April 2014

FINAL REPORT

SD 7-4 Conceptual Fisheries Protection and Offsetting Plan - Meliadine Gold Project, Nunavut

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REPORT

Report Number: Doc 361-1314280007 Ver. 0

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Abbreviation and Acronym List

AEM	Agnico Eagle Mines Limited
CCME	Canadian Council of Ministers of the Environment
CPUE	Catch-per-Unit-Effort
CRA	Commercial, recreational or Aboriginal
DEIS	Draft Environmental Impact Statement
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
FEIS	Final Environmental Impact Statement
Golder	Golder Associates Ltd.
HADD	harmful alteration, disruption or destruction
HEP	Habitat Evaluation Procedure
HSI	Habitat Suitability Index
HTO	Hunters and Trappers Organization
HU	Habitat Unit
KIA	Kivalliq Inuit Association
MMER	Metal Mining Effluent Regulations
NIRB	Nunavut Impact Review Board
NNL	No Net Loss
NNLP	No Net Loss Plan
RMF	Risk Management Framework (DFO 2010)
TSF	Tailings Storage Facility
VEC	Valued Ecosystem Component

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Agnico Eagle Mines Limited (AEM) has prepared the present Conceptual Fisheries Protection and Offsetting plan pursuant to the aquatic effects assessment outlined in the Final Environmental Impact Statement (FEIS) for the Meliadine Gold Mine Project (the Project), located in Nunavut. The present Conceptual Fisheries Protection and Offsetting Plan discusses measures to counterbalance the unavoidable serious harm to fish resulting from Project activities and components, with the goal of maintaining or improving the productivity of the commercial, recreational or Aboriginal (CRA) fishery. It also provides the philosophy and structure that will be applied to fulfill the offsetting requirements throughout the life of the Project.

The currently proposed Conceptual Fisheries Protection and Offsetting Plan takes into account the range of project activities and potential project-environment interactions identified as being of concern for the aquatic ecosystem. It incorporates the objective of the fisheries protection policy to maintain or enhance the ongoing productivity and sustainability of CRA fisheries, as outlined in the Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (DFO 2013a), and includes habitat replacement options and monitoring programs as developed in consultation with Fisheries and Oceans Canada (DFO) and Kivalliq Inuit Association (KIA). The requirements of the Metal Mining Effluent Regulations (MMER) of the *Fisheries Act* are also considered, where appropriate.

As noted in Section 1.1 below, the Conceptual Fisheries Protection and Offsetting Plan was presented in the Draft Environmental Impact Statement (DEIS) as a Conceptual No-Net-Loss Plan (NNLP). The NNLP was prepared to comply with requirements in Section 9.4.18 of the "Guidelines for the Preparation of an Environmental Impact Statement for Agnico Eagle Mines Limited's Meliadine Gold Project (NIRB File No. 11MN034)" (NIRB 2012). The complete Guidelines for the Project, including FEIS section and page number referencing, are summarized in the main FEIS concordance (Volume 1, Appendix 1.0-A). Since preparation of the NIRB Guidelines (NIRB 2012) and submission of the DEIS, there have been substantial changes to the *Fisheries Act,* with the emphasis shifting from compensation for habitats affected by harmful alteration, disruption or destruction (HADD) to the concepts of offsetting potential impacts to the productivity of CRA fisheries. In accordance with commitments made during the Technical Meetings and Pre-hearing Conference concerning the Project (NIRB 2014), this Conceptual Fisheries Protection and Offsetting Plan has been prepared to update the NNLP to reflect the new objectives of the current *Fisheries Act*. As such, while this document remains consistent with the original Guidelines for the Project (NIRB 2012), it may no longer be in strict compliance with those Guidelines. AEM has consulted with NIRB about this issue and any potential discrepancies are discussed in FEIS Volume 1.

The construction and operation of the Project will cause serious harm to fish, which is defined in Section 2 of the *Fisheries Act* as the death of fish or any permanent alteration to, or destruction of, fish habitat. As death of fish is not anticipated as a direct result of the Project (except for fish distributed to local communities during fish-out of waterbodies to be dewatered – see Section 7.0), the serious harm to fish will result mainly from the alteration and destruction of fish habitat in the Meliadine Lake watershed. The affected habitat areas will include portions of waterbodies (i.e., lakes and ponds) and watercourses (i.e., streams) on a large Peninsula in the Meliadine Lake watershed, and ponds adjacent to Chickenhead Lake at the Discovery site. Some lakes and ponds will be permanently lost (i.e., destroyed), while others will be physically altered (e.g., deepened) by mining activities, or will be dewatered (or partially dewatered) during the construction and operation phases, but otherwise physically unaltered. Where avoidance or mitigation of serious harm to fish is not feasible, the residual net effects will be offset by measures to ensure the sustainability and ongoing productivity of CRA fisheries.

This Conceptual Fisheries Protection and Offsetting Plan provides an outline of the proposed offsetting measures in relation to the Project effects as they are predicted in the FEIS. These options have been discussed with DFO staff and local stakeholders (Hunters and Trappers Organizations [HTO], KIA, and community members) during several meetings over the past years, to further the planning of offsetting measures and allow for feedback (see Table A-1 in Appendix A). A final offsetting plan, which will include the detailed design and monitoring methods, will be developed during the Project permitting phase. This document provides background, rationale, objectives and information on data collection and analysis for the communities, public, and regulatory authorities participating in the development of the Conceptual Fisheries Protection and Offsetting Plan to illustrate the approach that AEM plans to follow. It will be used to provide the basis for the development of the final offsetting plan, after a consensus with the regulators and stakeholders is achieved.

1.1 Regulatory Framework

The Conceptual Fisheries Protection and Offsetting Plan was presented in the DEIS as a Conceptual No-Net-Loss Plan (NNLP). It was developed in accordance with DFO's No-Net-Loss (NNL) policy, which was current at the time of NNLP development, and focussed on compensation for aquatic habitats affected by HADD resulting from the Project. Since the submission of the original NNLP in the DEIS, there have been substantial changes to the *Fisheries Act,* with the emphasis shifting from compensation for habitats affected by HADD to the concepts of offsetting potential impacts to the productivity of CRA fisheries.

Although the language of the present Conceptual Fisheries Protection and Offsetting Plan was changed to reflect the new objectives of the current *Fisheries Act* (i.e., to maintain or enhance productivity of CRA fishery and avoid serious harm to fish), the Conceptual Fisheries Protection and Offsetting Plan remains focused on changes in the availability and suitability of fish habitat, as estimated by the total number of habitat units (HU) before and after the Project. The proposed use of HU as a surrogate for estimating productivity of CRA fishery was discussed with DFO in January 2014, when it was agreed that, due to the conceptual and preliminary nature of the Conceptual Fisheries Protection and Offsetting Plan, the methods of estimating habitat losses and gains under the new policy can remain similar to the requirements of the NNL policy under the previous legislation.

In view of the above agreement, the following description of the regulatory framework reflects the transitional period between the previous and the new regulatory environment. The final offsetting plan will be developed in consultation with DFO in the permitting stage of the Project and will provide more conformity to the spirit of the new law.

To meet the requirements of DFO's "NNL" policy (i.e., the predecessor to the current fisheries productivity investment policy), fish habitat compensation or offsetting measures will be required to offset fish habitat altered and/or destroyed by Project development. The principle of NNL strives to "balance unavoidable habitat losses with habitat replacement on a project-by-project basis so that further reductions to Canada's fisheries resources due to habitat loss or damage may be prevented" (DFO 1986). The DFO document "Practitioner's Guide to the Risk Management Framework for DFO Habitat Management Staff, Version 1.0" (DFO 2010) specifies that risk occurring due to HADD may be categorized as low, medium, or high using a matrix based on the "sensitivity of fish and fish habitat" and "scale of negative effect", thus allowing to manage risk accordingly. Although mitigation measures related to various Project development/construction activities (see Section 2.6) will reduce the amount of fish habitat altered or lost, some alteration and losses will be unavoidable, and as such will require the implementation of offsetting measures.

The selection of the habitat compensation approach included consideration of the hierarchy of compensation preferences as outlined in DFO's Policy for the Management of Fish Habitat (DFO 1986), Habitat Conservation and Protection Guidelines (DFO 1998), and Practitioner's Guide to the Risk Management Framework for DFO Habitat Management Staff (DFO 2010), which is generally consistent with the hierarchy of the new Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (DFO 2013a). These preferences for habitat compensation are summarized below, in declining order of priority:

1) Create similar habitat at or near the development site within the same ecological unit; that is, replace natural habitat with the same type of habitat at or near the site.
2) Create similar habitat in a different ecological unit that supports the same stock or species.
3) Increase the productive capacity of existing habitat at or near the development site and within the same ecological unit.
4) Increase the productive capacity of a different ecological unit that supports the same stock or species.
5) Increase the productive capacity of existing habitat for a different species of fish either on or off site.
6) Where it is not technically feasible to compensate for the habitat itself, use artificial production techniques, such as maintaining a stock of fish, deferring compensation, or restoring other sites.

As mentioned above, the hierarchy of compensation approaches used in this document is similar under the new regulations. Offsetting measures may be "in-kind" where the same kind of habitat and fisheries that are lost are replaced through habitat restoration or creation (DFO 2013a). Alternatively, offsetting measures may be "out-of-kind" where offset measures target the limiting factors of productivity in a given area rather than replacing exactly what was lost. Out-of-kind offsetting measures may include the restoration or creation of habitat types that are different from the habitat type that was lost.

It is recognized that physical habitat offset projects will be required for the permanent habitat losses resulting from the Project to satisfy the requirements of DFO. It is also recognized that the areas of habitat alterations will change the characteristics of the fish habitat after closure of the Project, and thus may require physical habitat offsets to account for those changes. Consideration will also be given in the Conceptual Fisheries Protection and Offsetting Plan for habitats that will be dewatered during operations and re-submerged at closure, but will be otherwise unaltered, as the biological productivity of these areas will be interrupted (i.e., habitat will be unavailable to support the fishery until re-submerged and suitable water quality is achieved).

Once the fisheries protection and offsetting plan is approved and works are constructed, a compliance and effectiveness monitoring program will be carried out to show that the offsetting works have been built as specified and approved, and that they are functioning effectively as designed (see Section 8). The monitoring program will be used to demonstrate that the offsetting works for the Project have met the DFO's requirement; if not, additional measures and/or contingency options may be implemented.

1.2 Specific Objectives

Several Project development activities are expected to result in the alteration and/or destruction of fish habitat. Although in-water construction activities will be designed to reduce effects to fish habitat, it is expected that some of these activities will result in serious harm to fish, and the subsequent need for offsetting measures under DFO's fisheries productivity investment policy (DFO 2013a).

To address the Project concerns relating to fish habitat, this Conceptual Fisheries Protection and Offsetting Plan was prepared following consultation with DFO. Before an authorization to proceed is issued by DFO, a plan for the mitigation and replacement of fish habitat losses must be in place and approved by DFO. Following approval of the final offsetting plan, and subsequent implementation of the various offsetting works proposed therein, no additional residual effects on fish habitat are anticipated. The objectives of this Conceptual Fisheries Protection and Offsetting Plan are to

- describe habitats and fisheries to be impacted by the Project;
- estimate the residual effects of the Project on the productivity of CRA fisheries, using the concept of HU as a surrogate measure to estimate changes in productivity;
- describe procedures and structures designed to avoid and mitigate/manage potential Project impacts to fisheries productivity;
- assess the risk on fisheries productivity from a regional perspective;
- incorporate Traditional Knowledge into the development of the fisheries protection and offsetting plan;
- develop offsetting options so that the DFO's fisheries protection policy (DFO 2013b) can be achieved;
- describe fish-out protocols that will be used, if deemed necessary;
- describe time schedule and costs associated with the implementation of the plan; and
- describe plans to monitor offsetting measures and to assess their effectiveness.

1.3 Ecosystem Setting

The Project is located within the physiographic region of the Canadian Shield, and, as such, the land contains features formed by glaciation, including eskers and boulder moraines. 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 also located in the Southern Arctic Ecozone, which is characterized by continuous permafrost. Low precipitation and extremely low winter temperatures prevent tree growth in this ecozone (Parks Canada 2012). Summers are cool and about 4 months in length. 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. Common types of vegetation that may be found in the Southern Arctic Ecozone include low-lying shrubs such as dwarf birch, willows, and heath species; these are commonly mixed with various herbs and lichens (Parks Canada 2012).

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 permafrost active layer increases, thereby increasing the amount of storage available within the ground. Secondary peaks in stream flows are common in late summer or early fall due to precipitation later in the season. Smaller streams may freeze completely to channel bottom throughout the winter, and begin to flow again overtop the anchor ice when spring melt begins. Lake ice thickens over the winter reaching a depth of approximately 2 metres (m). Thus, many shallow ponds freeze completely and a substantial portion of the volume of larger lakes is frozen by late winter. Based on this, and for the purposes of this report, all waterbodies not exceeding 2 m in maximum depth are referred to as "ponds", and waterbodies deeper than 2 m in maximum depth are referred to as "lakes".

Between 1997 and 2012, substantial sampling effort was put forth to survey aquatic habitat and fish in the areas near the Project. Investigations were focused on determining the distribution of species throughout the watersheds; movements of Arctic char, lake trout and Arctic grayling using radio telemetry; and the timing and size of the Arctic char run in the Meliadine River. Surveys were also conducted to identify habitat features with regard to their suitability for spawning, rearing, migration, and overwintering. The detailed results of these surveys are presented in FEIS Volume 7, Section 7.5 Fish and Fish Habitat, and supporting documents (SD 7-1 2009 Aquatics Synthesis Baseline and SD 7-2 2011 Aquatics Baseline). They are briefly summarized below.

Most of the proposed Project is located on a large Peninsula within the Meliadine Lake watershed. The Peninsula (68 square kilometres [km^2] in area) contains 368 lakes and ponds, which cover almost 20% of its terrestrial extent (Figure 1-1). Most (87%) of the waterbodies are small (<5 hectares [ha] in area) and shallow (<2 m deep). There are 15 lakes larger than 20 ha on the Peninsula. The largest lake (A8) is 91 ha in area. The maximum recorded water depth in the Peninsula lakes was 5.4 m (in Lake B69).

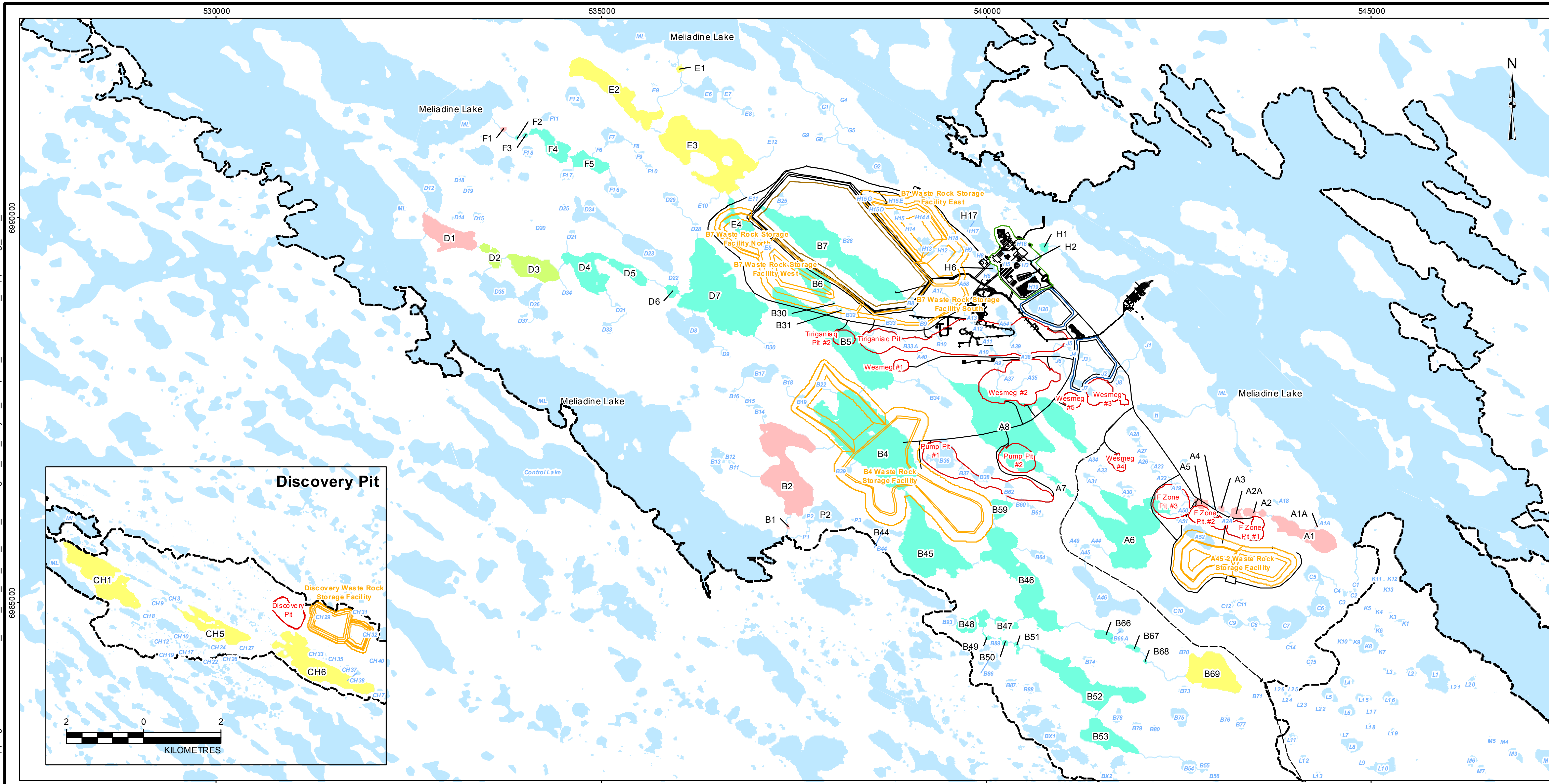
The lakes and ponds of the Peninsula drain into Meliadine Lake through several watersheds, designated by letters A to P (Figure 1-1). The lower reaches of the larger watersheds feature short, but well-defined stream sections between lakes; however, most of the ponds in the middle and upper reaches are poorly connected and typically drain through poorly defined paths over the tundra during freshet and after rainfall events.

The lakes and ponds are generally well-oxygenated during open water conditions and do not stratify. Most of their volume is contributed by the surface 2 m layer of water. As discussed above, when the ice cover reaches 2 m in depth, as is often the case during late winter, the under-ice water volume is greatly reduced and the waterbody may freeze to the bottom. This is likely a frequent occurrence in all ponds and most of the small lakes, where only a small part of the total volume is contributed by zones deeper than 2 m. The proportions of deep water zones are higher in some of the larger lakes (e.g., A6, A8, B2, B5, B6, B7, B69, and E3) and appear to be sufficient to allow fish to overwinter.

The Meliadine Lake and the lower lakes and streams of the Peninsula watersheds are inhabited by 9 fish species that include Arctic char (*Salvelinus alpinus)*, lake trout (*Salvelinus namaycush)*, Arctic grayling (*Thymallus arcticus)*, round whitefish (*Prosopium cylindraceum)*, cisco (*Coregonus artedi)*, burbot (*Lota lota*), slimy sculpin (*Cottus cognatus*), ninespine stickleback (*Pungitius pungitius*), and threespine stickleback (*Gasterosteus aculeatus)*. Four of these species (Arctic char, lake trout, round whitefish, and threespine stickleback) tend to use only the lowermost sections of the basins in close proximity to Meliadine Lake. These species have not been recorded in the upper Peninsula lakes, ponds, and streams (e.g., Lake A6 and upstream, Lake B4 and upstream, and entire basins H and J), where most of the Project activities are proposed to occur (Figure 1-1).

