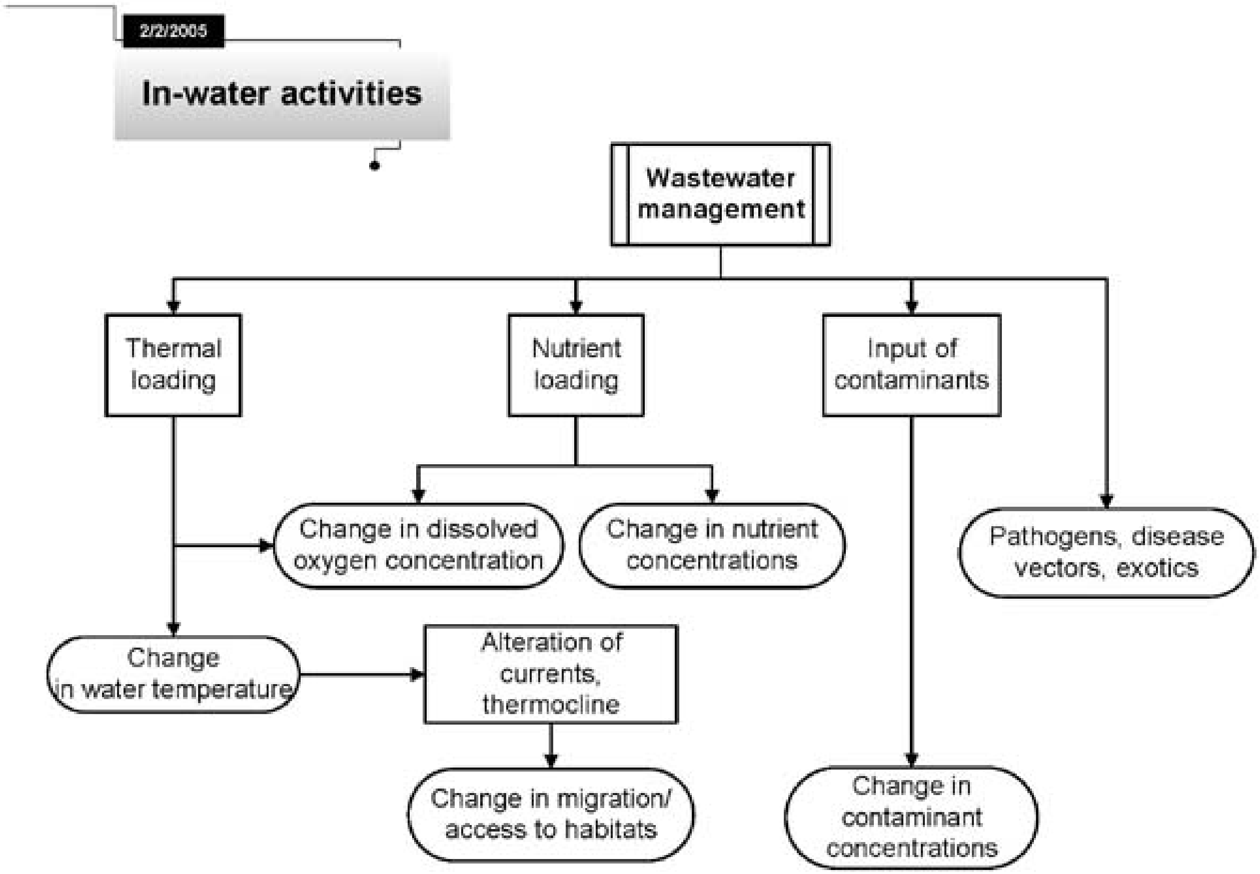

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Pathogens, disease vectors, exotics: Wastewater management sites can be a mechanism to introduce and transport pathogens and other contaminants into the water system.

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Vegetation Clearing

Land-Based Activities

- Vegetation Clearing
- Cleaning or maintenance of bridges or other structures
- Excavation
- Use of explosives
- Grading
- Use of industrial equipment
- Streamside livestock grazing
- Riparian Planting

The removal or clearing of the existing terrestrial vegetation within a given tract of land. This may be achieved through the manual or mechanized removal of vegetation using industrial equipment, herbicides which kill or inhibit the growth of certain plants, or any other method (i.e.: manual) that results in the alteration of terrestrial vegetation.