From 1997 to 2012, the total fish catch in the upper Peninsula lakes, ponds, and streams (5572 fish) was dominated by ninespine stickleback (4681 fish or 84%) and Arctic grayling (775 fish or 14%). Ninespine stickleback appeared to prefer the upper Peninsula waterbodies (especially shallow ponds) and smaller streams over the open lake environment of Meliadine Lake and the lower lakes, where predators are common. Arctic grayling use the Peninsula streams for spawning and rearing, and appear to overwinter in some of the deeper Peninsula lakes. Using a mark and re-capture program, the size of the Arctic grayling population in Lake B7 was estimated at 1345 fish in 2008. Cisco (n=42) were captured in 3 upper Peninsula lakes (A6, B6, and B7) where they are likely year-round residents; they were not recorded in any upper Peninsula ponds or streams. Slimy sculpin (n=54), burbot (n=12), and lake trout (n=2) were captured infrequently.

In general terms, most waterbodies on the Peninsula provide only seasonal foraging and rearing habitat for fish. Overwintering habitat is found in Meliadine Lake and a few deeper lakes (e.g., A6, A8, B2, B5, B6, B7, B69, E3) on the Peninsula. All ponds and all streams freeze to the bottom by late winter. Many of the larger stream systems on the Peninsula support Arctic grayling spawning runs, as well as other fish species that move into the streams during the open water period to forage or to escape predatory fish in the overwintering lakes.



LEGEND

Proposed Project Infrastructure	**Waterbody (Pre-Construction)**
All-weather Access Road (AWAR)	Arctic Char (ARCH), Lake Trout (LKTR), Arctic Grayling (ARGR)
Road - New	Arctic Char (ARCH), Arctic Grayling (ARGR)
Watercourse	Lake Trout (LKTR), Arctic Grayling (ARGR))
Local Study Area (LSA)	Arctic Grayling (ARGR)
Tailings Storage Facility (TSF)	Waterbody
Open Pit	
Plant Pad	
Pad for Low Grade Ore	
Waste Rock Storage Facility	

REFERENCE

Base data obtained from Agnico Eagle Mines Limited (AEM).
Datum: NAD 83 Projection: UTM Zone 15

1 0 1
KILOMETRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

PROJECT FOOTPRINT AND WATERBODIES SUPPORTING ARCTIC CHAR, LAKE TROUT, AND ARCTIC GRAYLING ON THE MELIADINE PENINSULA

Golder Associates

PROJECT NO.	10-1373-0076		FILE No.	
DESIGN	JP	06 Nov. 2012	SCALE AS SHOWN	REV. 0
GIS	KI	19 Feb. 2014		
CHECK	DW	18 Feb. 2014	**FIGURE 1-1**	
REVIEW	DW	18 Feb. 2014		

N:\Bur-Graphics\Projects\2013\1428\13-1428-0007\GIS\Mapping\MXD\FEIS\Volume_7\SD_7-4_No_Net_Loss_Plan\Figure_1-1_Project_Footprint_Waterbodies_Supporting_Fish_A.mxd

1.4 Commercial, Recreational and Aboriginal Fisheries Setting

This section describes the Meliadine Lake fisheries setting as legislated in the Nunavut Land Claims Agreement (NLCA) and under the new fisheries protection provisions of the *Fisheries Act,* particularly the Fisheries Protection Policy Statement (DFO 2013b). The goal of the new provisions is to manage threats to the sustainability and productivity of Canada's commercial, recreational and Aboriginal (CRA) fisheries. According to Section 2(1) of the new *Fisheries Act*, these fisheries are defined as follows:

- commercial, in relation to a fishery, means that fish is harvested under the authority of a licence for the purpose of sale, trade or barter.
- recreational, in relation to a fishery, means that fish is harvested under the authority of a licence for personal use of the fish or for sport.
- Aboriginal, in relation to a fishery, means that fish is harvested by an Aboriginal organization or any of its members for the purpose of using fish as food, for social or ceremonial purposes or for purposes set out in a land claims agreement entered into with the Aboriginal organization.

The comprehensive land claim that led to the eventual division of the Northwest Territories (NWT) was signed in 1993 by representatives of the Nunavut Tunngavik Incorporated, the NWT, and the federal government. The NLCA provides Inuit title to 350 000 km^2 of land in the eastern Canadian Arctic and subsurface mineral rights to one tenth of that. Inuit beneficiaries of the claim also are entitled to a share of the royalties from oil and gas extraction on Crown land and are granted hunting and fishing rights, as well as the right to participate in decisions over land and resource management (Henderson 2009).

This section provides some "high-level" watershed information and recent consultations to guide the DFO's decision related to the definition of the fishery. The evaluation must take into account the following factors in reviewing the application (under Section 6 of the *Fisheries Act*):

- the contribution of the relevant fish to the ongoing productivity of commercial, recreational or Aboriginal fisheries;
- fisheries management objectives;
- whether there are measures and standards to avoid, mitigate or offset serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or that support such a fishery; and
- the public interest.

Based on traditional knowledge and consultation with local harvesters and based on the proponent's interpretation under the new *Fisheries Act*, Meliadine Lake is considered a recreational and Aboriginal fishery. Since 1997, extensive baseline monitoring in Meliadine Lake has determined the presence of lake trout, Arctic char, Arctic grayling, round whitefish, cisco, burbot, slimy sculpin, and threespine stickleback. Of these species, traditional knowledge and recent consultation with local harvesters (Kangliqlinik HTO on 6 and 7 November 2013 – see Appendix A) suggest that lake trout, Arctic char, and Arctic grayling are most commonly harvested as a food source and are presently used for traditional and/or recreational purposes. Less commonly, local harvesters collect round whitefish and cisco in Meliadine Lake. Commercial fishing licenses have not been issued for Meliadine Lake or any of the Peninsula lakes (Chris Lewis and Elizabeth Patreau, DFO 2014, pers. comm.).

These findings are consistent with the species identified as Valued Ecosystem Components (VECs), which were carried through in the FEIS, and these species are the focus of the Conceptual Fisheries Protection and Offsetting Plan.

The Meliadine Lake watershed has a total area of 532.7 km^2 and includes a total of 1905 lakes and ponds. Although there is a high proportion of water in the watershed (i.e., 40% of the area is covered by lakes or ponds), the majority of waterbodies (85%) are small (<5 ha in area) and have a depth of <2 m. As a result, many of these ponds freeze to the bottom for 8 months of the year. The Peninsula, where the Meliadine mine is proposed, has 365 waterbodies, of which 82 waterbodies are potentially affected by the footprint of the Project; 65 of these waterbodies are poorly connected or offline, are <2 m in depth, and, therefore, freeze to the bottom. The remaining 17 waterbodies (<1% of the Meliadine Lake watershed) have Arctic grayling, and only a few of the lower Peninsula waterbodies, immediately upstream of Meliadine Lake, have a few lake trout and Arctic char in them.

Although it is potentially possible to fish recreationally in any Nunavut waters under the current sport fishing regulations (provided a valid fishing license is obtained by non-beneficiaries of NLCA; DFO 2012), it is very unlikely that anyone would catch or harvest fish from the Peninsula lakes, according to the Kangliqlinik HTO (see Appendix A3). However, under the fisheries protection policy, a few lakes within the lower reaches of the Peninsula watersheds are considered to support the Arctic char and lake trout fishery in Meliadine Lake. These lakes are not essential habitats for spawning, nursery, foraging, or overwintering for Arctic char nor lake trout, which is why these fish have not been caught frequently during baseline studies. Lake trout generally spawn over large, course gravel-cobble substrates on sloped structures (i.e., shorelines or shoals) with interstitial spaces that allow oxygenation of eggs. This type of habitat generally occurs between 3 m and 20 m depth in Arctic lakes. Arctic char also use this type of habitat for spawning, although possibly prefer smaller grain sizes. Near-shore boulder-cobble areas (less than 3 m depth) are used as refugia and are considered rearing areas for young of the year for those species that are dependent on the availability of zooplankton – their primary food source. The transition zones between angular substrate and fine sediment (occurring at 2 m to 8 m depth) are important for foraging of juvenile lake trout and Arctic char, which feed primarily on benthos. Adult lake trout are omnivorous and feed at depths up to 35 m, in both the near-shore and pelagic zones. Adult Arctic char occupy a wide range of depths and were found to largely feed on zooplankton. Overwintering habitat for all lake-dwelling species occurs at depths greater than 3 m, because of ice formation.

Although few juvenile lake trout and Arctic char have been collected opportunistically foraging in the lower Peninsula waterbodies and streams (e.g., Lake A1) from nearby areas in Meliadine Lake, the habitat available on the Peninsula is not ideal for these species as very few waterbodies provide suitable overwintering, spawning, rearing, and foraging habitat. As a result, these waterbodies are considered to provide minor support to the lake trout and Arctic char fishery in Meliadine Lake, and this support is mainly limited to seasonal use for juvenile rearing.

Data collected along the Meliadine River between 1997 and 2009 illustrates the high number of Arctic char that use the Meliadine Lake system (see fish fence data in SD 7-1 of the Aquatic Synthesis 1994-2009; sections 9.2.4 and 9.3.1). Although population estimates from these data have not been statistically derived[1],

[1] AEM is proposing to evaluate these data and conduct additional research projects related to Meliadine Lake productivity as complementary offsetting measures, and to inform the Meliadine Project offsetting concepts and future offsetting plans in Nunavut (see Section 5.2.4)

crude population estimates of sea-going adult Arctic char suggest that approximately 2000 adults were using the Meliadine Lake watershed (assuming 50% capture success during 3 consecutive years of fish fence program in the lower Meliadine River in the late 1990s). As a comparison, only 11 Arctic char and 29 lake trout juveniles were collected through 107 sampling events conducted during 1997 to 2012 in the Peninsula Basin A. Arctic char and lake trout do not use the project footprint area in the upper Peninsula lakes, where Arctic grayling were the only sportfish collected. Although more research needs to be done to evaluate the productivity of Meliadine Lake and the relative contribution of the Peninsula lakes to support the fishery, a preliminary assessment of these fish population comparisons suggests that the Peninsula lakes provide insignificant support to the Meliadine Lake fishery.

As described in the subsequent sections of this document, the main project impacts are limited to the upper Peninsula lakes, which are predominantly Arctic graying habitat. Most importantly, the project is not expected to cause serious harm to fish in the lower Peninsula lakes nor impact the Meliadine Lake Arctic grayling, Arctic char, or lake trout fishery. As a result, it is expected that the loss of the habitat will not significantly change the fishery in Meliadine Lake, even with large works/undertakings/activities that are proposed, and thus will have low impacts on the productivity of the fisheries species. Furthermore, the Peninsula lakes are not currently being fished by local Inuit. As stated during November 2013 consultation (see Appendix A), the Kangliqlinik HTO is amenable “to the loss of the Peninsula lakes for the benefit of the jobs the mine will bring” as long as Meliadine Lake is protected. Given the size of Meliadine Lake, the size of the surrounding watershed, and the small proportional fisheries contribution of the Peninsula waterbodies to the Meliadine Lake fishery, it is expected that the residual serious harm to fish are offset through measures described in Section 5 (offsetting plan). Ultimately, this will ensure the protection of the Meliadine Lake Arctic char, lake trout, and Arctic grayling fishery.

2.0 FISH HABITAT AFFECTED BY PROJECT ACTIVITIES

The Fish and Fish Habitat section of the FEIS (Volume 7, Section 7.5) identified and evaluated the effects of potential changes predicted to occur due to the development of the Project. The assessment was based on valid linkages and effects pathways between Project activities and predicted changes to surface water hydrology or water quality, as well as linkages assessed specifically for fish and fish habitat. Changes in fish and fish habitat identified in the assessment that are relevant to the Conceptual Fisheries Protection and Offsetting Plan include those works, undertakings, or activities that can result in serious harm to fish, as per Section 35(1) of the *Fisheries Act*.

The following subsections briefly describe the main components of the Project infrastructure, with a focus on the lakes, ponds, and streams that are within the footprint and may be affected by each component. The affected areas are described and a summary of habitat characteristics and fish populations that inhabit each affected waterbody and watercourse is also included, as an indicator of their potential value on a local and regional scale. More detailed descriptions of fish habitat and fish populations in the Project area are presented in Volume 7, Section 7.5 of the FEIS, as well as in the supporting documents SD 7-1 2009 Aquatics Synthesis Baseline and SD 7-2 2011 Aquatics Baseline.

2.1 Open Pits and Underground Facility

The Project is proposed to be a combination of open-pit and underground mining. Based on current known resources, these methods will result in an estimated operating life of about 10 to 13 years for the mine. Mining is currently proposed at 5 gold deposits in the Project area: Tiriganiaq as the main deposit, and the F Zone, Wesmeg, Pump, and Discovery deposits as satellite operations. All 5 deposits remain open at depth, with the potential for discovery of additional gold resources and extension of the proposed mine life.

Open-pit mining is proposed for the Tiriganiaq (2 pits), F Zone (3 pits), Pump (2 pits), Wesmeg (5 pits), and Discovery (1 pit) deposits, using conventional surface mining methods of drill and blast excavation and truck haulage. Dewatering dikes will be required for select pits for surface water management. Underground mining to approximately 770 m below the ground surface is also proposed for the Tiriganiaq deposit; however, this component is not expected to affect the existing aquatic habitat, and will not be discussed in this report.

2.1.1 Tiriganiaq Pits

Two open-pits in the Tiriganiaq deposit will affect 1 lake (B5) and 10 ponds (Table 2-1). The larger pit (#1) will extend from the east shore of Lake B5 (where it will affect 0.71 ha of near-shore habitat) for about 2.7 kilometres (km) to the east. The pit's footprint includes 10 small ponds, 9 of which are smaller than 1.80 ha. The largest pond (A54) has a maximum depth of 1.3 m, whereas the remaining ponds vary from 0.3 to 1.0 m in depth. Ninespine stickleback is the only species confirmed or suspected in some of these ponds. Seven of these ponds will be affected only by pit excavation. The remaining 3 ponds (A9, A38, and A54) will be partially affected by the excavation, and, in addition, areas of these ponds will be drained during mine operations. After closure, when the ponds are connected to the flooded pit to provide shallow littoral habitat on the pit's periphery, 4.88 ha will be restored.

The smaller pit (#2) of the Tiriganiaq deposit will be located entirely within Lake B5, where the excavation will affect 4.71 ha of the lake bottom. In addition, 41.98 ha of the lake will be drained during the mining operations, and the northern part of the lake will be affected by the B7 West waste rock storage facility (see Section 2.2.1) and access road construction (Section 2.1.4.3). Lake B5 is inhabited by Arctic grayling and burbot (confirmed), and also likely by cisco and ninespine stickleback (based on catches upstream in lakes B6 and B7).

Table 2-1: Lakes and Ponds Affected by Open Pits in the Tiriganiaq Deposit

Open Pit	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Tiriganiaq #1	Pond A9	1.76	0.47	1.30	-	-	-	-	-	-	-	-	-
	Pond A10	0.26	0.67	0.26	-	-	-	-	-	-	-	C	-
	Pond A11	0.40	0.45	0.40	-	-	-	-	-	-	-	S	-
	Pond A12	0.47	0.87	0.47	-	-	-	-	-	-	-	C	-
	Pond A13	0.26	0.31	0.26	-	-	-	-	-	-	-	C	-
	Pond A38	0.54	0.74	0.39	-	-	-	-	-	-	-	-	-
	Pond A39	0.12	0.48	0.12	-	-	-	-	-	-	-	-	-
	Pond A54	5.99	1.30	5.99	-	-	-	-	-	-	-	C	-
	Pond B10	0.33	0.80	0.33	-	-	-	-	-	-	-	-	-
	Pond B33a	0.35	0.98	0.35	-	-	-	-	-	-	-	-	-
	Lake B5	56.74	3.40	47.40	-	-	C	-	S	C	-	S	-
Tiriganiaq #2	Lake B5												

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC=slimy sculpin, NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S=species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

The excavation of Tiriganiaq pit #1 will affect 8 small streams in the headwaters of the A, B and J basins (Table 2-2). The total length of these streams is 1168 m; however, none feature defined channels and all consist of dispersed and braided flow paths through the tundra. The flow is limited to freshet and after precipitation events during the open water season. The habitat is not suitable to species other than ninespine stickleback, which were confirmed in A38-54 and are suspected to occur in 4 of the other streams. No streams will be affected by Tiriganiaq pit #2, as it is located entirely within Lake B5.

Table 2-2: Streams Affected by Open Pits in the Tiriganiaq Deposit

Open Pit	Stream	Defined Channel	Total Length (m)	Affected Length (m)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Tiriganiaq #1	A10-11	no	57	57	-	-	-	-	-	-	-	S	-
	A11-12	no	167	167	-	-	-	-	-	-	-	S	-
	A12-13	no	30	30	-	-	-	-	-	-	-	S	-
	A38-39	no	110	110	-	-	-	-	-	-	-	-	-
	A39-54	no	182	182	-	-	-	-	-	-	-	C	-
	A9-10	no	65	65	-	-	-	-	-	-	-	S	-
	B9-10	no	258	258	-	-	-	-	-	-	-	-	-
	J5-6	no	299	299	-	-	-	-	-	-	-	-	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin, NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

2.1.2 F Zone Pits

Three open pits in the F Zone deposit will affect 1 lake (A6) and 8 ponds (Table 2-3). During construction and operations of the F Zone pits, these ponds and the interconnecting streams will be dewatered, while the flow from Lake A6 will be diverted into Lake A1, by-passing the ponds.

Table 2-3: Lakes and Ponds Affected by Open Pits in the F Zone Deposit

Open Pit	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
F Zone #1	Pond A2	2.36	0.70	2.36	S	S	S	-	-	-	-	C	C
	Pond A2a	1.95	0.80	1.54	S	S	S	-	-	-	-	C	C
F Zone #2	Pond A3	0.48	0.96	0.48	S	S	S	-	-	-	-	S	S
	Pond A4	0.07	0.53	0.03	S	S	S	-	-	-	-	S	S
	Pond A5	2.00	1.20	0.94	S	S	S	-	-	-	-	C	S
F Zone #3	Lake A6	55.28	4.70	55.28	-	-	C	-	C	-	-	C	C
	Pond A19	1.01	0.94	1.01	-	-	-	-	-	-	-	-	-
	Pond A50	0.08	0.60	0.08	-	-	-	-	-	-	-	S	-
	Pond A51	0.44	0.66	0.20	-	-	-	-	-	-	-	C	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin, NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

The 2 smaller pits (#1 and #2) will be located immediately south of the main stream system that drains the upper lakes in the A basin (lakes A6 and A8) to Meliadine Lake. The operation of these pits will require dewatering of ponds A2, A2a, A3, A4, and A5 during construction and operation of the F Zone pits, where 4.97 ha of habitat will be affected. These drained habitats will be restored during closure, when the open pits will be flooded and the ponds will provide shallow water rearing habitat adjacent to the deep-water overwintering habitat in the pits. In addition, a small area (0.37 ha) of Pond A5 will be affected by excavation of pit #2.

Although the ponds affected by the F Zone pits #1 and #2 are shallow (<1.2 m in maximum depth), they provide a migration route for Arctic grayling, lake trout, and Arctic char between Meliadine Lake and the outflow of Lake A6. Although these species were not captured in the ponds, 139 Arctic grayling, 15 lake trout, and 2 Arctic char were recorded in the interconnecting streams between Pond A2 and Lake A6, and, therefore, are assumed to be using the ponds seasonally. Ninespine stickleback and threespine stickleback are common in the ponds.

The largest F Zone pit (#3) has its footprint over the northeast bay of Lake A6, where 2.68 ha will be affected through pit excavation. Associated with the construction of pit #3 will be a partial drawdown of Lake A6 during operation and closure phases, when the lake water surface will be lowered by approximately 1 m, thus permanently draining the areas around the lake periphery (17.64 ha). Parts of the lake that remain submerged (34.96 ha) will be affected in their depth characteristics (i.e., maximum depth will be reduced from 4.7 to 3.7 m). Lake A6 is inhabited year-round by Arctic grayling, cisco, ninespine stickleback, and threespine stickleback.

Besides affecting Lake A6, F Zone pit #3 will affect 0.74 ha of habitat in ponds A19, A50, and A51 through pit excavation. These small (<1.0 ha) and shallow (<1.0 m) ponds are not suitable to species other than ninespine stickleback. Parts of ponds A19 and A51 (0.55 ha in total) will be dewatered during operations, but restored and connected to the rehabilitated pit lake after closure. In addition, part of Pond A51 will be affected by road construction (see Section 2.3.3).

The excavation of F Zone pits #1 and #2 will affect 4 streams in Basin A (A2-2a, A2a-3, A3-4, and A4-5; Table 2-4). These well-defined stream channels (total length of 237 m) are used by Arctic grayling for spawning, and as movement corridors for other species, such as lake trout and Arctic char. The streams will be dewatered during operations, while the flow from Lake A6 is diverted to Lake A1, by-passing the stream system. After closure, these 4 streams will be restored.

Table 2-4: Streams Affected by Open Pits in the F Zone Deposit

Open Pit	Stream	Defined Channel	Total Length (m)	Affected Length (m)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
F Zone #1	A2-2a	yes	16	16	S	S	S	-	-	-	S	S	S
	A2a-3	yes	83	83	S	S	S	-	-	-	S	S	S
F Zone #2	A3-4	yes	26	26	S	S	C	-	-	-	S	C	S
	A4-5	yes	112	112	S	S	C	-	-	-	S	C	S
F Zone #3	A5-6	yes	406	406	C	C	C	-	-	-	C	C	C
	A50-51	no	56	56	-	-	-	-	-	-	-	S	-
	A50-6	no	34	34	-	-	-	-	-	-	-	S	-
	A5-19	no	260	260	-	-	-	-	-	-	-	-	-
	A5-50	no	177	177	-	-	-	-	-	-	-	S	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin, NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

Five streams (total length of 933 m) will be affected by the construction of F Zone pit #3. The longest of these streams (A5-6) is 406 m in length, features a well-defined channel and provides good habitat for Arctic grayling spawning. Juvenile Arctic char and lake trout were also documented in this stream, as well as slimy sculpin, ninespine stickleback, and threespine stickleback. The remaining 4 streams (A50-51, A50-6, A5-19 and A5-50) are peripheral to the main stream system, and, as such, do not have well-defined channels and feature poor habitat that is suitable only for ninespine stickleback.

2.1.3 Pump Pits

Two open pits in the Pump deposit will affect 1 lake (A8) and 6 ponds (Table 2-5). The larger Pump pit (#1) will extend from the east end of Lake B4 (which will be covered by waste rock) for about 1.8 km to the east. The pit's footprint will include 5 ponds affecting 11.14 ha of habitat. The largest pond (B36) is 7.93 ha in area, but has a maximum depth of only 0.8 m. The remaining ponds vary from 0.6 m to 1.9 m in maximum depth. Ninespine stickleback is the only species confirmed or suspected in these ponds.

Table 2-5: Lakes and Ponds Affected by Open Pits in the Pump Deposit

Open Pit	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Pump #1	Pond B36	7.93	0.80	7.93	-	-	-	-	-	-	-	C	-
	Pond B37	0.85	0.55	0.85	-	-	-	-	-	-	-	C	-
	Pond B38	3.30	1.50	3.30	-	-	-	-	-	-	-	C	-
	Pond B60	0.98	1.85	0.98	-	-	-	-	-	-	-	-	-
	Pond B61	1.16	0.90	1.16	-	-	-	-	-	-	-	-	-
	Pond B62	1.79	1.30	1.79	-	-	-	-	-	-	-	C	-
Pump #2	Lake A8	90.54	4.20	78.11[b]	-	-	C	-	-	-	-	S	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin, NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

[b] In addition to 10.84 ha of habitat affected by excavation of the Pump pit #2 and 67.28 ha of habitat dewatered during operations, 4.81 ha of Lake A8 will be affected by the Wesmeg pit #2 (see Section 2.1.4) and 7.61 ha will be affected by access roads (see Section 2.3.3).

Pit excavation and dewatering will affect 1 pond (B61) outside of the footprint during operations. Parts of ponds B36, B38, and B60 that are outside of the footprint will also be affected. These areas (4.87 ha) will be restored after closure, when the ponds are connected to the flooded pit to provide shallow water habitat on the pit's periphery.

The smaller Pump pit (#2) will be located mainly within the south basin of Lake A8 and will affect 10.84 ha of lake habitat. This lake has a maximum depth of 4.2 m and provides year-round habitat to Arctic grayling and ninespine stickleback. As all of Lake A8 will need to be drained during operations, 67.28 ha will be affected. The dewatered areas will be restored during closure, when the lake will be re-flooded to provide rearing habitat adjacent to the deep-water overwintering habitat created by pit excavation. Lake A8 will also be affected by the Wesmeg pit #2 (Section 2.1.4), which will be located on the north margin of Lake A8, and by access road construction on the lake bottom (Section 2.3.3)

Associated with Pump pit #1 is the effect on Stream B46-59 (Table 2-6). This small stream is 145 m long and connects Lake B46 to Lake B59. At present, this connection drains Lake B59 and a small watershed of 3 small upstream ponds (B60, B61 and B62), and provides limited fish passage, primarily during spring. Upon post-closure, flows from the end pit lake created in Pump pit #1 will drain through this connection to Lake B46 and downstream to Lake Meliadine.

The dewatering of Lake A8 for Pump pit #2 operations will affect streams A6-7 and A7-8, which connect Lake A6 to Lake A8 through Pond A7. Although these streams will not be affected directly by construction activities, the water level drawdown in Lake A6 and the draining of Lake A8 during open pit excavation will likely result in dewatering of the streams (i.e., they will have no upstream watershed during operations). As a result of the drawdown, 211 m will be affected in these 2 streams. Both streams feature well-defined channels and provide habitat for Arctic grayling, slimy sculpin, and ninespine stickleback. Arctic grayling spawning use has been documented in both streams. In addition, a small section (35 m) of Stream A6-7 will be affected due to culvert construction under the access road (see Section 2.3.3).

Table 2-6: Streams Affected by Open Pits in the Pump Deposit

Open Pit	Stream	Defined Channel	Total Length (m)	Affected Length (m)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Pump #1	B46-59	yes	145	145	-	-	C	-	-	-	-	C	-
Pump #2	A7-8	yes	133	133	-	-	C	-	-	-	C	C	-
	A6-7	yes	113	113	-	-	C	-	-	-	C	C	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin, NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

2.1.4 Wesmeg Pits

Five open pits are proposed in the Wesmeg deposit. The footprint of 3 pits (#1, #4, and #5) does not encroach on existing aquatic habitat. The remaining 2 pits (#2 and #3) will affect 1 lake (A8) and 4 ponds (Table 2-7). The largest pit in the Wesmeg deposit (#2) will extend from the north shore of Lake A8, where it will affect 4.81 ha of near-shore habitat. Arctic grayling have been documented in Lake A8, and ninespine stickleback are likely present. The footprint of pit #2 will also include 2 small ponds (A35 and A37), both of which are smaller than 1 ha and do not exceed 1.1 m in maximum depth. The entire area of both ponds (1.28 ha) will be affected by pit excavation. Ninespine stickleback is the only species confirmed or suspected to inhabit these ponds.

The second largest pit in the Wesmeg deposit (#3) will affect 1.97 ha of Pond J7 and 1.35 ha of Pond J8. Both ponds are inhabited by ninespine stickleback, the only species documented in the entire Basin J.

Table 2-7: Lakes and Ponds Affected by Open Pits in the Wesmeg Deposit

Open Pit	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Wesmeg #2	Lake A8	90.54	4.20	4.81[b]	-	-	C	-	-	-	-	S	-
	Pond A35	0.36	0.58	0.36	-	-	-	-	-	-	-	-	-
	Pond A37	0.92	1.10	0.92	-	-	-	-	-	-	-	C	-
Wesmeg #3	Pond J7	3.51	1.75	1.97[c]	-	-	-	-	-	-	-	C	-
	Pond J8	1.35	1.00	1.35	-	-	-	-	-	-	-	C	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin, NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

[b] In addition to 4.81 ha of habitat affected by the Wesmeg pit #2, 10.84 ha of Lake A8 will be affected by the Pump pit #2 (see Section 2.1.3), 67.28 ha will be affected by dewatering (see Section 2.1.3), and 7.61 ha will be affected by access roads (see Section 2.3.3).

[c] In addition to 1.97 ha of habitat affected by the Wesmeg pit #3, 1.54 ha will be affected by the low grade ore pad (see Section 2.3.2).

The excavation of Wesmeg pit #2 will affect 4 small streams in the headwaters of Basin A (Table 2-8). The total length of these streams is 1220 m; however, none of the streams feature defined channels and all consist of dispersed and braided flow paths through the tundra. The flow is limited to freshet and after precipitation events during the open water season. The habitat is not suitable to species other than ninespine stickleback, which were confirmed in streams A8-37 and A8-9.

Table 2-8: Streams Affected by Open Pits in the Wesmeg Deposit

Open Pit	Stream	Defined Channel	Total Length (m)	Affected Length (m)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Wesmeg #2	A35-38	no	355	355	-	-	-	-	-	-	-	-	-
	A8-9	no	312	312	-	-	-	-	-	-	-	C	-
	A8-35	no	451	451	-	-	-	-	-	-	-	-	-
	A8-37	no	102	102	-	-	-	-	-	-	-	C	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

2.1.5 Discovery Pit

There are no waterbodies or watercourses within the footprint of the open pit proposed in the Discovery deposit.

2.2 Waste Rock Storage Facilities

Waste rock and overburden from the open pits that is not used for site development purposes will be deposited in waste rock storage facilities. The closure footprints for the stockpiles, as shown in Figure 1-1, have been identified based on the anticipated volumes of waste rock and overburden.

The waste rock and overburden from Tiriganiaq open pits and underground facility will be placed at the B7 waste rock storage facility, which will surround the dams of the Tailings Storage Facility (TSF) on 3 sides. The waste rock and overburden from Wesmeg and Pump open pits will be placed at the B4 waste rock storage facility, which will encompass Lake B4. The waste rock and overburden from the F Zone open pits will be placed at the A45 waste rock storage facility located south of the F Zone open pits. The waste rock and overburden from the Discovery open pits will be placed at the Discovery waste rock storage facility located east of the Discovery open pit.

2.2.1 B7 Waste Rock Storage Facility

The B7 waste rock storage facility is divided into 4 components: East, South, West, and North (Figure 1-1). In total, the B7 waste rock storage facilities will affect 27.25 ha of habitat in 5 lakes (B5, B6, B7, E4, and E5) and 12.37 ha of habitat in 20 ponds (Table 2-9).

The B7 West waste rock storage facility will affect lakes B6 and E5 and the north part of Lake B5 (5.64 ha of shallow [<2.5 m] habitat). Lake B6 is 11.80 ha in area with a maximum depth of 4.0 m. Lake E5 is a smaller lake (1.30 ha in area) with a maximum depth of 3.0 m. Arctic grayling, cisco, burbot, and ninespine stickleback are confirmed or suspected to inhabit lakes B5 and B6. Fish sampling has not been conducted in Lake E5.

Table 2-9: Lakes and Ponds Affected by B7 Waste Rock Storage Facility

Facility[a]	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
WR-B7 East	Pond H10	0.10	0.11	0.10	-	-	-	-	-	-	-	C	-
	Pond H11	0.28	0.27	0.28	-	-	-	-	-	-	-	S	-
	Pond H12	0.97	0.81	0.97	-	-	-	-	-	-	-	S	-
	Pond H13	3.49	1.04	3.49	-	-	-	-	-	-	-	C	-
	Pond H14	0.23	0.61	0.23	-	-	-	-	-	-	-	S	-
	Pond H14a	0.15	0.37	0.15	-	-	-	-	-	-	-	-	-
	Pond H15	1.10	0.83	1.10	-	-	-	-	-	-	-	C	-
	Pond H15d	0.15	0.34	0.15	-	-	-	-	-	-	-	-	-
	Pond H15e	0.21	0.48	0.21	-	-	-	-	-	-	-	-	-
	Pond H15g	0.38	0.44	0.38	-	-	-	-	-	-	-	C	-
	Pond H18	0.74	0.67	0.74	-	-	-	-	-	-	-	-	-
	Pond H9	0.42	0.42	0.42	-	-	-	-	-	-	-	-	-
WR-B7 South	Pond A17	0.16	0.30	0.16	-	-	-	-	-	-	-	C	-
	Pond A58	0.43	0.50	0.43	-	-	-	-	-	-	-	C	-
	Pond B33	0.67	1.20	0.67	-	-	-	-	-	-	-	-	-
	Pond B8	1.43	0.82	1.43	-	-	-	-	-	-	-	C	-
	Pond B9	0.64	1.40	0.64	-	-	-	-	-	-	-	-	-

Table 2-9: Lakes and Ponds Affected by B7 Waste Rock Storage Facility (continued)

Facility[a]	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
WR-B7 West	Lake B5	56.74	3.40	5.64	-	-	C	-	S	C	-	S	-
	Lake B6	11.80	4.00	11.80	-	-	C	-	C	S	-	C	-
	Pond B30	0.09	1.10	0.09	-	-	S	-	-	-	-	C	-
	Pond B31	0.13	1.20	0.13	-	-	S	-	-	-	-	C	-
	Pond B32	0.60	0.90	0.60	-	-	-	-	-	-	-	C	-
	Lake E5	1.30	3.00	1.30	*	*	*	*	*	*	*	S	*
WR-B7 North	Lake B7	57.88	5.10	0.30	-	-	C	-	C	C	-	C	-
	Lake E4	8.52	3.70	8.21	-	-	C	-	-	-	-	C	-

[a] WR = waste rock; ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely; * = not sampled.

The B7 North waste rock storage facility will affect a small portion (0.30 ha) of Lake B7 (i.e., under the containment dike for the TSF) and most (8.21 ha) of Lake E4. Lake B7 (57.88 ha), most of it under the footprint of the TSF (see Section 2.4), is located at the headwaters of Basin B and is one of the deepest lakes on the Peninsula (maximum depth of 5.1 m). It provides year-round habitat to Arctic grayling, cisco, burbot, and ninespine stickleback. Lake E4 is 8.52 ha in area (maximum depth of 3.7 m) and is inhabited by Arctic grayling and ninespine stickleback.

Of the 20 ponds that will be affected by the B7 waste rock storage facilities, 12 are located in the footprint of the East facility, whereas 5 and 3 ponds are located under the South and West facilities, respectively. The largest pond (H13) is 3.49 ha in area and the remaining ponds vary from 0.09 to 1.43 ha in area. The maximum depths range from 0.1 m in Pond H10 to 1.4 m in Pond B9. Ninespine stickleback is the only species confirmed or suspected in 11 of these ponds. Arctic grayling are likely present in ponds B30 and B31, based on their documented presence in Stream B31-30, which connects these 2 ponds along the secondary outlet from Lake B6 to Lake B5. Despite effort exerted in sampling, fish were not captured in 7 ponds (B9, B33, H9, H14a, H15d, H15e, H18), due to poor connectivity to fish bearing waterbodies and watercourses.

The B7 waste rock storage facility will affect 9 streams (Table 2-10). The total length of these streams is 855 m; however, only 5 of these streams have a well-defined channel. The 5 streams with well-defined channels (B30-6, B31-30, B5-31, B5-6, and B6-7) are located in the footprint of the B7 West waste rock storage facility. Arctic grayling and ninespine stickleback have been captured or are suspected to occur in all of the streams with well-defined channels, whereas slimy sculpin have been captured in 4 of these streams, and burbot in one. Arctic grayling spawning was documented in streams B5-6 and B6-7; these streams provide gravel substrate and abundant cover suitable as rearing habitat for juveniles.

Table 2-10: Streams Affected by B7 Waste Rock Storage Facility

Facility[a]	Stream	Defined Channel	Total Length (m)	Affected Length (m)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
WR-B7 South	B7-8	no	38	38	-	-	-	-	-	-	-	C	-
	B8-9	no	201	201	-	-	-	-	-	-	-	-	-
WR-B7 West	B30-6	yes	24	24	-	-	S	-	-	-	C	C	-
	B31-30	yes	102	102	-	-	C	-	-	-	-	C	-
	B31-32	no	122	122	-	-	-	-	-	-	-	S	-
	B5-31	yes	108	108	-	-	C	-	-	-	C	C	-
	B5-6	yes	98	98	-	-	C	-	-	-	C	C	-
	B6-7	yes	116	116	-	-	C	-	-	C	C	C	-
WR-B7 North	E4-5	no	46	46	-	-	S	-	-	-	-	C	-

[a] WR = waste rock; ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

The remaining 4 streams lack defined channels and consist of dispersed and braided flow paths through the tundra. The flow is limited to freshet and short periods after precipitation events during the open water season. The habitat in streams B7-8 and B31-32 is not suitable to species other than ninespine stickleback. Their presence was confirmed in Stream B7-8 and is suspected in Stream B31-32 (based on catches in ponds B31 and B32). Fish are unlikely to inhabit Stream B8-9, as fish have not been recorded upstream in ponds B9 and B10. Stream E4-5 is the only stream affected by the B7 North waste rock storage facility. Although only ninespine stickleback have been captured in this stream, Arctic grayling may also occur here given their presence in Lake E4 downstream; however, there is no suitable spawning habitat for this species in the stream.

2.2.2 B4 Waste Rock Storage Facility

The B4 waste rock storage facility, located west of the Pump pits, will affect 1 lake (B4) and 3 ponds (Table 2-11). Lake B4 (85.82 ha) is the second largest lake on the Peninsula; however, it is shallow (maximum depth of 2.4 m). Only 3% of the lake area is contributed by zones deeper than 2 m. As a result, the lake likely freezes to bottom during winter and does not provide overwintering habitat. Arctic grayling and ninespine stickleback have been captured in Lake B4, and burbot are also likely present. In addition to Lake B4, 3 small ponds that drain to Lake B4 from the south (B39) and west (B19 and B22) will be affected. They are 3.10 ha in total area and do not exceed 1.3 m in maximum depth. Ninespine stickleback have been recorded in Pond B19. Although fish sampling has not been conducted in the remaining 2 ponds, the habitat was not suitable for species other than ninespine stickleback.

Table 2-11: Lakes and Ponds Affected by B4 Waste Rock Storage Facility

Facility[a]	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
WR-B4	Lake B4	85.82	2.40	85.82	-	-	C	-	-	S	-	C	-
	Pond B19	1.57	1.30	1.57	-	-	-	-	-	-	-	C	-
	Pond B22	0.35	0.77	0.35	*	*	*	*	*	*	*	*	*
	Pond B39	1.18	0.80	1.18	*	*	*	*	*	*	*	*	*

[a] WR = waste rock; ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely; * = not sampled.