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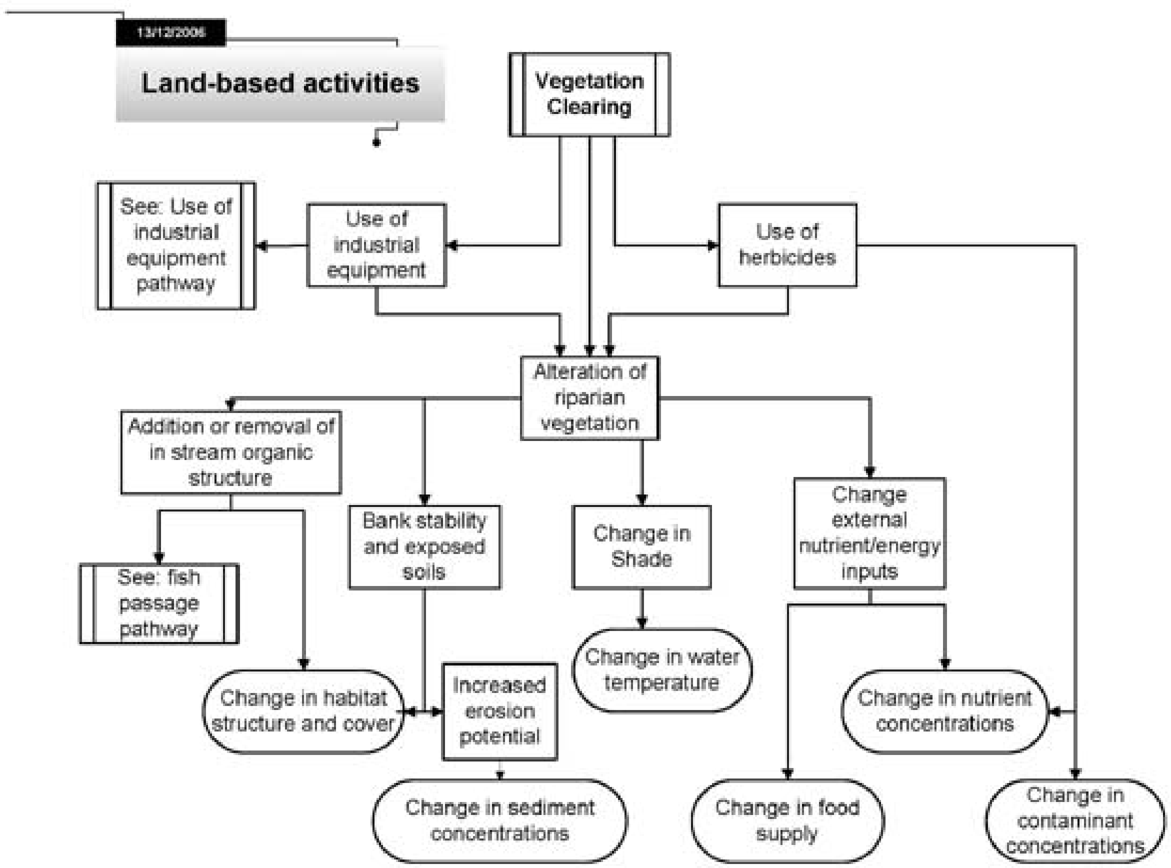

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Change in nutrient concentrations: Some activities may cause an increase in nutrifying elements such as nitrogen and phosphorus and mineral compounds such as ammonia, nitrates, nitrites, orthophosphates. This leads to 'eutrophication', thick growths of aquatic plants (especially algae) that block light needed by aquatic vegetation, either by clouding the water column or coating the vegetation itself. When the algae die, they settle to the bottom and are consumed by bacteria during the decomposition process. This process consumes oxygen, depleting it from bottom waters. The resulting low dissolved oxygen concentrations drive fish from their preferred habitat and can cause other organisms to die.

Change in food supply: The aquatic food supply must be plentiful and diverse to sustain the productivity of a watershed. An increase or decrease in the quantity or composition of the food supply, beginning with plants and organic debris that fall into a waterway, can alter the structure of the aquatic community.

Change in contaminant concentrations: An increase in concentrations of toxins and pollutants in sediments and waters can breach the range of chemical parameters that support healthy aquatic communities, seriousy affecting fish and fish habitat. The ecological effects can range from direct fatality to organisims, alteration of the ecosystem structure through changes in the abundance, composition, and diversity of communities and habitats, and persistence and progressive accumulation in sediments or biological tissues (bioaccumulation, biomagnification). Deformities, alterations in growth, reproductive success, and competitive abilities can result.