The B4 waste rock storage facility will affect 4 streams (Table 2-12). The total length of these streams is 503 m; however, only 1 of these streams (B4-5) features a well-defined channel. Stream B4-5 is 146 m in length and provides good habitat for Arctic grayling, burbot, slimy sculpin, and ninespine stickleback. Arctic grayling spawning was documented in sections with gravel substrate, and abundant cover provides suitable rearing habitat for juveniles.

Table 2-12: Streams Affected by B4 Waste Rock Storage Facility

Facility[a]	Stream	Defined Channel	Total Length (m)	Affected Length (m)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
WR-B4	B4-5	yes	146	146	-	-	C	-	-	C	C	C	-
	B4-19	no	75	75	-	-	-	-	-	-	-	S	-
	B4-36	no	163	163	-	-	-	-	-	-	-	C	-
	B4-39	No	119	119	-	-	-	-	-	-	-	-	-

[a] WR = waste rock; ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = not sampled.

The remaining 3 streams lack defined channels and consist of dispersed and braided flow paths through the tundra. The flow is limited to freshet and short periods after precipitation events during the open water season. The habitat is not suitable to species other than ninespine stickleback. Their presence was confirmed in Stream B4-36 and is suspected in Stream B4-19 (based on catches in Pond B19).

2.2.3 A45 Waste Rock Storage Facility

The A45 waste rock storage facility, located south of the F Zone pits (Figure 1-1), will affect one pond (A52), which is a comparatively large (7.07 ha) waterbody with a maximum depth of 2.0 m. The north part (1.41 ha) of the pond will be dewatered during operations, but will be restored after closure. The remaining area of the pond (5.66 ha) will be affected. Ninespine stickleback is the only species confirmed or suspected in this pond.

There are no streams under the footprint of the A45 waste rock storage facility.

2.2.4 Discovery Waste Rock Storage Facility

The Discovery waste rock storage facility, located east of the Discovery open pit, will affect 4 small ponds (CH28, CH29, CH31, and CH32; Figure 1-1). The largest pond (CH31) is 1.09 ha in area, and the remaining ponds vary from 0.52 to 1.08 ha in area. The total area of the ponds that will be affected is 3.44 ha. The maximum depths range from 0.4 m in Pond CH28 to 1.6 m in Pond CH32. It is unlikely that ninespine stickleback can reach these ponds during the spring freshet due to poor connectivity and the high gradient of the terrain that separates the ponds from Chickenhead Lake. Fish were not observed in the ponds during surveys completed in 2012.

There are no streams under the footprint of the Discovery waste rock storage facility.

2.3 Mine Infrastructure

The key mine infrastructure includes a process plant, power plant, camp, mine maintenance shop, sewage treatment plant, tank farm, and explosives facility. The infrastructure will be constructed on gravel pads. The aquatic habitats affected by the pad construction for the above infrastructure are grouped here into one category called plant pad.

The aquatic habitats affected by the construction of pads for low grade ore are discussed separately. Access roads will also be constructed as part of the mine infrastructure. In addition, a water intake jetty will be constructed in Meliadine Lake to provide drinking water and make-up water for the process plant. The MMER discharge point, including the diffuser, will be installed in the East basin of Meliadine Lake; details of this infrastructure will be confirmed during the detailed design phase of the Project. The key mine infrastructure at Rankin Inlet includes a laydown area and a tank farm; however, they will not affect freshwater habitats and are not discussed here.

2.3.1 Plant Pad

The plant pad, located east of the B7 waste rock storage facility (Figure 1-1), will affect 8 small ponds in Basin H (Table 2-13). The largest pond (H19) is 2.91 ha in area and the remaining ponds vary from 0.06 ha to 0.75 ha in area. The total aquatic habitat area that will be affected by the plant pad is 4.81 ha. None of the ponds exceed 1.4 m in maximum depth. Upstream of Pond H2, ninespine stickleback is the only species captured or suspected to occur. Based on captures of young-of-the-year Arctic grayling in Pond H2, this species uses the lowermost parts of Basin H for spawning and rearing.

Table 2-13: Ponds Affected by Construction of the Plant Pad

Infrastructure	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Plant Pad	Pond H2	0.16	0.26	0.16	-	-	C	-	-	-	-	S	-
	Pond H3	0.27	0.36	0.27	-	-	-	-	-	-	-	S	-
	Pond H4	0.06	0.55	0.06	-	-	-	-	-	-	-	C	-
	Pond H5	0.37	0.62	0.37	-	-	-	-	-	-	-	C	-
	Pond H6	0.75	0.58	0.75	-	-	-	-	-	-	-	C	-
	Pond H7	0.11	0.67	0.11	-	-	-	-	-	-	-	C	-
	Pond H16	0.18	0.36	0.18	-	-	-	-	-	-	-	-	-
	Pond H19	2.91	1.40	2.91	-	-	-	-	-	-	-	-	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

The plant pad will affect 10 streams in Basin H (Table 2-14). The total length of these streams is 1350 m. Streams in Basin H are primarily seasonal, with flows relying heavily on snowmelt or large precipitation events. The length of time that the streams experience flow decreases with distance upstream in the watershed. Streams upstream of Pond H2 are poorly defined, flow for short periods of time, and are the first to dry among basin streams. In contrast, Stream H1-2 features a well-defined channel and sections of coarse substrate.

Table 2-14: Streams Affected by Construction of the Plant Pad

Infrastructure	Stream	Defined Channel	Total Length (m)	Affected Length (m)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Plant Pad	H1-2	yes	174	174	-	-	C[b]	-	-	-	-	C	-
	H2-3	no	35	35	-	-	-	-	-	-	-	S	-
	H3-4	no	141	141	-	-	-	-	-	-	-	S	-
	H4-5	no	55	55	-	-	-	-	-	-	-	S	-
	H5-17	no	150	150	-	-	-	-	-	-	-	C	-
	H5-6	no	213	213	-	-	-	-	-	-	-	S	-
	H6-7	no	100	100	-	-	-	-	-	-	-	S	-
	H7-8	no	105	105	-	-	-	-	-	-	-	S	-
	H1-19	no	341	341	-	-	-	-	-	-	-	-	-
	H19-20	no	36	36	-	-	-	-	-	-	-	-	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely

[b] Arctic grayling eggs were collected in June 2012

The lower streams in Basin H provide seasonal access for ninespine stickleback to Basin H ponds from Meliadine Lake. The extent to which fish move throughout the basin likely varies annually and is a direct result of the timing and extent of flows in the small streams connecting Basin H ponds. If streams flow for longer periods of time, fish will have more opportunities to move into more areas of the watershed. Streams H1-19 and H19-20 are unlikely to support fish, based on the absence of fish in ponds H19 and H20. Arctic grayling are likely present only in Stream H1-2, where spawning habitat was confirmed through collection of Arctic grayling eggs in 2012.

2.3.2 Pads for Low Grade Ore

The pads for low grade ore, located southeast of the plant pad (Figure 1-1), will affect 4 small ponds (Table 2-15). The largest pond (H20) is 9.58 ha in area; however, it is shallow (maximum depth of 1.6 m). Ponds J2 and J3 are 1.89 and 1.47 ha in area, with maximum depths of 1.3 and 1.2 m, respectively. In addition, a portion (1.54 ha) of Pond J7 will be affected (the pond will also be affected by excavation of Wesmeg pit #3; see Section 2.1.4). The total area that will be affected under the pads is 14.48 ha. Fish have not been captured in Pond H20, and given the poor connectivity to this pond, fish are not suspected to occur. Ninespine stickleback is the only species confirmed or suspected to inhabit the other 3 ponds in Basin J.

Table 2-15: Ponds Affected by the Low Grade Ore Pad

Infrastructure	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Low Grade Ore Pad	Pond H20	9.58	1.60	9.58	-	-	-	-	-	-	-	-	-
	Pond J2	1.89	1.30	1.89	-	-	-	-	-	-	-	C	-
	Pond J3	1.47	1.20	1.47	-	-	-	-	-	-	-	S	-
	Pond J7	3.51	1.75	1.54 [b]	-	-	-	-	-	-	-	C	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

[b] In addition to 1.54 ha of habitat affected by the low grade ore pads, 0.54 ha will be affected by the Wesmeg pit #3 (see Section 2.1.4).

The pads for low grade ore will affect 3 streams in Basin J (Table 2-16). The total length of these streams is 668 m. They lack defined channels and consist of dispersed and braided flow paths through the tundra. The flow is limited to freshet and short periods after precipitation events during the open water season. The habitat is not suitable to species other than ninespine stickleback, whose presence was documented in upstream ponds.

Table 2-16: Streams Affected by the Low Grade Ore Pad

Infrastructure	Stream	Defined Channel	Total Length (m)	Affected Length (m)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Low Grade Ore Pad	J1-2	no	512	512	-	-	-	-	-	-	-	S	-
	J2-3	no	140	140	-	-	-	-	-	-	-	S	-
	J3-4	no	16	16	-	-	-	-	-	-	-	S	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

2.3.3 Mine Access Roads

Access roads will be constructed to open pits and waste rock storage facilities (Figure 1-1). Where they cross a waterbody, they will be constructed either on the bottom of drained lakes or at terrain elevation (over shallow ponds). Many of these waterbodies and streams have been discussed in previous sections.

Roads constructed on the bottom of drained waterbodies and then reflooded after closure affect 2 lakes (A8 and B5) and 1 pond (Pond A5). In total, 12.37 ha of aquatic habitat will be affected (Table 2-17) by covering predominantly fine substrates with gravel and rock. Lake A8 has a maximum depth of 4.2 m and provides year-round habitat to Arctic grayling and ninespine stickleback. During operations, all of Lake A8 will be drained, and the south and north basins of the lake will be excavated for Pump pit #2 and Wesmeg pit #2, respectively. Lake B5 (56.74 ha in area) has a maximum depth of 3.7 m and is inhabited by Arctic grayling and burbot (confirmed), and also likely by cisco and ninespine stickleback (based on catches upstream in lakes B6 and B7). Lake B5 will also be affected by Tiriganiaq pit #2 and the B7 West waste rock storage facility (see sections 2.1.1 and 2.2.1, respectively). Pond A5 provides a migration route for Arctic grayling, lake trout, and Arctic char between Meliadine Lake and the outflow of Lake A6.

Table 2-17: Lakes and Ponds Affected by the Mine Access Roads

Access Road	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
To F Zone Pits	Pond A2a	1.95	0.80	0.41	S	S	S	-	-	-	-	C	C
	Pond A4	0.07	0.53	0.03	S	S	S	-	-	-	-	S	S
	Pond A5	2.00	1.20	1.06	S	S	S	-	-	-	-	C	S
To Pump Pits	Lake A8	90.54	4.20	7.61	-	-	C	-	-	-	-	S	-
To Tiriganiaq Pits	Pond A9	1.76	0.47	0.46	-	-	-	-	-	-	-	-	-
	Pond A38	0.54	0.74	0.15	-	-	-	-	-	-	-	-	-
	Pond J4	0.22	0.50	0.22	-	-	-	-	-	-	-	C	-
	Pond J6	1.75	0.69	1.75	-	-	-	-	-	-	-	-	-
To WR-A45	Pond A51	0.44	0.66	0.24	-	-	-	-	-	-	-	C	-
To WR-B7	Lake B5	56.74	3.40	3.70	-	-	C	-	-	C	-	S	-
	Lake E4	8.52	3.70	0.31	-	-	C	-	-	-	-	C	-
	Pond E11	0.22	0.82	0.22	—	—	—	—	—	—	—	—	—

[a] WR = waste rock; ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence; - = species presence unlikely; — = not sampled.

Roads constructed at elevation that will not permit reflooding of the waterbodies will affect 1 lake and 8 ponds. In total, 2.46 ha of aquatic habitat will be affected in the lake and ponds. The northern tip of Lake E4 will be crossed by the road to the B7 waste rock storage facility, affecting 0.31 ha. Lake E4 is 8.52 ha in area (maximum depth of 3.7 m) and is inhabited by Arctic grayling and ninespine stickleback.

Of the 8 ponds crossed by the roads, the largest (A2a) is 1.95 ha in area and most (60%) are less than 0.25 ha in area. The maximum depths range from 0.5 m in Pond A9 to 0.8 m in Pond E11. Arctic char, lake trout, Arctic grayling, ninespine stickleback, and threespine stickleback have been captured from, or are suspected of occurring, in ponds A2a and A4. These ponds provide a migration route for Arctic grayling, lake trout, and Arctic char between Meliadine Lake and the outflow of Lake A6. Ninespine stickleback is the only species confirmed or suspected in ponds A51 and J4. Despite effort exerted in sampling, fish were not captured in 3 ponds (A9, A38, and J6), likely due to poor connectivity to fish bearing waterbodies and watercourses. Although fish sampling has not been conducted in Pond E11, the habitat was observed to be not suitable for species other than ninespine stickleback.

Off-road habitat that will need to be drained and then reflooded will affect 1.33 ha of habitat in 2 ponds (J6 and E11). Habitat in these ponds is suitable for ninespine stickleback only.

Culvert installations along the mine access roads will affect small sections (i.e., 179 m in total) of 6 streams (Table 2-18). Stream A6-7 features a well-defined channel and provides habitat for Arctic grayling, slimy sculpin, and ninespine stickleback. Arctic grayling spawning use has been documented in the stream. In addition, 78 m of aquatic habitat in Stream A6-7 will be affected by the water level drawdown in Lake A6 (see Section 2.1.3). The remaining 5 streams lack defined channels and consist of dispersed and braided flow paths through the tundra. The flow is limited to freshet and short periods after precipitation events during the open water season. The habitat is not suitable to species other than ninespine stickleback.

Table 2-18: Streams Affected by the Mine Access Roads

Access Road	Stream	Defined Channel	Total Length (m)	Affected Length (m)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
To F Zone Pits	A19-22	no	178	24	-	-	-	-	-	-	-	-	-
To Mine Site	A6-7	yes	113	113	-	-	C	-	-	-	C	C	-
	A45-46	no	174	52	-	-	-	-	-	-	-	C	-
	J1-8	no	340	25	-	-	-	-	-	-	-	-	-
To Wesmeg Pit	A8-40	no	438	22	-	-	-	-	-	-	-	C	-
To Tiriganiaq Pit	J6-7	no	227	21	-	-	-	-	-	-	-	-	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture; S = species presence suspected because of their presence in waterbodies upstream; - = species presence unlikely.

2.3.4 Water Intake Jetty

The water intake jetty, to be constructed near the west end of the east basin of Meliadine Lake, will affect 0.09 ha of lakeshore habitat, directly under the above-water footprint of the jetty. The jetty (67 m long and 13 m wide) will cover coarse substrates located in the 0 m to 5 m depth zone, which is highly prevalent habitat along Meliadine Lake shoreline. Meliadine Lake is inhabited by 9 fish species (Arctic char, lake trout, Arctic grayling, round whitefish, cisco, burbot, slimy sculpin, ninespine stickleback, and threespine stickleback). The area under the jetty footprint could potentially be used as rearing habitat for most of the above species, as well as spawning habitat for lake trout. The intake screens on the jetty and associated water velocities will be designed to minimize potential impingement or entrainment of juvenile fish or eggs.

2.3.5 Water Management Facilities

The water management facilities will include sumps, attenuation ponds, interceptor channels, dikes, water treatment plant, and tailings water reclaim pond. Interceptor channels will direct non-contact runoff water away from areas affected by mining activities. Contact water originating from mine site areas will be intercepted, collected, and conveyed to sumps and pumped to attenuation ponds. Water from the attenuation ponds will be discharged to the environment if water quality meets discharge criteria. If needed, the discharge water will be treated before release to the environment.

Most of the sumps and attenuation ponds proposed for the operations phase of the Project will be located in waterbodies that will already be dewatered for open pits and/or waste rock storage facilities (e.g., contact water ponds will be located on the bottom of drained lakes A8, B4, and B5). Ponds H17 and H1 will also be affected by water management facilities, as they will be used for storing contact waters throughout the operations phase of the Project. Pond H17 (15.80 ha) has a maximum depth of 1.7 m and is occasionally used by ninespine stickleback. The habitat is unsuitable for use by other fish species. Pond H1 (1.14 ha) has a maximum depth of 1.3 m and is used by Arctic grayling, mainly for rearing purposes. Ninespine stickleback are also present in Pond H1.

The outflow stream (H0-1) to Meliadine Lake will be affected by the use of Pond H1 as an attenuation area . This stream is 175 m in length and has a well-defined channel with sections of coarse substrate. It provides suitable habitat for Arctic grayling spawning, as confirmed through collection of eggs in June 2012.

2.4 Tailings Storage Facility (Amendment of Schedule 2 of MMER)

The TSF is located north of the Tiriganiaq open pits and will be surrounded on the east, west, and south sides by the B7 waste rock storage facility (Figure 1-1). The TSF has been designed to store approximately 34.5 million tonnes of tailings, based on a tailings solids content of 55% (SD 2-3 Tailings Storage Facility Preliminary Design).

The TSF footprint includes Lake B7 and ponds B25 and B28. Lake B7 (57.88 ha) is located at the headwaters of Basin B and is one of the deepest lakes on the Peninsula (maximum depth of 5.1 m). It provides year-round habitat to Arctic grayling, cisco, burbot, and ninespine stickleback (Table 2-19). Coarse substrates around the perimeter of the lake provide abundant cover for rearing juveniles. Patches of sand among the coarse substrate may provide suitable spawning habitat for burbot and cisco. Arctic grayling do not spawn within the lake, but have been documented spawning in the outlet stream (B6-7).

Table 2-19: Lake and Ponds Affected by the Tailings Storage Facility

Infrastructure	Waterbody	Total Area (ha)	Maximum Depth (m)	Affected Area (ha)	Fish Species[a]								
					ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Tailings Storage Facility	Lake B7	57.88	5.10	57.58	-	-	C	-	C	C	-	C	-
	Pond B25	1.58	1.10	1.58	-	-	-	-	-	-	-	C	-
	Pond B28	0.45	0.55	0.45	-	-	-	-	-	-	-	C	-

[a] ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback; C = species presence confirmed through capture;; - = species presence unlikely.

Approximately 99.5% of Lake B7 (57.58 ha) will be in direct contact with deposited tailings and will require an amendment to Schedule 2 of the MMER of the *Fisheries Act*. In addition to the area under the TSF, a small area (0.30 ha) in the west margin of the lake will be covered by the containment dike around the TSF. As this part of the lake will not be in direct contact with the tailings, it will not require an amendment to Schedule 2; however, an authorization under Section 35(2) of the *Fisheries Act* will be needed before proceeding with mine development.

Two small ponds (B25 and B28) located close to the north shore of Lake B7 are also within the TSF footprint. The larger pond (B25) is 1.58 ha in area and has a maximum depth of <1.1 m. The smaller pond (B28) is 0.45 ha in area and has a maximum depth of 0.55 m. Both ponds provide occasional habitat to ninespine stickleback; however, the habitat is not suitable to other species. These ponds are not well connected to Lake B7. The connecting streams (B7-25 and B7-28) are short (90 and 59 m in length, respectively), lack defined channels, feature dispersed flow paths over the tundra, and are unsuitable for use by species other than ninespine stickleback.

2.5 Proposed Avoidance Measures

The layout of the Meliadine Project has been condensed to minimize disturbance to nearby waterbodies that are culturally and ecologically significant or rare (e.g., Meliadine Lake and the lower Peninsula lakes). Although there are waterbodies within the Peninsula that may be destroyed or disturbed during construction and operations of the project, the activities will be managed to protect surface water quality by reducing the footprint of the mine as much as possible, diverting non-contact water, and managing contact water (i.e., water that has been in contact with mine processes).