Date modified: 2010-03-02

Fisheries and Oceans Canada

Use of explosives

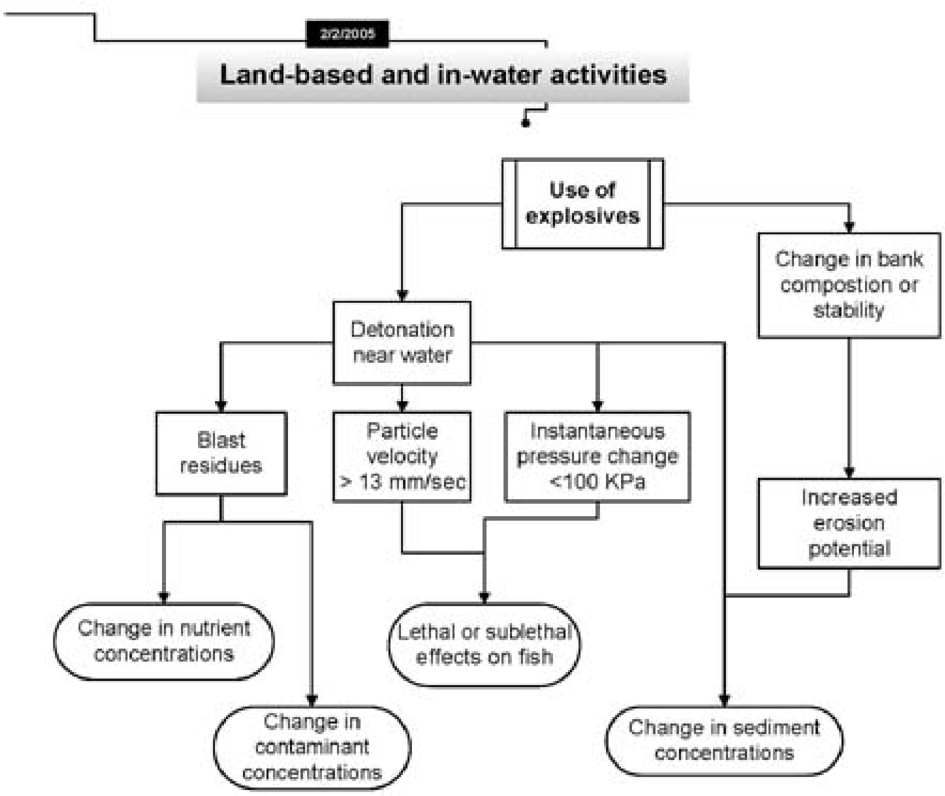
Land-Based Activities

- Vegetation Clearing
- Cleaning or maintenance of bridges or other structures
- Excavation
- Use of explosives
- Grading
- Use of industrial equipment
- Streamside livestock grazing
- Riparian Planting

Detonation of explosive materials in or near water during construction, maintenance or decommissioning phases.

NOTE:

Pathways of Effects diagrams have been developed by Fisheries and Oceans Canada as a tool to communicate potential effects of development proposals on fish and fish habitat and were developed through extensive consultation. It is expected that these diagrams will be updated to describe new activities and stressors as required.



Effects

Change in nutrient concentrations: Some activities may cause an increase in nutrifying elements such as nitrogen and phosphorus and mineral compounds such as ammonia, nitrates, nitrites, orthophosphates. This leads to 'eutrophication', thick growths of aquatic plants (especially algae) that block light needed by aquatic vegetation, either by clouding the water column or coating the vegetation itself. When the algae die, they settle to the bottom and are consumed by bacteria during the decomposition process. This process consumes oxygen, depleting it from bottom waters. The resulting low dissolved oxygen concentrations drive fish from their preferred habitat and can cause other organisms to die

Lethal or sublethal effects on fish: Blasting in or near water produces shock waves that can damage fish swim bladders and rupture internal organs. Vibrations from the use of explosives may also kill or damage fish eggs or larvae

Change in contaminant concentrations: An increase in concentrations of toxins and pollutants in sediments and waters can breach the range of chemical parameters that support healthy aquatic communities, seriously affecting fish and fish habitat. The ecological effects can range from direct fatality to organisms, alteration of the ecosystem structure through changes in the abundance, composition, and diversity of communities and habitats, and persistence and progressive accumulation in sediments or biological tissues (bioaccumulation, biomagnification). Deformities, alterations in growth, reproductive success, and competitive abilities can result