Alternatives to Project components and activities were assessed during Project development (see SD 2-1 Alternatives Assessment Report). The environmental effects of the preferred technical and economic alternatives were considered as part of the alternative selection process. Other assessed criteria included community preference, social acceptability, and reclamation and closure. This led to alternatives being evaluated and rated using the criteria. The alternative with the most favorable ratings was preferred among those considered. A "no-go" alternative was also evaluated. Residual effects that cannot be fully mitigated were avoided, if at all possible, especially if the residual effects are significant and long-term.

2.6 Proposed Mitigation Measures

Mitigation measures have been incorporated into the Project design, and will be incorporated into various Project construction activities to limit changes to fish habitat quantity and quality. These measures include the following:

- Compact layout of the surface facilities, located as much as possible within local watersheds, will limit the area that is disturbed by construction and operation.
- Access roads will be as narrow as possible, while maintaining safe construction and operation practices. Minimum haul road widths will follow that defined under the *Mine Health and Safety Act.*
- Cross-drainage structures will be designed and constructed such that structures will not create a hydraulic barrier to fish passage and will convey peak flows corresponding to 1:25 year 24-hour rainfall event.

- Use of staggered culvert configuration and removal of snow at the culvert inlet and outlet prior to the freshet will be implemented to promote drainage during spring thaw and freshet.
- Disturbed areas along the stream banks will be stabilized and allowed to revegetate upon completion of work.
- Where practical, natural drainage patterns will be used to reduce the use of ditches or diversion berms.
- To the extent possible, in-stream works will be constructed in winter when watercourses are frozen. No in-stream works will be conducted between 1 May to 15 July to avoid critical periods for fish.
- Installation of the lake water intake structures and effluent diffuser structures will follow best management practices, including the installation of turbidity barriers prior to construction in Meliadine Lake.
- Diversion channels will be designed to keep runoff and water flows within natural drainage pathways, to the extent possible. Diversion outlet channels will be designed and constructed to prevent erosion and sedimentation.
- Diversion channels will be designed to provide fish habitat and conditions allowing for passage of Arctic char, lake trout, and Arctic grayling, where necessary.
- Watersheds will be reconnected along previous connecting streams during closure, where possible.
- Fish-out protocols will be followed prior to dewatering of waterbodies and streams to minimize the potential for fish losses due to stranding.
- Pumped discharges will be directed to the lake environment, and not directly to outlets, to attenuate flow changes.
- Water withdrawal rates will be controlled to avoid adverse effects on the water source lake.
- Appropriate sized fish screens following DFO guidelines will be used on the pump intakes to limit fish entrainment.
- Shoreline areas susceptible to extensive erosion will be addressed by armouring using cobbles and boulders, mitigation measures based on adaptive management, or a combination of both, to reduce erosion and associated re-suspension of fine sediment.
- Construction runoff will be captured and discharged into a water management pond where possible; the pond will capture suspended sediments prior to release to Meliadine Lake. If necessary, the water will be treated to remove Total Suspended Solids prior to release to the environment.
- Mine wastewater will be treated and tested before released to Meliadine Lake. Effluent quality will meet MMER at end of pipe and will meet Canadian Council of Ministers of the Environment (CCME) aquatic life standards within a 100 m wide mixing zone in Meliadine Lake.
- Treated sewage will be piped to the TSF.
- Hazardous materials and fuel will be stored according to regulatory requirements to protect the environment and workers.
- Potential acid generating rock and metal leaching waste rock will be segregated at source and placed into waste rock storage facilities.

- At closure, the TSF will be dewatered and covered with waste rock; runoff will be collected and then treated until it is confirmed that water meets water quality criteria.
- Blasting will follow recommended DFO guidelines for use of explosives in or near Canadian fisheries waters. Lessons learned at the Meadowbank Mine will be integrated into blasting plans.
- Where possible, stockpiling of rock and fill from quarries and borrow sites will be placed such that surface water is not diverted through the piles with runoff to surface waterbodies.
- Mining staff will not be allowed to hunt or fish while on their work rotation. AEM will develop and enforce "no hunting, trapping, harvesting, or fishing policy" for employees and contractors.
- The mine pits (and borrow pits) will be progressively reclaimed as excavation is completed; slopes will be designed to be stable during pit construction and operation.
- Pumping rates to fill the open pits will be managed to minimize effects to Meliadine Lake and will ensure that the total annual discharge does not drop below the 10-year dry condition. No pumping will occur in years during which Meliadine Lake discharges are forecast to naturally fall below the 10-year dry condition. A 10-year pit filling schedule is anticipated.

The above proposed measures describe the general approaches that will be used to mitigate effects to fisheries productivity. The information regarding the offsetting measures for the residual effects of the Project is presented in Section 5.0. The Conceptual Fisheries Protection and Offsetting Plan will be submitted to NIRB and DFO for review. Only after the Fisheries Protection and Offsetting Plan receives approval, and the Project receives DFO's Authorization, can any Project work that may result in serious harm to fish begin.

2.7 Risk Categorization

One of the main components of the DFO Risk Management Framework (RMF; DFO 2010) is the Risk Assessment that provides decision criteria for risk management. Waterbodies under the TSF footprint (most of Lake B7 and ponds B25 and B28) that will require an amendment of Schedule 2 of MMER were not considered as part of this analysis due to differences in definitions between Environment Canada's MMER (that require a Section 36 authorization) and DFO Section 35(2). In agreement with the DFO guidance, all remaining waterbodies, identified as having a medium and high risk within the RMF, require the proponent to address habitat compensation through the fisheries protection and offsetting plan in support of future Fisheries Act authorizations. Decision trees were used in the categorization to determine the sensitivity of fish and fish habitat as low, medium, or high and to determine the scale of negative effects as low, moderate, or high. The results of the assessment of each waterbody within the proposed project footprint were integrated to produce a risk categorization within the RMF matrix (DFO 2010).

This method is consistent with the new Fisheries Protection Policy Statement (DFO 2013b), which evaluates the risk of the associated changes to the fishery and affected species or habitats due to proposed works/undertakings/activities, also referred to as projects. The DFO states that the department's decisions related to issuing Section 35(2) authorizations will be guided by the application of precaution and a risk-based approach to decision making (DFO 2013b). Furthermore, DFO intends to evaluate projects based on "the relationship between the productivity of the fishery and the state of the affected species or habitats…, which can inform management decisions about risks associated with changes to the state of the affected species or habitats" (Koops et al. 2013). Koops et al. (2013) also state that "the current RMF practically facilitates the placement of individual projects in risk categories based on the scale of negative effects and the sensitivity of fish and fish habitat".

The application of the RMF and risk categorization, presented in full in Appendix B, aligns with the new fisheries protection policy. The risk categorization is intended to assist DFO in the evaluation of the potential cumulative change to the affected species and habitats, and thus on the productivity of the fisheries, specifically the Arctic char, lake trout, and Arctic grayling fisheries in Meliadine Lake, under the new Fisheries Protection Policy Statement (DFO 2013b). A draft technical memorandum of the *Meliadine Gold Project – Fisheries Risk Assessment and Application of the DFO Risk Management Framework* was submitted to DFO on 30 October 2012, proposing a method to categorize low, medium, or high risk fish habitat within the DFO RMF matrix. General consensus on this method was confirmed in follow-up conversations with DFO representatives, and the memorandum was finalized to integrate recent changes to the mine plan as part of the DEIS and was more recently revised to incorporate changes to the *Fisheries Act* in the FEIS.

The risk categorization uses a decision tree to evaluate the sensitivity of fish and fish habitat (x-axis of the DFO matrix; see Figure 1-1 in Appendix B). Independent of the sensitivity of fish and fish habitat categorization, a second decision tree is used to determine the scale of negative effects (y-axis of the DFO matrix). The results of these analyses are then integrated to produce a risk categorization of the proposed project on each waterbody, according to the DFO RMF matrix. Waterbodies identified as overall medium and high risk, that will require Section 35(2) Fisheries Act authorizations, are evaluated individually through a Habitat Evaluation Procedure (see Section 3) to determine the overall level of offsets required to reduce the serious harm to fish (discussed in Sections 4 to 6).

2.7.1 Lakes and Ponds

As detailed in Appendix B, waterbodies (i.e., lakes and ponds) under the Project footprint were evaluated using decision trees for assessing "sensitivity of fish and fish habitat" and "scale of negative effect" in the context of the prevalence and year-round use of fish habitat on a regional scale. Following the DFO (2010) guidance, the attributes considered for the "sensitivity of fish and fish habitat" included species sensitivity, species dependence on habitat, species or habitat rarity, and habitat resiliency, whereas the attributes considered for the "scale of negative effect" included the extent, duration, and intensity of the Project.

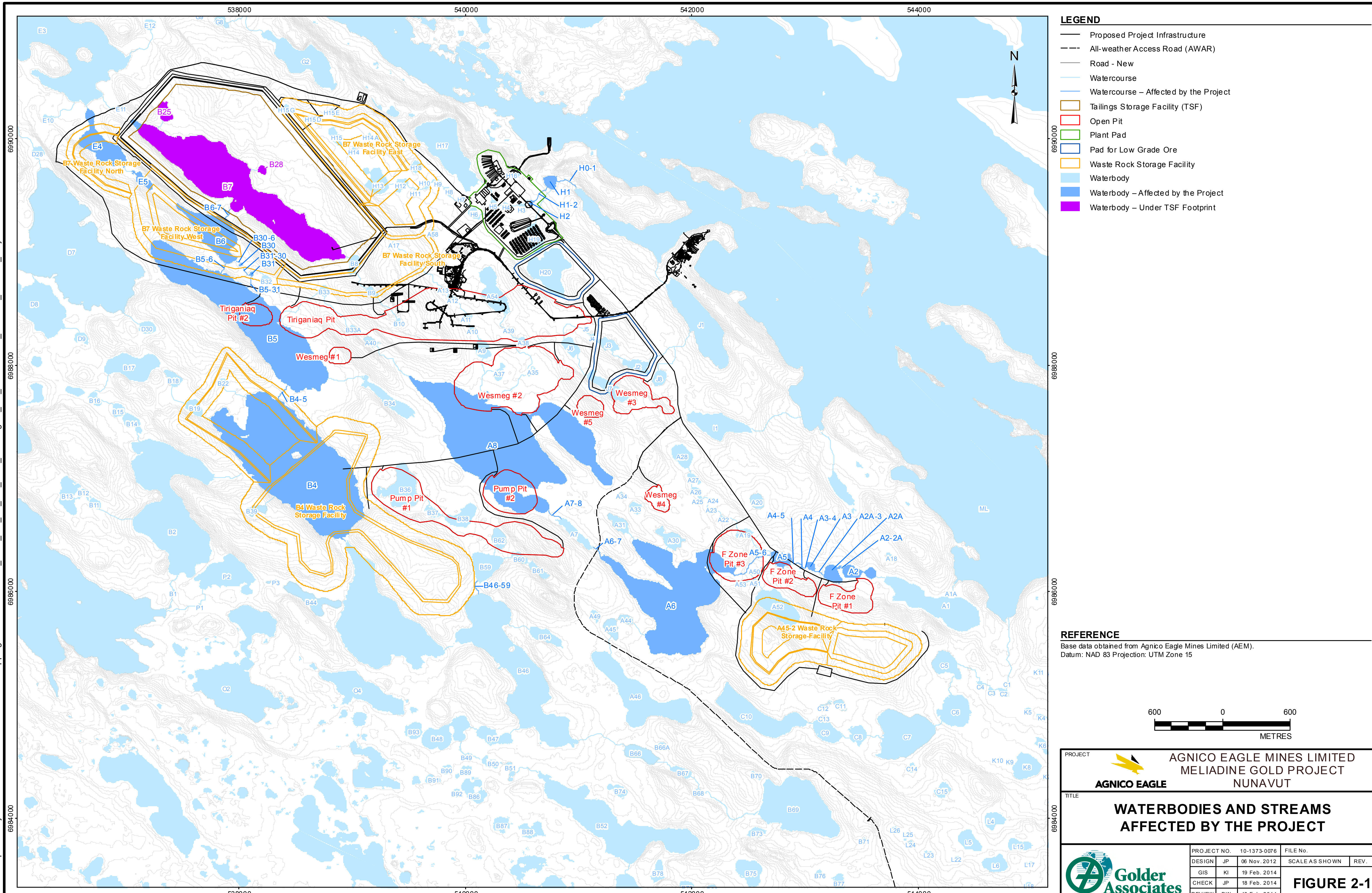
The detailed risk categorization for each waterbody is presented in Appendix B. Out of the total of 80 waterbodies that will be potentially affected by the footprint of the Project (as discussed in sections 2.1 to 2.3), most (89%) do not have overwintering habitat (i.e., depths are less than 2 m), are limited to occasional or seasonal use by 1 species only (ninespine stickleback), and are mostly offline. Of these ponds, 63 are of a type highly prevalent in the region and are not critical to the survival of ninespine stickleback in the region. As such, most of the ponds within the Project footprint were categorized as low risk, according to the DFO RMF matrix, and the potential for cumulative change to the affected species or habitats will be small and will have low or negligible impact on the productivity of Arctic grayling, lake trout, and Arctic char fisheries in Meliadine Lake.

Peninsula waterbodies classified as moderate or high risk according to the RMF (DFO 2010) include 17 lakes and ponds identified in Figure 2-1. Nine of these waterbodies are stream-like corridors located in the lower reach of Basin A (ponds A2, A2a, A3, A4, and A5 used by Arctic grayling, lake trout, Arctic char, ninespine stickleback, and threespine stickleback), the middle reach of Basin B basin (ponds B30 and B31 used by Arctic grayling and ninespine stickleback), and the lower reach of Basin H (ponds H1 and H2 used by Arctic grayling and ninespine stickleback). The remaining 8 waterbodies (lakes A6, A8, B4, B5, B6, B7, E4, and E5) are multi-species (Arctic grayling, cisco, burbot, and/or ninespine stickleback) lakes, of which most provide adequate overwintering for these species, most are greater than 10 ha in area, and all are seasonally connected to Meliadine Lake. As these waterbodies are considered rare within the Peninsula and provide minor support to the Arctic grayling fishery, they were rated as medium or high risk using the RMF and, therefore, may require authorization under the Section 35(2) of the *Fisheries Act*. The habitat losses in these waterbodies are described and quantified in Section 4.1, and the corresponding offsetting measures are presented in Section 5.2.

2.7.2 Streams

Integrating the results of the risk assessment on waterbodies (lakes and ponds) and applying a similar approach, watercourses (i.e., streams) under the Project footprint were also categorized according to risk. The main criteria used for identifying medium and high risk streams was the presence of a defined channel and presence of coarse substrates. Streams featuring dispersed flow (i.e., multiple pathways over terrestrial vegetation during freshet or after rain events) were considered to be low risk due to the poor quality of habitat and the prevalence of this habitat type on a regional scale. The potential for cumulative change to the affected species or habitats in these streams will be small and will have low impact on the productivity of Arctic grayling, lake trout, and Arctic char fisheries in Meliadine Lake.

Out of the total of 59 watercourses that will be potentially affected by the Project, most (43) were rated as low risk watercourses due to the lack of a defined channel. Using the RMF, the remaining 16 watercourses were classified as medium or high risk and are identified in Figure 2-1. Most (14 of 16) of these streams are located in Basins A and B; they are used by multi-species and provide connections to waterbodies located upstream. The remaining 2 streams (H0-1 and H1-2) are located in lower reaches of Basin H, have well defined channels and are known to provide Arctic grayling spawning and rearing habitat, in addition to being used by ninespine stickleback. Given that these watercourses are considered rare within the Peninsula and have well defined channels that support the Arctic grayling fishery in Meliadine Lake, these 16 streams were rated as medium or high risk and, therefore, will require authorization under Section 35(2) of the *Fisheries Act*. The habitat losses in streams considered as medium and high risk are described and quantified in Section 4.2, and the corresponding offsetting measures are presented in Section 5.3.


LEGEND
Proposed Project Infrastructure
All-weather Access Road (AWAR)
Road - New
Watercourse
Watercourse – Affected by the Project
Tailings Storage Facility (TSF)
Open Pit
Plant Pad
Pad for Low Grade Ore
Waste Rock Storage Facility
Waterbody
Waterbody – Affected by the Project
Waterbody – Under TSF Footprint
REFERENCE
Base data obtained from Agnico Eagle Mines Limited (AEM).
Datum: NAD 83 Projection: UTM Zone 15
600 0 600
METRES
PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT
TITLE
WATERBODIES AND STREAMS
AFFECTED BY THE PROJECT
PROJECT NO. 10-1373-0076
FILE No.
DESIGN JP 06 Nov. 2012
SCALE AS SHOWN
REV. 0
GIS KI 19 Feb. 2014
CHECK JP 18 Feb. 2014
REVIEW DW 18 Feb. 2014
FIGURE 2-1
B7 Waste Rock Storage Facility North
B7 Waste Rock Storage Facility East
B7 Waste Rock Storage Facility West
B7 Waste Rock Storage Facility South
B4 Waste Rock Storage Facility
A45-2 Waste Rock Storage Facility
Tiriganiaq Pit #2
Tiriganiaq Pit
Wesmeg #1
Wesmeg #2
Wesmeg #3
Wesmeg #4
Wesmeg #5
Pump Pit #1
Pump Pit #2
F Zone Pit #1
F Zone Pit #2
F Zone Pit #3
N:\Bur-Graphics\Projects\2013\1428\13-1428-0007\GIS\Mapping\MXD\FEIS\Volume_7\SD_7-4_No_Net_Loss_Plan\Figure_2-1_Waterbodies_Streams_Affected_Project.mxd

3.0 METHODOLOGY FOR QUANTIFYING HABITAT LOSSES AND GAINS

The most commonly used method to estimate habitat losses and gains is a Habitat Evaluation Procedure (HEP), which involves the multiplication of the area where each loss or gain will occur by the habitat suitability index (HSI) of that area and a fish species weighting (based on fishery value and relative abundance) to derive a value in terms of habitat units (HU), a surrogate for productivity. The HU is a unit-less number that describes both the quantity and quality of habitat and allows for an objective quantification of habitat losses that need to be offset by habitat gains.

A modified version of this basic model was developed by Golder Associates Ltd. (Golder) and AEM for the Project. The Meliadine HEP model was first presented to DFO at a workshop on 17 November 2011 and the model was reviewed by DFO in consultation with Dr. Ken Minns in February 2012 and subsequently accepted by DFO. The following description of the methods used in this Conceptual Fisheries Protection and Offsetting Plan is based on the above consultations.

3.1 Overview

As the first stage of habitat evaluation, pre-construction (i.e., natural or baseline) habitat units are calculated for medium and high risk waterbodies and streams affected by the mine site where permanent habitat changes are expected to occur. These are referred to as “habitat losses” in this report because they will be altered or destroyed by mine activities during the construction and operation stages and, therefore, will require offsetting measures according to DFO (2013a). Some of these habitat losses will be disruptions over a period of time (e.g., waterbody drained and then refilled after mine operations), whereas others will result in permanent alteration (e.g., increase in depth through open pit excavation) or destruction (e.g., covered by waste rock).

Although no physical changes are anticipated in disrupted habitats, the duration of the disruptions may exceed a reasonable number of generation times to be considered temporary, as interpreted by DFO (Koops et al. 2013). As such, the disrupted habitats are included with altered habitats in the calculations of losses and gains so that the impacts associated with the disruption of biological productivity in waterbodies that support the CRA fishery in Meliadine Lake are accounted for in the offsets. The separation of disrupted habitats from the altered ones is no longer required under the current *Fisheries Act* (i.e., serious harm to fish can result from permanent alterations only); nevertheless, the original plan was prepared when altered and disrupted habitats were differentiated under the definition of HADD, and it was decided to retain this distinction for the preliminary purposes of this conceptual offsetting plan.