Change in sediment concentrations: Change in sediment concentrations Increased erosion of stream bank soils and rocks result in an excess of fragmented organic and inorganic material which is transported by water, wind, ice, and gravity. These sediments, which contain nutrifying elements and can capture or absorb contaminants, are suspended or else settle and collect in waterways affecting physical processes, structural attributes, and ecological conditions such as water clarity (by reducing visibility and sunlight and damaging fish gills) and reducing the availability and quality of spawning/ rearing habitat (through infilling)

Date modified: 2010-03-02

Attachment B Fisheries Offsetting and Meeting Summary

MEMO

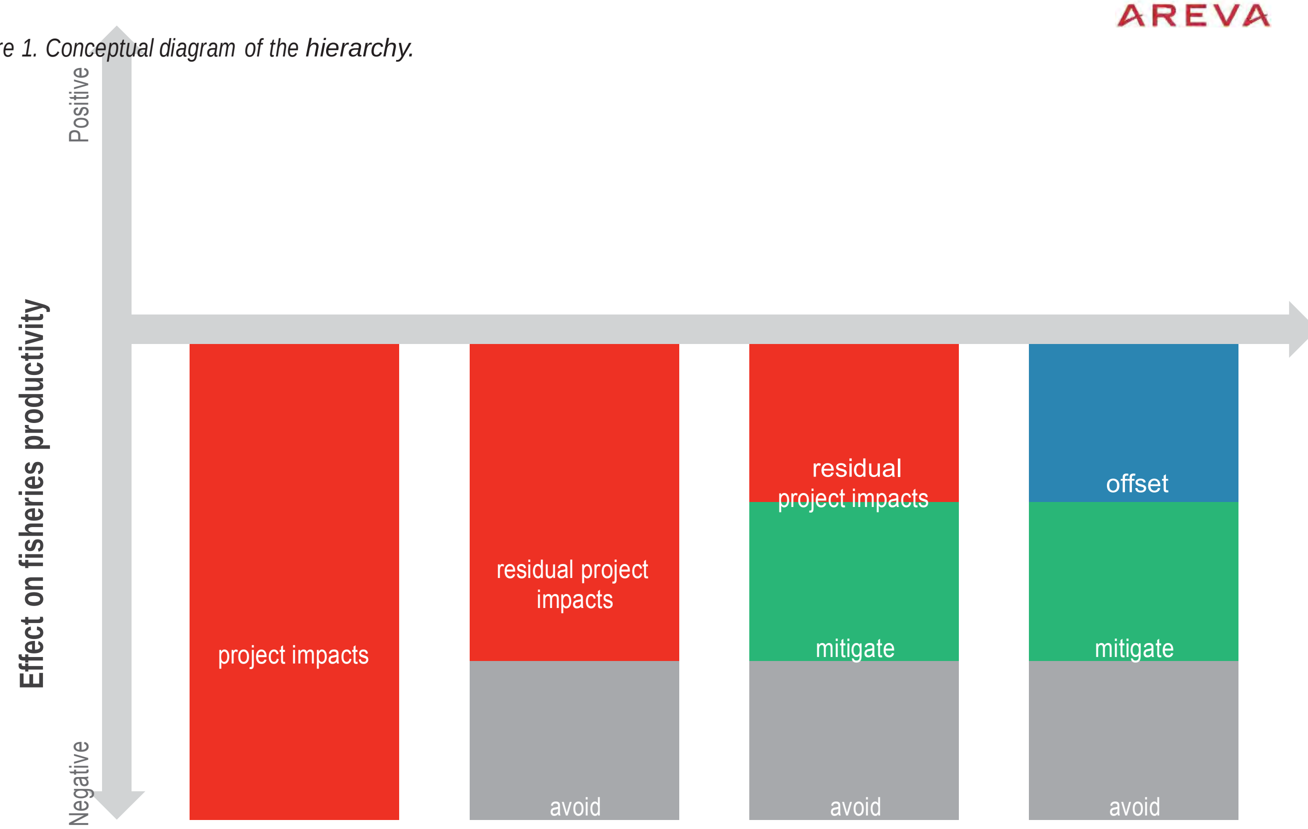
Kiggavik Department

Date: July 25, 2014		**Pages** (this page included/cette page incluse):	
To / A:	Arden Rosaasen		
Company / Société:			**Fax:**
From / De:	Barry McCallum	**E-mail:**	
Tel. / Phone:	306-343-4596		**Fax:**
Copy to / Copie à:			
Subject / Objet:			

Community input for a Fisheries Offset Plan was obtained from community members in Baker Lake. On April 24, a presentation on Fisheries Offset was given to the Baker Lake HTO and a questionnaire in English and Inuktitut was left with the HTO (provided below). On June 23, a group of eight people from Baker Lake who fish regularly was invited to a discussion group meeting at the AREVA Baker Lake Office. Later on June 23, fisheries offset was a topic of discussion at the Community Liaison Committee meeting. The discussion group and CLC discussion were based on the offset questionnaire (provided below).

We haven't received feedback from the Baker Lake HTO. Between the two discussions on June 23, 12 people participated in the meetings including HTO Board members and elders. The following answers were provided to the questions on the questionnaire. The locations described have been shown on the attached figure (Attachment C Community Input for Fisheries Offset).

Figure 1. Conceptual diagram of the hierarchy.



Projects can negatively affect fish and fish habitat (red boxes). Efforts should be made to avoid impacts first (grey boxes). When avoidance is not possible, then efforts should be made to mitigate impacts caused by the project in question (green boxes). After these actions, any residual impacts should then be addressed by offsetting (blue boxes). ***Note****: the size of these boxes is for illustrative purposes only.*

If it is determined that the interactions of the Kiggavik Project results in residual project impacts to fisheries productivity, an Offset Plan will be required.

What would you like to see in an Offset Plan?

Are there streams or channels where fish cannot pass?

- *There are steams near Rankin Inlet, Chesterfield Inlet and Whale Cove where char get stranded and die. The dead fish face the same way. The locals in those communities can show where.*
- *Fewer fish are being seen in the Prince River near Baker Lake due to low water.*
- *One of the first streams on the way to Meadowbank (at sign before Meadowbank road) has fish that can't pass in low water.*

Are there areas where the water is muddy and the stream banks are eroding?

- *A stream at the northwest end of Aberdeen lake gets milky.*
- *Lots of erosion at the first rapids on the Thelon.*

- *Dust from Meadowbank is clouding streams along the road.*
- *The mouth of the Prince River is eroded.*
- The river entering Baker Lake to the east of the Kazan River gets milky when it is windy.

Are there areas where fish get stranded?

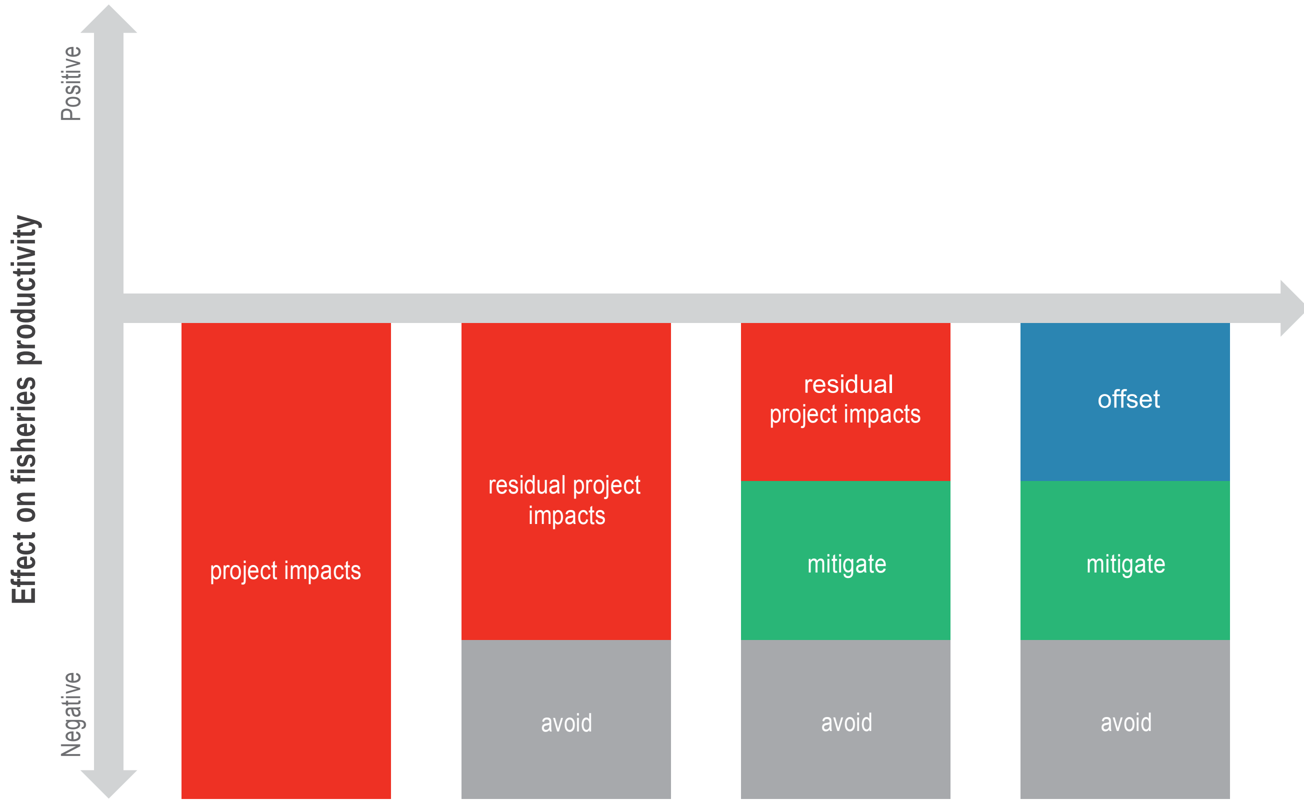
- *The river that enters Shultz Lake from the north at the east end gets fish stranded.*
- *There are many streams where fish get stranded when the water level drops.*