As the second stage of the evaluation, post-closure habitat units are estimated. Based on mine closure designs and conceptual plans for offset measures, the total number of habitat units available after mining (“habitat gains”) is calculated using the same methods as those used for calculating losses. The habitat gains will include previously terrestrial areas transformed into aquatic habitat (i.e., flooded open pit areas), as well as parts of existing lakes and ponds that will be altered (e.g., deepened) through pit excavation and additional enhancements to increase overwintering and spawning potential. Rehabilitated stream channels will also add to habitat gains by providing movement corridors between lakes and spawning or rearing habitat for key fish species.

The ratio of habitat gains to habitat losses is referred to as the offset ratio. It is generally expected that the habitat gains exceed the losses, to account for the time delay to make up for the lost fisheries productivity and the uncertainty associated with the anticipated benefits of offsetting measures.

3.2 HEP Model

The Project HEP model used for the Project calculates HU by multiplying 4 parameters and summing the products for each waterbody or watercourse and for each fish species. For lakes and ponds, it can be expressed as follows:

$HU_{spp\ 1\text{-}n} = \sum_{HT\ 1\text{-}10} \{\sum_{sp,re,fo,ow}(HT_{1\text{-}10} \times HSI_{sp,re,fo,ow} \times \text{life function weighting} \times \text{fish species weighting})\}$

where $HT_{1\text{-}10}$ = area (ha) of habitat types 1 through 10 (see Section 3.2.1 for definitions), and

$HSI_{sp,re,fo,ow}$ = species-specific habitat suitability index for each life function: spawning (sp), rearing (re), foraging (fo), and overwintering (ow) use

A similar equation is used for calculating habitat units in streams. The only difference is that the stream habitat types ($HT_{11\text{-}16}$) are based on linear channel length (in m) rather than on area. Because of the difference in the units used to describe habitat types, habitat unit calculations were done separately for lakes/ponds and streams.

Each parameter that forms part of the above equation is explained below.

3.2.1 Habitat Type

3.2.1.1 Lakes and Ponds

Lake and pond habitat under the Project footprint was classified into distinct habitat types based on combinations of depth and substrate categories.

Depth determinations for most lakes (defined for this Project as waterbodies of greater than 2 m in maximum depth) were based on bathymetric surveys. Maximum depths of most ponds (less than or equal to 2 m in maximum depth) were assessed by wading with a measuring rod or spot sounding from an inflatable boat during field surveys. Total area of each waterbody was obtained from LiDAR imagery. Using the bathymetric data and LiDAR-defined shorelines, the total area of each waterbody (in ha) was subdivided into 3 depth zones:

- Shallow (<2 m) – areas likely to freeze to bottom during winter (includes all ponds);
- Moderate (2 m to 4 m) – areas of under-ice water during winter, but with potentially inadequate oxygen levels to support overwintering use by fish; and
- Deep (>4 m) – areas likely to support overwintering.

Substrate determinations for each waterbody were made during field surveys using an underwater viewer along transects, verifying bottom types with a grab sample (e.g., using an Ekman dredge), prodding with a long pole, and/or visual observations from shore, boat, and/or helicopter. These field data were supplemented by examination of aerial photographs and satellite imagery. For the purposes of the Meliadine HEP model, substrate was classified into 3 types:

- Fines – area covered entirely by silt, sand, and/or organic material;
- Mixed – coarse substrate interspersed with large patches of organic or silt material; and
- Coarse – most of the area covered by gravel, cobble, and/or boulder.

Substrate composition was determined for each depth zone and expressed as a percentage of total area for each lake and pond (FEIS Volume 7, Section 7.5).

Habitat types for the Meliadine HEP model for lakes and ponds are based on the 9 possible combinations of the 3 depth and 3 substrate categories outlined above (Table 3-1). An additional habitat type (HT 10) was included to reflect habitat conditions during mine post-closure, when some areas of the proposed pit lakes (i.e., habitat gains proposed as offsets) will likely be stratified (meromictic), with anoxic conditions prevailing below a permanent chemocline (zone known as monimolimnion and assumed to be below 20 m depth for the Meliadine HEP model). The upper zones in the water column within areas of HT 10 can likely be used by pelagic fish for feeding and overwintering; however, the lower zones are not considered fish habitat because of the anticipated lack of dissolved oxygen.

Table 3-1: Lake and Pond Habitat Types proposed for the Meliadine HEP Model

Habitat Type	Depth Zone	Substrate
HT 1	Shallow (<2 m)	Fines
HT 2		Mixed
HT 3		Coarse
HT 4	Moderate (2 m to 4 m)	Fines
HT 5		Mixed
HT 6		Coarse
HT 7	Deep (>4 m)	Fines
HT 8		Mixed
HT 9		Coarse
HT 10	Monimolimnion (>20 m)	None

The areas of each habitat type were calculated (in ha) for all waterbodies under the Project footprint for pre-construction conditions (habitat losses) and the proposed post-closure conditions (habitat gains). The areas of each habitat type per waterbody are presented in Table C-1 in Appendix C. The criteria used for quantifying areas of habitat losses were the same as those used for quantifying habitat gains.

3.2.1.2 Streams

Similar to the method used for lakes and ponds, stream habitat under the Project footprint was classified into distinct habitat types based on combinations of depth and substrate categories.

Depth and substrate characteristics were determined for all streams during field surveys. Because stream habitat is most critical for Arctic grayling spawning in spring, and flows are greatly reduced in late summer and fall, only spring and early summer data were used for habitat classifications. Based on the maximum depth encountered within the surveyed stream sections, the total length of each stream (in m) was subdivided into 2 depth zones:

- Shallow (<0.5 m) – sections likely to provide rearing habitat, but unsuitable for use by large-bodied fish;
- Deep (≥0.5 m) – sections likely to support use by large-bodied fish.

For the purposes of the Meliadine HEP model for streams, substrate composition was determined for all depth zones. Substrate was classified into 3 types:

- Fines – sections of silt, sand, and/or organic material, largely unsuitable for Arctic grayling spawning;
- Gravel – preferred substrate for Arctic grayling spawning and incubation; and
- Coarse – stream sections dominated by coarse substrates (mainly fractured rock in cobble or boulder size-classes), important in providing instream cover for juvenile fish.

Habitat types for the Meliadine HEP model for streams are based on the 6 possible combinations of the 2 depth and 3 substrate categories outlined above (Table 3-2).

Table 3-2: Stream Habitat Types Proposed for the Meliadine HEP Model

Habitat Type	Depth Zone	Substrate
HT 11	Shallow (<0.5 m)	Fines
HT 12		Gravel
HT 13		Coarse
HT 14	Deep (≥0.5 m)	Fines
HT 15		Gravel
HT 16		Coarse

The lengths of each habitat type were calculated (in m) for all watercourses under the Project footprint for pre-construction conditions (Table C-2 in Appendix C). The criteria used for quantifying areas of habitat losses were the same as those used for quantifying habitat gains.

3.2.2 Habitat Suitability Index

For each habitat type identified for lakes, ponds, and streams in Section 3.2.1, a HSI was determined for each life history function of each fish species present in the region. For the Meliadine HEP model, the life functions under consideration included the following:

- spawning/nursery (sp), considering the suitability of habitat used by fish for spawning and embryo development;
- rearing (re), considering the suitability of habitat used by young-of-the-year and small-bodied juveniles for foraging and refuge from predators;
- foraging (fo), considering the suitability of habitat used by adult fish for feeding; and
- overwintering (ow), considering the suitability of habitat used by all fish during the winter.

Habitat suitability was ranked for each life function of each species on a 5-point scale, where

- 0 = unsuitable;
- 0.25 = below average;
- 0.5 = average;
- 0.75 = above average; and
- 1 = optimal.

Habitat suitability rankings are based on general life history characteristics published for Arctic fishes (e.g., Evans et al. 2002; Richardson et al. 2001; Stewart et al. 2007) and local observations. They are similar to the rankings used in the recently submitted NNLP for the Meadowbank Project (AEM 2012). In total, 576 HSI ratings were derived for each of the 16 habitat types, 9 fish species, and 4 life functions (Table D-1 in Appendix D).

As noted previously, habitat type HT 10 was proposed for evaluating end pit lakes during mine post-closure, when refilling of deep open pits will re-establish these areas as fish habitat. Although fish will not use the deepest areas of the pits, the photic zone will remain suitable habitat for pelagic functions, similar to deep-water areas pre-construction. Foraging and overwintering functions, particularly for pelagic zone feeders, should not be impeded in these areas and, therefore, were rated between 0 and 0.75, depending on the species. It is recognized, however, that the deeper areas of end pit lakes will not provide spawning habitat (lack of oxygenated substrate for egg incubation) or proper rearing habitat (most juvenile fish prefer close proximity to substrate and cover). As such, the HSI for spawning and rearing were rated as zero for all species in these areas.

3.2.3 Life Function Weighting

Consistent with the Meadowbank NNLP (AEM 2012), as well as several other HEP models used in the Arctic, life function weightings were rated as equal at 0.25 each for spawning, rearing, foraging, and overwintering functions, so they sum to 1.

3.2.4 Fish Species Weighting

In an adaptation of a procedure suggested by Minns (2010), the potential species assemblages in Meliadine waterbodies and watercourses were weighted so that the sum of all individual species weightings equals to 1. In this manner, the overall value of fish habitat that may be shared among various species does not exceed 1, regardless of how many species are present. It is important to the HEP model that all rated parameters (i.e., HSI, life function weighting, and species weighting) are on a scale between 0 and 1 to preserve the relationship between the measured units of habitat loss (i.e., hectares for lakes and ponds, and metres for streams) and the unit-less value of HU. As such, 10 ha of optimal habitat for all species and all life functions would have a value of 10 HU for lakes and ponds. Similarly, 100 m of optimal habitat in a stream channel would have a value of 100 HU; however, the stream HU will not be comparable to a lake or pond HU. In general, the higher the ratio between HU and the aerial or linear measure of habitat types, the better is the suitability of habitat for all fish.

As indicated in Section 1.3, the species assemblages of upper lakes in the Peninsula basins were quite distinct from the lower lakes. Despite considerable fishing effort in the upper lakes and ponds, species such as Arctic char, lake trout, and round whitefish were not recorded there. There was an exception of 2 lake trout caught in Lake B69; however, this lake is not a typical upper Peninsula lake (it is the deepest lake on the Peninsula). The presence of lake trout in Lake B69 was considered an anomaly; therefore, it did not change the methods of species weighting for the purposes of the Meliadine HEP model.

Based on the differences in species assemblages, the following 5 ecotypes were identified for the Project (see Figure 1-1 for waterbody and stream locations):

- **Meliadine Lake** - inhabited by all 9 species present in the region, but dominated by lake trout and cisco – an aboriginal and recreational fishery;
- **Lower Peninsula Lakes and Ponds** (A1 to A5, B2, D1 to D3, E1 to E3) - inhabited by all or most of the 9 species present in Meliadine Lake, but dominated by Arctic grayling - support Meliadine Lake fishery;
- **Upper Peninsula Lakes and Ponds** (upstream of A5, B3, D3, E3, all of basins C, H, and J) - inhabited by a maximum of 4 species (Arctic grayling, cisco, burbot, and ninespine stickleback);
- **Lower Peninsula Streams** (A0-1 to A5-6, B0-1 to B3-4, D0-1 to D2-3, E0-1, to E3-4) - inhabited by all or most of the 9 species present in Meliadine Lake, but dominated by Arctic grayling - support the Meliadine Lake fishery; and
- **Upper Peninsula Streams** (upstream of A5-6, B3-4, D2-3, E3-4, C0-1, H0-1, J0-1) - inhabited by a maximum of 4 species (Arctic grayling, burbot, slimy sculpin, and ninespine stickleback).

Due to the large number of waterbodies and streams within the footprint of the Project, their relative abundance within each individual waterbody and stream, fish species weightings for the Meliadine HEP model were based on the potential fish presence within each ecotype (i.e., through an assessment of general trends within the Peninsula), rather than individual waterbodies or streams, where the level of fishing effort was often biased by the objectives of the investigations. In this manner, the data set pooled over the entire ecotype was sufficiently large to allow for confident predictions of fish presence, relative abundance, and their relative contribution to the fisheries of Arctic grayling, Arctic char, and lake trout in Meliadine Lake,

The fish species weightings consider 2 separate components (fishery value and relative abundance) that are combined to arrive at an overall species weighting for each ecotype. These 2 components are described below.

3.2.4.1 Fishery Value

Fishery values reflect the relative importance of each fish species for commercial, recreational, and Aboriginal fisheries. As there are no commercial or recreational fisheries in the footprint of the Project, the fishery value is based on the perception of the usefulness of each species to the Aboriginal fishers of Rankin Inlet, and was derived in consultation with the traditional knowledge component of the study. All fishery values were rated on a scale of 0 to 1, taking into consideration that the sum of all species values must be 1 for each ecotype. The ratings used for the Meliadine HEP model are presented for each ecotype in Table 3-3.

Table 3-3: Fishery Values for Fish Species per Ecotype

Species	Meliadine Lake	Lower Peninsula Lakes and Ponds	Upper Peninsula Lakes and Ponds	Lower Peninsula Streams	Upper Peninsula Streams
Arctic Char	0.5	0.5	-	0.5	-
Lake Trout	0.25	0.25	-	0.25	-
Arctic Grayling	0.1	0.1	0.5	0.1	0.75
Round Whitefish	0.05	0.05	-	0.05	-
Cisco	0.05	0.05	0.25	0.05	-
Burbot	0.05	0.05	0.25	0.05	0.25
Slimy Sculpin	0	0	-	0	0
Ninespine Stickleback	0	0	0.	0	0
Threespine Stickleback	0	0	-	0	-
Total	**1**	**1**	**1**	**1**	**1**

Due to the importance of Arctic char for the Aboriginal fishery in Rankin Inlet, its fishery value was set to 0.50 in all ecotypes where this species is potentially present. Conversely, the value of slimy sculpin, ninespine stickleback, and threespine stickleback was set at zero because these species are not a targeted fishery by local harvesters. Ecotypes where some species are not likely to be encountered were not assigned a fishery value; instead the values for the species potentially present were distributed so that they add up to 1.

3.2.4.2 Relative Abundance

Relative abundance of fish species within each ecotype was calculated using biomass as an indicator because it was recognized that it is a better estimator of productive capacity than the number of fish present. Biomass of all species captured within each ecotype was calculated by multiplying the number of fish captured by the mean weight of each species (as not all captured fish were weighed, the mean derived from the weighed sample was applied to the total catch). Relative biomass of each species was then estimated as a proportion of the total biomass within each ecotype (Table D-2 in Appendix D).

3.2.4.3 Fish Species Weighting

The fish species weighting is the mean of the fishery value and the relative abundance values for each species in each ecotype (i.e., both components are weighted equally). The equation for fish species weightings can be summarized as follows:

Fish Species Weighting = (fishery value + relative abundance) / 2

The calculated species weightings applied in the Meliadine HEP model are presented for lake and pond, and stream ecotypes in Tables 3-4 and 3-5, respectively. Arctic grayling have the highest overall species weightings in the upper Peninsula lakes, ponds, and streams, whereas Arctic char and lake trout dominate the species weightings for Meliadine Lake and the lower Peninsula lakes and streams.

Table 3-4: Fish Species Weightings for Lake and Pond Ecotypes

Species	Meliadine Lake			Lower Peninsula Lakes			Upper Peninsula Lakes and Ponds		
	FV[a]	RA[b]	**Overall**	FV	RA	**Overall**	FV	RA	**Overall**
Arctic char	0.5	0.11	**0.31**	0.5	0.23	**0.36**	-	-	**-**
Lake trout	0.25	0.54	**0.39**	0.25	0.19	**0.22**	-	-	**-**
Arctic grayling	0.1	0.07	**0.08**	0.1	0.32	**0.21**	0.5	0.82	**0.66**
Round whitefish	0.05	0.03	**0.04**	0.05	0.03	**0.04**	-	-	**-**
Cisco	0.05	0.24	**0.15**	0.05	0.22	**0.13**	0.25	0.12	**0.19**
Burbot	0.05	0.01	**0.03**	0.05	0.01	**0.03**	0.25	0.01	**0.13**
Slimy sculpin	0	0.00	**0.00**	0	0.00	**0.00**	-	-	**-**
Ninespine stickleback	0	0.00	**0.00**	0	0.01	**0.00**	0	0.05	**0.03**
Threespine stickleback	0	0.01	**0.01**	0	0.00	**0.00**	-	-	**-**

[a] FV = fishery value
[b] RA = relative abundance (biomass)
Note: Some numbers are rounded for presentation purposes.

Table 3-5: Fish Species Weightings for Stream Ecotypes

Species	Lower Peninsula Streams			Upper Peninsula Streams		
	FV[a]	RA[b]	**Overall**	FV	RA	**Overall**
Arctic char	0.5	0.02	**0.26**	-	-	**-**
Lake trout	0.25	0.03	**0.14**	-	-	**-**
Arctic grayling	0.1	0.85	**0.47**	0.75	0.84	**0.79**
Round whitefish	0.05	0.00	**0.03**	-	-	**-**
Cisco	0.05	0.01	**0.03**	-	-	**-**
Burbot	0.05	0.04	**0.04**	0.25	0.00	**0.13**
Slimy sculpin	0	0.02	**0.01**	0.	0.02	**0.01**
Ninespine stickleback	0	0.03	**0.01**	0	0.14	**0.07**
Threespine stickleback	0	0.01	**0.00**	-	-	**-**

[a] FV = fishery value
[b] RA = relative abundance (biomass)
Note: Some numbers are rounded for presentation purposes.

4.0 HABITAT LOSSES

As summarized in Section 2 and Appendix B, medium and high risk waterbodies and watercourses were carried forward to the assessment stage to account for habitat losses. The Meliadine HEP method of accounting for habitat losses was applied to 9 lakes, 10 ponds, and 16 streams (Figure 2-1). In accordance with DFO (2010), the loss of low-risk ponds (i.e., those used only by ninespine stickleback) and streams (i.e., those with undefined channels and flow dispersed through terrestrial vegetation) will be addressed through appropriate mitigation measures and best management practices to minimize the impact on fish and fish habitat.

Recognizing the need to separate the predicted habitat losses into 2 regulatory components (i.e., losses that will require DFO authorization under Section 35(2) of the *Fisheries Act* and losses that will require an authorization under Section 36 of the *Fisheries Act* through an amendment to Schedule 2 of MMER), habitat losses for the first component (Section 35[2] authorizations) are presented in sections 4.1 and 4.2, whereas habitat losses associated with the TSF (Section 36 authorizations through an amendment to Schedule 2 of MMER) are presented separately in Section 4.3.

4.1 Lakes and Ponds (Section 35 Authorization)

Using the methodology outlined in Section 3, anticipated habitat losses due to the Project in lakes and ponds are summarized in Table 4-1 for 3 types of habitat impacts: permanent alteration, disruption (e.g., waterbody drained and then refilled after mine operations), and permanent destruction. The losses are presented in terms of both area (ha) and HU (calculated through the Meliadine HEP model). In total, the habitat lost in 17 lakes and ponds in Basins A, B, E and H, as well as in Meliadine Lake is estimated at 318.75 ha, resulting in a loss of 90.76 HU. The descriptions of fish habitat in the waterbodies that will be altered, disrupted, or destroyed, and brief discussions of post-closure scenarios are presented below.

4.1.1 Altered Lake and Pond Habitat

The Project footprint will alter the existing habitat in parts of Pond A5 and lakes A6, A8, and B5 (Figure 2-1). The total area that will be altered is 71.46 ha, corresponding to 21.30 HU.