Are there areas where garbage gets into the water?

- Downstream of garbage dump, the stream, Finger Lake and Airplane Lake is polluted and full of garbage.
    - Fish turn black
    - Fish are the first to show pollution
    - Maybe harming drinking water
    - Hamlet looking at new garbage dump
    - Used to be good fishing near town.
    - Would be good legacy for AREVA to fix (maybe with new garbage facilities)

OFFSET QUESTIONNAIRE

Figure 1. Conceptual diagram of the hierarchy.



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If it is determined that the interactions of the Kiggavik Project results in residual project impacts to fisheries productivity, an Offset Plan will be required.

What would you like to see in an Offset Plan?

Are there streams or channels where fish cannot pass?

Are there areas where the water is muddy and the stream banks are eroding?

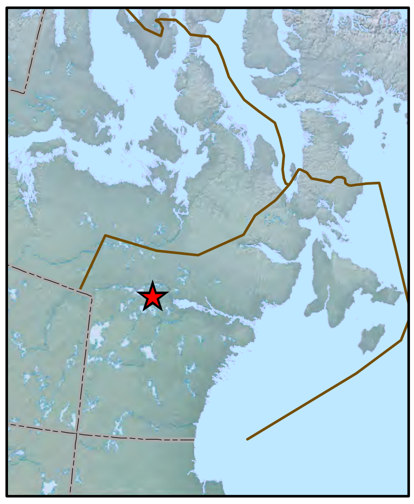
Are there areas where fish get stranded?

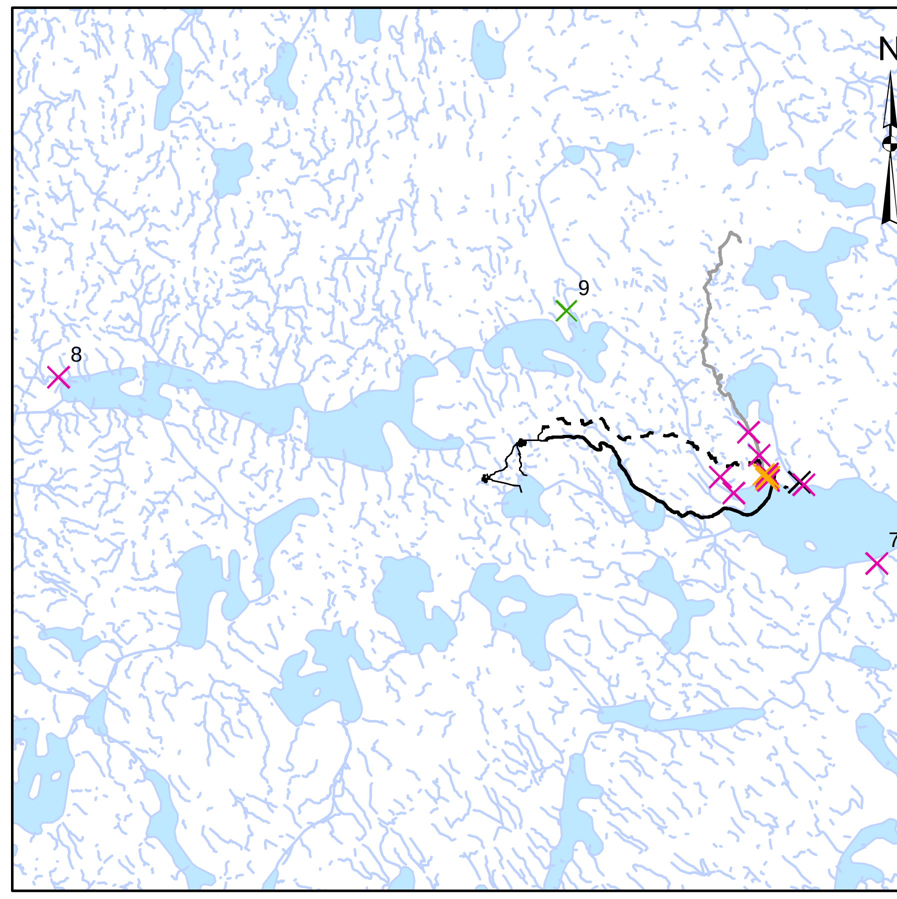
Are there areas where garbage gets into the water?