Pond A5

Pond A5 is a small (2.00 ha) and shallow (maximum depth of 1.2 m) waterbody located on the main stream system that connects the upper lakes in the A basin (lakes A6 and A8) to Meliadine Lake. The existing substrate consists mainly of fines and organic material (80%), with smaller areas of mixed and coarse substrates (10% each). The south part of the pond (approximately 0.37 ha or 0.06 HU) will be excavated to form walls of the F Zone pit #2, thus altering the depth and substrate in this part of the pond. After draining the pond for the operations phase, the bottom areas in the north and west parts of the pond will be covered with crushed rock to form the main access road to the F Zone pits and auxiliary roads to F Zone pit #2 and the A45 waste rock storage facility. The construction of these roads will alter the existing substrate under 1.07 ha (0.17 HU) of the pond, resulting in mainly coarse substrates during the closure phase when the pond will be re-flooded and connected to the future end pit lake on the south side of the pond.

Table 4-1: Surface Area and Habitat Units of Lakes and Ponds Affected by the Project

Lake/ Pond	Surface Area (ha)				Habitat Units (HU)			
	Altered	Disrupted	Destroyed	Total	Altered	Disrupted	Destroyed	Total
Pond A2	-	2.36	-	**2.36**	-	0.42	-	**0.42**
Pond A2a	-	1.54	0.41	**1.95**	-	0.26	0.07	**0.32**
Pond A3	-	0.48	-	**0.48**	-	0.08	-	**0.08**
Pond A4	-	0.03	0.03	**0.07**	-	0.01	0.01	**0.02**
Pond A5	1.44	0.56	-	**2.00**	0.22	0.09	-	**0.31**
Lake A6	37.64	-	17.64	**55.28**	12.02	-	4.18	**16.19**
Lake A8	23.26	67.28	-	**90.54**	6.58	21.46	-	**28.04**
Lake B4	-	-	85.82	**85.82**	-	-	22.35	**22.35**
Lake B5	9.12	41.98	5.64	**56.74**	2.49	12.65	1.48	**16.62**
Lake B6	-	-	11.80	**11.80**	-	-	3.37	**3.37**
Lake B7[a]	-	-	0.30	**0.30**	-	-	0.08	**0.08**
Pond B30	-	-	0.09	**0.09**	-	-	0.01	**0.01**
Pond B31	-	-	0.13	**0.13**	-	-	0.02	**0.02**
Lake E4	-	-	8.52	**8.52**	-	-	2.27	**2.27**
Lake E5	-	-	1.30	**1.30**	-	-	0.33	**0.33**
Pond H1	-	-	1.14	**1.14**	-	-	0.25	**0.25**
Pond H2	-	-	0.16	**0.16**	-	-	0.02	**0.02**
ML[b]	-	-	0.09	**0.09**	-	-	0.06	**0.06**
Total	**71.46**	**114.23**	**133.06**	**318.75**	**21.30**	**34.96**	**34.50**	S

[a] Lake B7 area under containment dikes for the TSF; the remainder of Lake B7 is discussed in Section 4.3

[b] ML = Meliadine Lake (area under the water intake jetty)

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Lake A6

The mine plans include a partial drawdown of Lake A6 during operation and closure phases. The lake water surface will be lowered by approximately 1 m, resulting in the change of depth characteristics in the parts of the lake that will remain submerged. As such, the maximum depth of Lake A6 will be reduced from 4.7 to 3.7 m, and the area of the lake that currently supports overwintering (i.e., deeper than 2 m) will decrease from 5.74 ha to 4.71 ha. The total area of the lake where depth will be altered is 34.96 ha, corresponding to 11.28 HU; this does not include 17.64 ha (4.18 HU) of the lake that is currently less than 1 m in depth and will be permanently dewatered due to the drawdown (this area is considered destroyed).

In addition to lake drawdown, approximately 2.68 ha (0.73 HU) in the northeast bay of the lake will be altered through excavation of the F Zone pit #1. This area will form part of the pit lake after re-flooding during closure.

Lake A8

Habitat alterations in Lake A8 will include the following:

- lake bottom excavations for Pump pit #2 in the south part of the lake (10.84 ha or 2.96 HU);
- lake bottom excavations for Wesmeg pit #2 in the north part of the lake (4.81 ha or 1.31 HU); and
- construction of approximately 1.9 km of access roads on the lake bottom drained during operations (7.61 ha or 2.31 HU) – this area will have an altered substrate after re-flooding during closure.

The total area of Lake A8 habitat that will be altered due to open pit excavation and road construction is 23.26 ha, corresponding to 6.58 HU.

Lake B5

Habitat alterations in Lake B5 will include the following:

- lake bottom excavations for Tiriganiaq pit #1 in the east part of the lake (0.71 ha or 0.16 HU);
- lake bottom excavations for Tiriganiaq pit #2 in the central part of the lake (4.71 ha or 1.25 HU); and
- construction of approximately 1.1 km of access roads on the lake bottom drained during operations (3.70 ha or 1.08 HU) – this area will have an altered substrate after re-flooding during closure.

The total area of Lake B5 habitat that will be altered due to the excavation of open pits or road construction is 9.12 ha, corresponding to 2.49 HU.

4.1.2 Disrupted Lake and Pond Habitat

In contrast to altered habitat, where physical changes to lake or pond bottom are expected during the construction and operation phases of the Project, disrupted habitat includes entire waterbodies or parts of waterbodies that will be dewatered during mining activities, but no physical changes will be made to the substrate. After the end of mining, these disrupted habitats will be re-flooded and re-connected (once monitoring indicates water quality criteria has been met) to the existing stream systems or newly constructed channels that will provide fish passage between the waterbody and Meliadine Lake. As such, the disruption represents a loss of habitat during operations, but the habitats are expected to be fully restored to their original form and functionality at post-closure.

The disrupted habitat encompasses 7 waterbodies and a total area of 114.23 ha (34.96 HU). Most of the disrupted habitat comprises parts of Lake A8 (67.28 ha or 21.46 HU) and Lake B5 (41.98 ha or 12.65 HU) that will not be altered by pit excavation or road construction, but will be drained to allow mining activities to take place. The remaining habitat disruptions will occur in ponds A2, A2a, A3, A4, and A5, with a total disrupted area of 4.97 ha (0.85 HU). These ponds are located on the main stream system that drains the upper lakes in Basin A (lakes A6 and A8) to Meliadine Lake. During construction and operations of the F Zone pits, these ponds and the interconnecting streams will be dewatered, while the flow from Lake A6 will be diverted to Lake A1, by-passing the ponds. The disrupted habitats will be restored during closure, when the open pits will be re-flooded and the ponds will provide shallow water rearing habitat adjacent to the deep-water overwintering habitat in the pits.

4.1.3 Destroyed Lake and Pond Habitat

The habitat destroyed by the mining activities consists mainly of waterbodies that will be covered by waste rock Other components of the Project footprint that will result in habitat destruction (but on a much smaller scale) include access roads, containment dikes for the tailings storage facility, pads for the plant and low grade ore storage, and water intake jetty. In total, 14 waterbodies will be partially or fully destroyed by the Project, resulting in a total loss of 133.06 ha of aquatic habitat, which corresponds to 34.50 HU. The destroyed habitat will not be restored after closure and will be offset through measures described in Section 5.2 The habitat losses in individual lakes and ponds are summarized below:

- **Pond A2a** – The south shore of this pond will be covered by a road constructed to access F Zone pit #1. This road will be higher in elevation than the adjacent pond and will not be re-flooded after closure. As such, the area under the road (0.41 ha or 0.07 HU) is considered destroyed habitat.
- **Pond A4** – Approximately one-half of this small pond (0.07 ha) will be covered by a road constructed to access F Zone pits #2 and #3. This road will be higher in elevation than the adjacent pond and will not be re-flooded after closure. As such, the area under the road (0.03 ha or 0.01 HU) is considered destroyed habitat.
- **Lake A6** – Due to the partial drawdown of Lake A6 during operation and closure phases, the lake water surface will be lowered by approximately 1 m, resulting in a permanent loss of all areas around the lake periphery that are currently less than 1 m in depth. The total area of the 0 m to 1 m depth zone is 17.64 ha, which corresponds to 4.18 HU.
- **Lake B4** – This large (85.82 ha) and shallow (maximum depth of 2.4 m) lake is located under the proposed footprint of the B4 waste rock storage facility. The entire lake will be destroyed, resulting in the loss of 22.35 HU.
- **Lake B5** – The north shoreline of this lake will be permanently destroyed as it will be covered by the B7 West waste rock storage facility. The affected area (5.64 ha or 1.48 HU) comprises approximately 10% of the entire lake surface.
- **Lake B6** - This lake (11.80 ha in total area) is located under the proposed footprint of the B7 West waste rock storage facility. The entire lake will be destroyed, resulting in the loss of 3.37 HU.
- **Lake B7** – Approximately 99.5% of this large (57.88 ha) and moderately deep (maximum depth of 5.1 m) lake will be covered by the TSF and is discussed separately in Section 4.3. In addition to the area under the TSF, a small area (0.30 ha or 0.08 HU) in the west margin of Lake B7 will be destroyed by placement of the containment dikes around the TSF. As this part of the lake will not be in direct contact with the tailings, it is included in the list of waterbodies that will require an authorization under Section 35(2) of the *Fisheries Act*.
- **Ponds B30 and B31** – These 2 small ponds (0.09 and 0.13 ha, respectively) are located along the outflow path from Lake B6 to Lake B5 and are frequented by Arctic grayling. The entire area will be covered by the B7 West waste rock storage facility, resulting in the total loss of 0.03 HU.
- **Lake E4** – This mid-sized lake (8.52 ha) has a maximum depth of 3.7 m. Approximately 96% of the lake area will be covered by the footprint of the B7 North waste rock storage facility, resulting in the loss of 8.21 ha or 2.20 HU. The remaining area of 0.31 ha (0.07 HU) is located in the north bay of the lake, which will be crossed by an access road along the periphery of the B7 waste rock storage facility. As the

remaining bay will have no inflow from upstream (area covered by the waste rock storage facility), it is anticipated that it will not be restored after closure and is considered permanently lost habitat.

- **Lake E5** – This small lake (1.30 ha) has a maximum depth of 3.0 m. It is located under the footprint of the B7 North waste rock storage facility. The entire lake will be destroyed, resulting in the loss of 0.33 HU.
- **Pond H1** – Pond H1 has a total area of 1.14 ha and a maximum depth of 1.3 m. Because of its proximity (175 m) to Meliadine Lake, the pond is seasonally used for rearing by Arctic grayling. The habitat in Pond H1 is considered destroyed because the upstream area in Basin H will not be restored after closure (i.e., most of Basin H will remain covered by B7 East waste rock storage facility and the plant/low grade ore pads). Pond H1 will be used for storing contact water during operations and water quality in this pond is expected to reach levels that will permit discharge to Meliadine Lake during post-closure, The habitat loss in Pond H1 corresponds to 0.25 HU.
- **Pond H2** – This small (0.16 ha) and shallow (maximum depth of 0.3 m) pond is located in the lower reaches of Basin H. Similar to Pond H1, this pond is seasonally used for rearing by Arctic grayling. The entire area of this pond will be covered by the plant pad, resulting in the loss of 0.02 HU.
- **Meliadine Lake** – The water intake jetty to be constructed near the west end of the east basin of Meliadine Lake will result in destruction of 0.09 ha of lakeshore habitat, directly under the above-water footprint of the jetty. The jetty (67 m long and 13 m wide) will cover coarse substrates located in the 0 m to 5 m depth zone, resulting in the total loss of 0.06 HU.

4.1.4 Lake and Pond Habitat Types Affected by the Project

The loss of habitat, expressed in terms of habitat units, is summarized in Table 4-2 for each waterbody and habitat type affected by the Project. Most (55.6%) of the affected habitat is HT 3, mainly due to the predominance of coarse substrates in the shallow, near-shore areas of the larger lakes (e.g., A8, B4, B5). Shallow habitats less than 2 m in depth, regardless of substrate, account for 68.3% of the affected area; whereas areas between 2 m and 4 m in depth account for most of the remainder (31.5%). The contribution of habitats deeper than 4 m to the overall affected area is low (0.2%).

Table 4-2: Lost Habitat Units for Lake and Pond Habitat Types Affected by the Project

Lake / Pond	Lake or Pond Habitat Type									
	HT 1 (<2 m; fines)	HT 2 (<2 m; mixed)	HT 3 (<2 m; coarse)	HT 4 (2 m to 4 m; fines)	HT 5 (2 m to 4 m; mixed)	HT 6 (2 m to 4 m; coarse)	HT 7 (>4 m; fines)	HT 8 (>4 m; mixed)	HT 9 (>4 m; coarse)	Total
Pond A2	0.20	0.08	0.15	-	-	-	-	-	-	**0.42**
Pond A2a	0.19	0.04	0.09	-	-	-	-	-	-	**0.32**
Pond A3	0.04	0.02	0.02	-	-	-	-	-	-	**0.08**
Pond A4	0.003	0.004	0.009	-	-	-	-	-	-	**0.02**
Pond A5	0.20	0.04	0.06	-	-	-	-	-	-	**0.31**
Lake A6	0.61	2.09	6.12	3.61	2.74	0.93	0.09	-	-	**16.19**
Lake A8	0.49	1.65	14.02	4.19	4.42	3.18	0.01	0.07	-	**28.04**

Table 4-2: Lost Habitat Units for Lake and Pond Habitat Types Affected by the Project (continued)

Lake / Pond	Lake or Pond Habitat Type									
	HT 1 (<2 m; fines)	HT 2 (<2 m; mixed)	HT 3 (<2 m; coarse)	HT 4 (2 m to 4 m; fines)	HT 5 (2 m to 4 m; mixed)	HT 6 (2 m to 4 m; coarse)	HT 7 (>4 m; fines)	HT 8 (>4 m; mixed)	HT 9 (>4 m; coarse)	Total
Lake B4	0.45	2.55	18.44	0.92	-	-	-	-	-	**22.35**
Lake B5	0.34	1.62	7.75	4.39	2.51	-	-	-	-	**16.62**
Lake B6	0.01	0.30	1.96	0.99	0.12	-	-	-	-	**3.37**
Lake B7[a]	-	-	0.08	-	-	-	-	-	-	**0.08**
Pond B30	0.008	0.002	0.002	-	-	-	-	-	-	**0.01**
Pond B31	0.011	0.004	0.003	-	-	-	-	-	-	**0.02**
Lake E4	0.10	0.30	1.38	0.28	0.12	0.09	-	-	-	**2.27**
Lake E5	0.01	0.06	0.20	0.06	-	-	-	-	-	**0.33**
Pond H1	0.04	0.04	0.17	-	-	-	-	-	-	**0.25**
Pond H2	0.013	0.004	0.009	-	-	-	-	-	-	**0.02**
ML[b]	-	-	0.015	-	-	0.029	-	-	0.011	**0.06**
Total	**2.72**	**8.80**	**50.48**	**14.44**	**9.91**	**4.23**	**0.10**	**0.07**	**0.01**	**90.76**

[a] Lake B7 area under containment dikes for the TSF; the remainder of Lake B7 is discussed in Section 4.3

[b] ML = Meliadine Lake (area under the water intake jetty)

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

4.2 Streams (Section 35 Authorization)

Anticipated stream habitat losses due to the Project are summarized for each type of habitat impact (alteration, disruption, and destruction) in Table 4-3. The losses are presented in terms of both channel length (metres) and habitat units (HU calculated through the Meliadine HEP model). In total, 19 streams in basins A, B, and H will be affected by the Project (Figure 2-1). The total affected channel length is estimated at 1978 m, resulting in a loss of 556 HU, which are not comparable to lake and pond HU calculated in Section 4.1 (i.e., stream HU are based on linear units [m], whereas lake and pond HU are based on aerial units [ha] of affected habitat). The streams that will be altered, disrupted, or destroyed are discussed below.

4.2.1 Altered Stream Habitat

The Project footprint will result in the alteration of 1 defined stream. This small stream (B46-59) is 145 m long and connects Lake B46 to Lake B59. At present, this connection drains only Lake B59 and a small watershed of 3 small and shallow upstream ponds (B60, B61, and B62), and provides limited fish passage, primarily during spring. Upon closure, flows from the end pit lake created in Pump pit #1 will be draining through this connection to Lake B46 and downstream to Lake Meliadine. As such, it will be necessary to alter this channel to support higher flows and to provide an effective fish passage to access the upstream end pit lake. The total channel length that will be altered is 145 m, corresponding to 19 HU.

4.2.2 Disrupted Stream Habitat

In contrast to altered habitat, where physical changes to stream channel are expected to result from the Project, disrupted habitat includes streams that will be dewatered during mining activities, but no physical changes will be made to the channel and substrate. After the end of mining, these disrupted streams will be re-flooded and re-connected to the existing stream systems that will provide fish passage to Meliadine Lake. As such, the disruptions represent a loss of habitat during operations, but the habitats are expected to be fully restored to their original form and habitat quality during closure.

Table 4-3: Channel Length and Habitat Units of Streams to be Affected by the Project

Stream	Channel Length (m)				Habitat Units (HU)			
	Altered	Disrupted	Destroyed	Total	Altered	Disrupted	Destroyed	Total
A2-2a	-	16	-	**16**	-	5	-	**5**
A2a-3	-	83	-	**83**	-	26	-	**26**
A3-4	-	26	-	**26**	-	8	-	**8**
A4-5	-	112	-	**112**	-	36	-	**36**
A5-6	-	-	407	**407**	-	-	91	**91**
A6-7	-	78	35	**113**	-	33	15	**48**
A7-8	-	133	-	**133**	-	56	-	**56**
B4-5	-	-	146	**146**	-	-	27	**27**
B5-6	-	-	98	**98**	-	-	41	**41**
B5-31	-	-	108	**108**	-	-	36	**36**
B31-30	-	-	102	**102**	-	-	32	**32**
B30-6	-	-	24	**24**	-	-	4	**4**
B6-7	-	-	116	**116**	-	-	50	**50**
B46-59	145	-	-	**145**	19	-	-	**19**
H0-1	-	-	175	**175**	-	-	54	**54**
H1-2	-	-	174	**174**	-	-	23	**23**
Total	**145**	**448**	**1385**	**1978**	**19**	**164**	**373**	**556**

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

The disrupted habitat encompasses 6 streams with a total length of 448 m (164 HU). Most of the disrupted habitat (in terms of stream length) comprises a stream system in lower reaches of Basin A (A2-2a, A2a-3, A3-4, and A4-5), with a total disrupted length of 237 m (75 HU). During construction and operations of the F Zone pits, these streams and the interconnected ponds will be dewatered to allow mining activities to take place, while the flow from Lake A6 will be diverted to Lake A1, by-passing the streams.

The remaining habitat disruptions will occur in streams A6-7 and A7-8, which connect Lake A6 to Lake A8 through Pond A7. Although these streams will not be altered directly by construction activities, the water level drawdown in Lake A6 and the draining of Lake A8 during open pit excavation will likely result in dewatering of the streams (i.e., they will have no upstream watershed during operations). The total length of these 2 disrupted streams is 211 m, corresponding to 89 HU.

The disrupted habitats will be restored during closure, when the open pits will be re-flooded and the streams will provide important Arctic grayling spawning and rearing habitat, and effective fish passage to the deep-water overwintering habitat in the end pit lakes.