Legend

Fisheries Concern

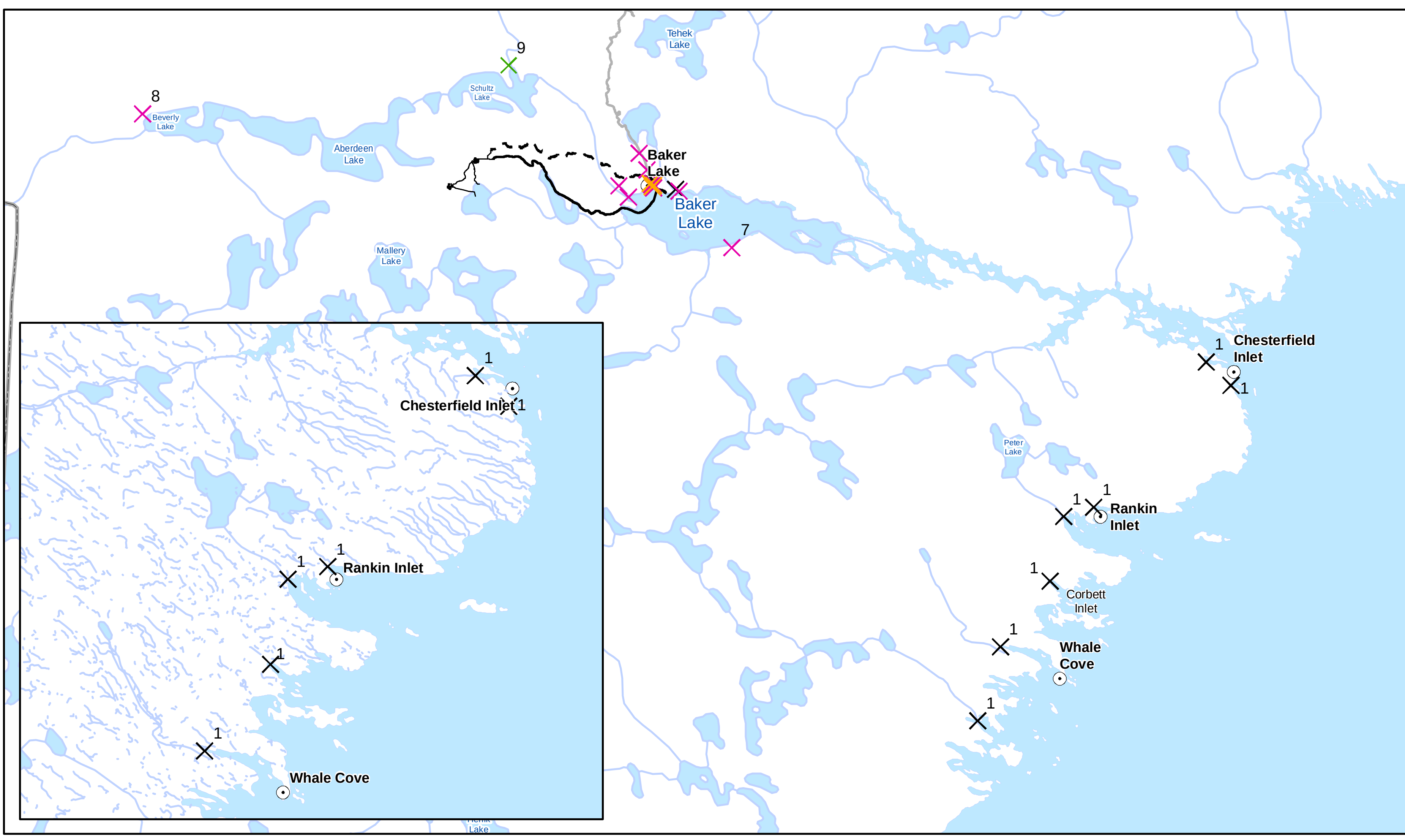
- Fish Cannot Pass
- Fish Stranded
- Garbage Enters Water
- Muddy Water or Eroded Banks
- Kiggavik Site
- Proposed All-Season Road (Option)
- Proposed Winter Road (Preferred)
- Meadowbank All-Season Road (Existing)
- River
- Lake

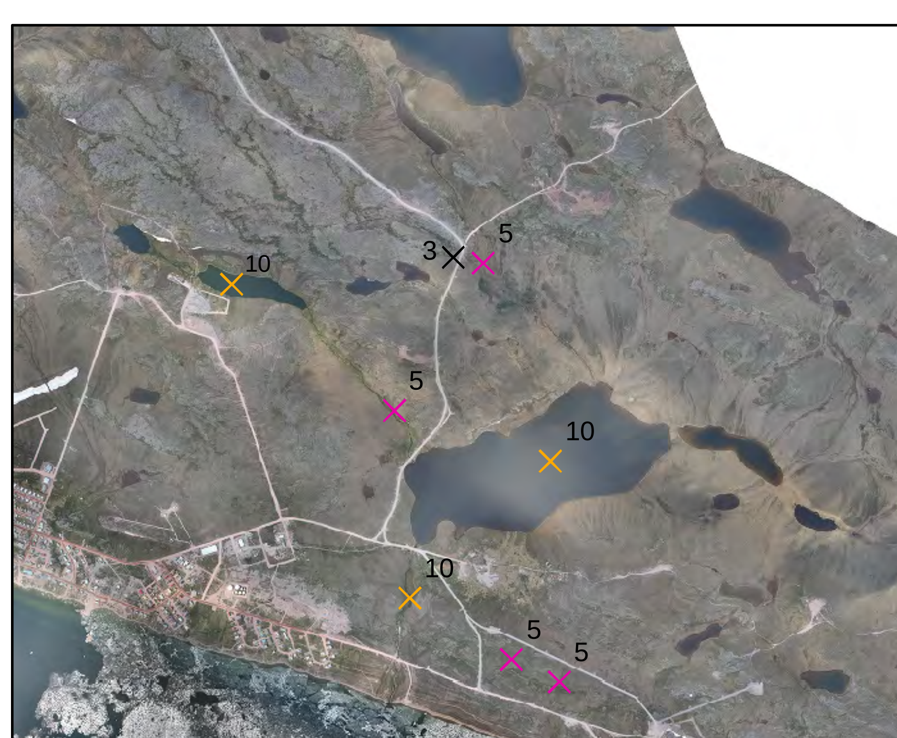




Description

1. There are streams near Rankin Inlet, Chesterfield Inlet, and Whale Cove where char get stranded and die.
2. Fewer fish are being seen in the Prince River near Baker Lake due to low water.
3. One of the first streams on the way to Meadowbank has fish that can't pass in low water.
4. Lots of erosion at the first rapids on the Thelon.
5. Dust from the Meadowbank is clouding streams along road.
6. The mouth of the Prince River is eroded.
7. The river entering Baker Lake to the east of the Kazan River gets milky when it is windy.
8. A stream at the northwest end of Aberdeen Lake gets milky.
9. The river that enters Schultz Lake from the north at the east end gets fish stranded.
10. Areas where garbage gets into water.





Projection: NAD 1983 UTM Zone 14N
Compiled: TL Drawn: TL
Date: 9/9/2014 Scale: 1:2,000,000
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, AREVA Resources Canada Inc.*

ATTACHMENT C
COMMUNITY INPUT FOR FISHERIES OFFSET

ENVIRONMENTAL IMPACT STATEMENT
APPENDIX 5L

40 0 40
Kilometers

KIGGAVIK PROJECT

AREVA

File: Q:\SHEQ\GIS\KIGGAVIK\2014\EIS\Volume 5 - Aquatic Environment\Maps\Volume 5 Tier 3\Appendix 5L - Conceptual Fisheries Offsetting Plan\MXD\Attachment C - Community Input for Fisheries Offset.mxd

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