4.2.3 Destroyed Stream Habitat

The stream habitat destroyed by the mining activities consists mainly of watercourses that will be covered by waste rock storage facilities and the plant pad. Other components of the Project footprint that will result in stream habitat destruction will include open pit excavation, construction of culverts under access roads, and infrastructure needed for water management. In total, 10 streams will be destroyed or partially destroyed by the Project, resulting in the total loss of 1385 m of stream channel habitat, which corresponds to 373 HU. The destroyed stream habitat will not be restored after closure and will be offset for by construction of engineered channels to convey water and provide fish passage after closure. The habitat losses in individual streams are summarized below:

- **Stream A5-6** – This stream drains Lake A6 and offers good quality habitat for Arctic grayling spawning and rearing within most of its 407 m channel length. The stream channel will be excavated during construction of the F Zone pit#1 and will form part of the end pit lake habitat after re-flooding at closure. The resulting habitat loss will correspond to 91 HU.
- **Stream A6-7** – The main access road to the mine site will cross this stream upstream of Lake A6**.** The proposed culvert to be constructed under the road is not considered fish habitat. As such, the stream length within the culvert (approximately 35 m) is considered destroyed habitat, corresponding to 15 HU. The remaining sections of this stream will be disrupted by the anticipated lack of flow during operations (see Section 4.2.2).
- **Stream B4-5** – This stream will be covered by the proposed footprint of the B4 waste rock storage facility and will not be restored after closure. The lost channel length will be 146 m, which corresponds to 27 HU.
- **Stream B5-6** – This stream will be permanently destroyed as it will be covered by the B7 West waste rock storage facility. The affected channel length will be 98 m, which corresponds to 41 HU.
- **Streams B5-31, B31-30, and B30-6** – These 3 small streams form a second outflow from Lake B6 to Lake B5 (in addition to Stream B5-6). They consist of short connections through ponds B31 and B30 and are used by Arctic grayling for rearing and spawning. These streams (and the interconnected ponds) will be permanently covered by the B7 West waste rock storage facility. The total affected stream channel length of 234 m corresponds to 72 HU.
- **Stream B6-7** - This outflow from Lake B7 is located under the proposed footprint of the B7 West waste rock storage facility. The entire length of stream channel (116 m) will be destroyed, resulting in the loss of 50 HU.
- **Stream H0-1** – This stream will be blocked by a dike downstream of Pond H1, which will be used as a contact water sump during operations. Although only the uppermost part of the stream will be covered by the dike, the habitat in the entire stream (175 m in length) is considered destroyed because natural flow conditions in Basin H will not be restored after closure (i.e., most of Basin H will be covered by B7 East

waste rock storage facility and the plant/low grade ore pads). The total habitat loss in Stream H1-0 corresponds to 54 HU.

- **Stream H1-2** – This stream is located in the lower reaches of Basin H. This entire area will be covered by the plant pad resulting in the total loss of 174 m of stream channel, which corresponds to 23 HU.

4.2.4 Stream Habitat Types Affected by the Project

The loss of stream habitat, expressed in terms of habitat units, is summarized in Table 4-4 for each stream and habitat type affected by alteration, disruption, and destruction of habitat due to the Project. Most (65.6%) of the affected habitat is HT 13, mainly due to the predominance of coarse substrates in the stream sections along the main drainage systems in Basin A (e.g., A4-5, A5-6, A7-8) and Basin B (e.g., B5-6, B6-7). Shallow habitats less than 0.5 m in depth, regardless of substrate, account for 98.1% of the overall affected area, whereas the contribution of habitats equal or deeper than 0.5 m is low (1.9%).

Table 4-4: Lost Habitat Units for Stream Habitat Types Affected by the Project

Stream	Stream Habitat Type						
	HT 11 (<0.5 m; fines)	HT 12 (<0.5 m; gravel)	HT 13 (<0.5 m; coarse)	HT 14 (≥0.5 m; fines)	HT 15 (≥0.5 m; gravel)	HT 16 (≥0.5 m; coarse)	Total
A2-2A	0.2	1.3	3.3	-	0.1	0.3	**5.1**
A2A-3	0.8	6.6	18.3	-	0.3	0.3	**26.4**
A3-4	0.4	1.7	5.3	-	-	0.1	**7.5**
A4-5	1.1	8.9	24.6	-	0.5	0.5	**35.5**
A5-6	12.8	13.3	63.1	0.3	-	1.7	**91.2**
A6-7	0.2	6.6	41.0	-	-	0.5	**48.3**
A7-8	0.4	5.9	48.2	-	0.7	1.2	**56.4**
B4-5	10.9	3.9	12.5	-	-	-	**27.4**
B5-6	0.6	3.6	36.5	-	-	-	**40.7**
B5-31	3.2	12.9	19.8	-	-	-	**35.9**
B31-30	3.6	6.3	22.3	-	-	-	**32.2**
B30-6	1.8	0.5	2.1	-	-	-	**4.4**
B6-7	0.1	7.1	42.6	-	-	-	**49.8**
B46-59	13.2	3.0	3.2	-	-	-	**19.4**
H0-1	6.2	21.8	22.9	0.1	1.8	1.6	**54.4**
H1-2	15	7.2	-	0.6	-	-	**22.8**
Total	**70.5**	**110.6**	**365.7**	**1.0**	**3.4**	**6.2**	**557.4**

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values

4.3 Lakes and Ponds under TSF (Amendment of Schedule 2 of MMER)

Development of the Meliadine Gold Project will require the construction of the Tailings Storage Facility (TSF), which will result in the destruction of Lake B7 and 2 adjacent ponds (B25 and B28). As tailings are a “deleterious substance” that will be “deposited in water frequented by fish”, the operation of the TSF will require an amendment to Schedule 2 of the MMER of the *Fisheries Act.* Because an offsetting plan for the loss of productivity in the TSF area must be approved by both DFO and Environment Canada as part of the regulatory process, the losses and gains associated with TSF waterbodies are presented separately from other waterbodies (described in sections 4.1 and 4.2) that may require a Section 35(2) authorization from DFO.

4.3.1 Destroyed Lake and Pond Habitat

Using the methodology outlined in Section 3, anticipated habitat losses due to the Project in lakes and ponds under the TSF footprint are summarized in Table 4-5. The losses are presented in terms of both area (ha) and HU (calculated through the Meliadine HEP model). In total, the habitat lost in 1 lake and 2 ponds in Basin B is estimated at 59.61 ha, resulting in a loss of 17.51 HU.

Table 4-5: Surface Area and Habitat Units of Lakes and Ponds under the Tailings Storage Facility

Lake/ Pond	Surface Area (ha)	Habitat Units (HU)
Lake B7[a]	57.58	17.15
Pond B25	1.58	0.29
Pond B28	0.45	0.07
Total	**59.61**	**17.51**

[a] Lake B7 area in direct contact with tailings; the remainder of Lake B7 area that will be covered by containment dikes for the TSF is discussed in Section 4.1

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Lake B7 is one of the deepest lakes on the Peninsula (maximum depth of 5.1 m) and provides year-round habitat to Arctic grayling, cisco, burbot, and ninespine stickleback. Due to their shallow depths (<1.1 m), ponds B25 and B28 provide occasional habitat to ninespine stickleback and are not suitable to other species. The ponds are less than 100 m from Lake B7 and are not well connected to the lake. The connecting flow paths lack defined channels and feature dispersed flow over the tundra. More detailed descriptions of fish habitat in the waterbodies under the TSF are presented in Section 2.4.

The destroyed habitat will not be restored after closure and will be offset through measures outlined in Section 5.4.

4.3.2 Lake and Pond Habitat Types Under the TSF

The loss of habitat, expressed in terms of habitat units, is summarized in Table 4-6 for each waterbody and habitat type affected by the TSF. Most (56.5%) of the affected habitat is HT 3, mainly due to the predominance of coarse substrates in the shallow, near-shore area of Lake B7. Shallow habitats less than 2 m in depth, regardless of substrate, account for 65.4% of the affected area, whereas areas between 2 m and 4 m in depth account for most of the remainder (31.6%). The contribution of habitats deeper than 4 m to the overall affected area is low (3.0%).

Table 4-6: Lost Habitat Units for Lake and Pond Habitat Types under the Tailings Storage Facility

Lake / Pond	Lake or Pond Habitat Type									
	HT 1 (<2 m; fines)	HT 2 (<2 m; mixed)	HT 3 (<2 m; coarse)	HT 4 (2 m to 4 m; fines)	HT 5 (2 m to 4 m; mixed)	HT 6 (2 m to 4 m; coarse)	HT 7 (>4 m; fines)	HT 8 (>4 m; mixed)	HT 9 (>4 m; coarse)	Total
Lake B7[a]	0.10	1.25	9.73	3.02	2.21	0.31	0.52	0.01	-	**17.15**
Pond B25	0.09	0.05	0.15	-	-	-	-	-	-	**0.29**
Pond B28	0.04	0.01	0.02	-	-	-	-	-	-	**0.07**
Total	**0.23**	**1.32**	**9.90**	**3.02**	**2.21**	**0.31**	**0.52**	**0.01**	**0.00**	**17.51**

[a] Lake B7 in direct contact with tailings; the remainder of Lake B7 area that will be covered by containment dikes for the TSF is discussed in Section 4.1.3

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

5.0 PROPOSED OFFSETTING OPTIONS

The main component of the Conceptual Fisheries Protection and Offsetting Plan proposed for the Project is rehabilitation of 13 open pits excavated during operations into productive lake habitats after closure (Figure 5-1). Because of the large terrestrial area that will be excavated in open pits, there will be substantial gains to the overall aquatic habitat on the Peninsula after the pits are flooded during closure. Incorporating the existing shallow lake and pond habitats as peripheral areas to the deep-water basins of the end pit lakes will allow for increased diversity of habitats and will provide overwintering habitat to large areas of the Peninsula. Recontouring of the pit rims and active backfilling of some of the pits will create additional littoral habitats and reduce the extent of monimolimnion.

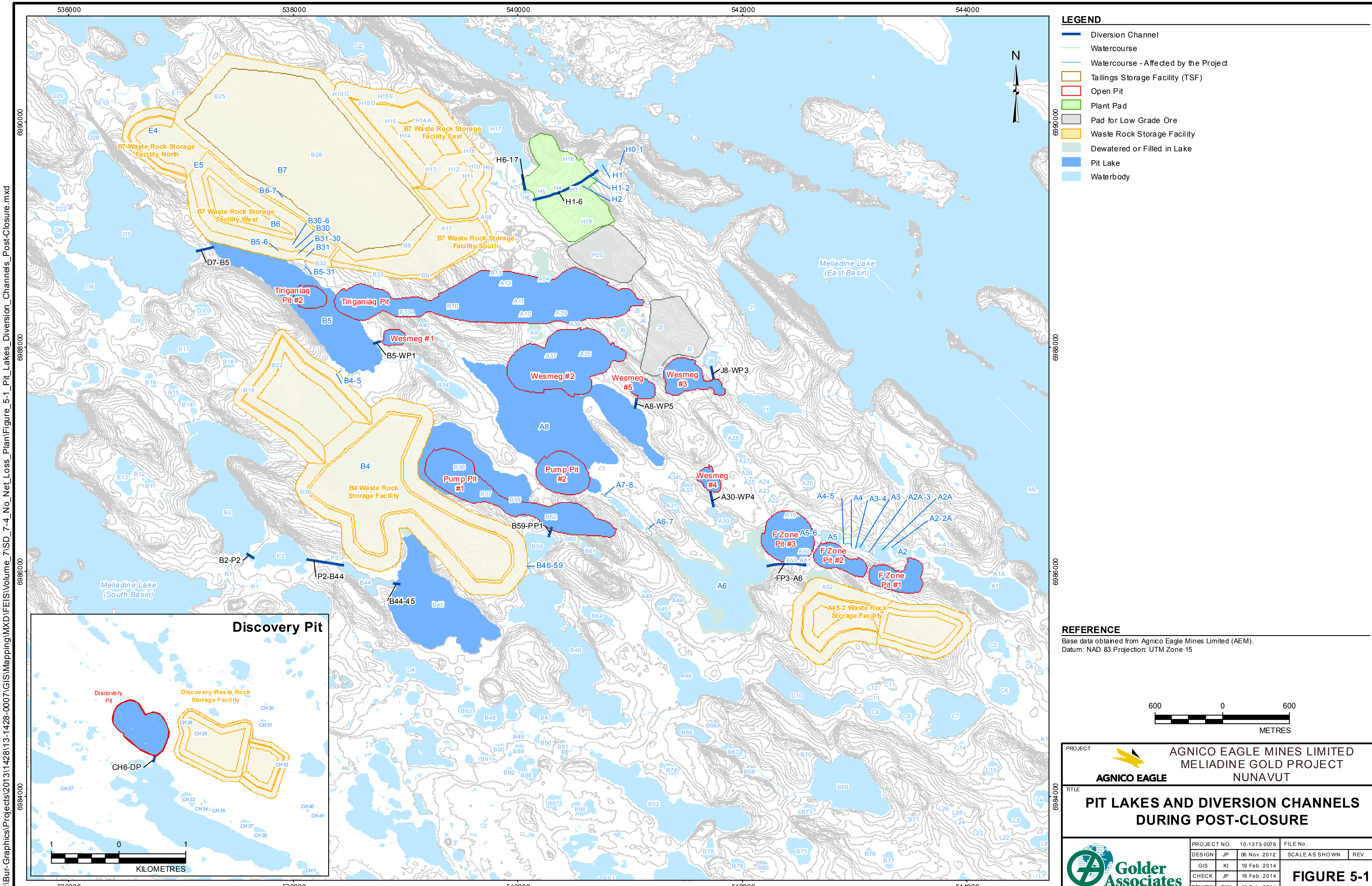
At present, the overwintering habitat on the peninsula is limited to a small number of lakes that support year-round populations of Arctic grayling, cisco, and ninespine stickleback. Species such as lake trout, Arctic char, and round whitefish frequent the lower lakes of the peninsula watersheds during the open water season, but return to Meliadine Lake to overwinter, possibly because they require higher dissolved oxygen concentrations than Arctic grayling, cisco, and ninespine stickleback. Connecting the end pit lakes to Meliadine Lake through channels passable to fish could allow for colonization of the end pit lakes by the full fish species assemblage that is currently present in Meliadine Lake and the lower Peninsula lakes.

The following subsections provide a brief discussion of limnological aspects of end pit lakes (Section 5.1), followed by a summary of the Meliadine HEP model procedure to quantify the habitat gains realized through offsetting, and the comparison of habitat gains to losses to derive the residual serious harm to fish presented as an offset ratio (Section 5.2). The discussion of conceptual offsetting opportunities for the loss of stream habitat is presented in Section 5.3. The offsetting measures proposed for the waterbodies under the TSF footprint are discussed separately in Section 5.4.

5.1 End Pit Lake Limnology

While the creation of end pit lakes from mining operations is common in temperate regions of Canada, this practice is relatively new to the north. To date, the only offsetting plans proposing re-flooding of excavated pits for use as fish habitat in the Northwest Territories or Nunavut are those proposed for the Diavik Diamond Mine (Diavik) and for Meadowbank. As a result, few observational studies examining fish populations or habitat suitability in Arctic end pit lakes have been published to date. Nevertheless, the use of end pit lakes for fish habitat in the north has historically been promoted (e.g., DFO 2003, 2007) and Gammons et al. (2009) published a comprehensive review of considerations for the development of lakes from pits in the north.

Until further information is available from northern end pit lakes, much can be interpolated from principles of limnology that apply in the south. Where end pit lakes studies have been conducted, reports of the re-establishment of successful fish populations are available. For example, the ability of rehabilitated end pit lakes at former coal mine pits in Alberta to support fish populations has been observed and discussed (Hatfield Consultants 2011; Brinker et al. 2011), and CEMA (2012) recently published a guidance document for developing end pit lakes in the oil sands region. While the lack of information regarding the aquatic biology of northern end pit lakes is recognized, a number of major factors should be considered for fish survival, including stratification, water quality, temperature, sunlight, and habitat diversity.


LEGEND
Diversion Channel
Watercourse
Watercourse - Affected by the Project
Tailings Storage Facility (TSF)
Open Pit
Plant Pad
Pad for Low Grade Ore
Waste Rock Storage Facility
Dewatered or Filled in Lake
Pit Lake
Waterbody
REFERENCE
Base data obtained from Agnico Eagle Mines Limited (AEM).
Datum: NAD 83 Projection: UTM Zone 15
600 0 600
METRES
N
Discovery Pit
Discovery Pit
Discovery Waste Rock Storage Facility
CH6-DP
1 0 1
KILOMETRES
B7 Waste Rock Storage Facility North
B7 Waste Rock Storage Facility East
B7 Waste Rock Storage Facility West
B7 Waste Rock Storage Facility South
B4 Waste Rock Storage Facility
A45-2 Waste Rock Storage Facility
Meliadine Lake (East Basin)
Meliadine Lake (South Basin)
Tiriganiaq Pit #2
Tiriganiaq Pit
Wesmeg #1
Wesmeg #2
Wesmeg #3
Wesmeg #4
Wesmeg #5
Pump Pit #1
Pump Pit #2
F Zone Pit #1
F Zone Pit #2
F Zone Pit #3
H6-17
H1-6
H0-1
H1
H1-2
H2
D7-B5
B6-7
B5-6
B30-6
B30
B31-30
B31
B5-31
B5-WP1
B4-5
J8-WP3
A8-WP5
A7-8
A30-WP4
A6-7
B59-PP1
B46-59
B2-P2
P2-B44
B44-45
FP3-A6
A5-6
A5
A4-5
A4
A3-4
A3
A2A-3
A2A
A2-2A
A2
A8
A6
B4
B5
B7
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PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT
TITLE
PIT LAKES AND DIVERSION CHANNELS DURING POST-CLOSURE
Golder Associates
PROJECT NO. 10-1373-0076
FILE No.
DESIGN JP 06 Nov. 2012
SCALE AS SHOWN
REV. 0
GIS KI 19 Feb. 2014
CHECK JP 18 Feb. 2014
REVIEW DW 18 Feb. 2014
FIGURE 5-1
N:\Bur-Graphics\Projects\2013\1428\13-1428-0007\GIS\Mapping\MXD\FEIS\Volume_7\SD_7-4_No_Net_Loss_Plan\Figure_5-1_Pit_Lakes_Diversion_Channels_Post-Closure.mxd

Stratification

Many Arctic lakes where pit development is occurring are naturally holomictic (i.e., mixing between the surface and deep waters occurs at least once a year). However, since the depth to width ratio is typically much higher in end pit lakes than in natural lakes, end pit lakes are likely to be meromictic (i.e., mixing does not occur) and the deep bottom layers (termed monimolimnion in meromictic lakes) are typically anoxic. While full mixing has the benefit of evenly distributing chemical elements so that the entire lake area and water column is suitable for fish, this may be undesirable if it occurs suddenly and/or unfavourable concentrations of contaminants and dissolved gases that have accumulated in the anoxic layer at depth are moved to surface layers (Boehrer and Schultze 2006). The development and dispersal of stratified conditions can be determined through modeling, as completed for the Meadowbank site (Cumberland 2005) and the Diavik site (Golder 2010). These preliminary models indicated that the presence of a small monimolimnion was not expected to persist for more than 4 years after re-flooding in the Portage Pit of the Meadowbank site, while stratification was predicted for at least 10 years (modeled period) at Diavik site (pit A154). Therefore, the proposed end pit lakes at Meadowbank and Diavik are predicted to provide fish habitat within the entire end pit lake within several years after closure of the mines. A similar modeling exercise will be completed for this Project as it proceeds into the detailed design phase.

Water Quality

The ability of end pit lakes to support viable fish populations also depends on the maintenance of adequate water quality, including factors such as pH, dissolved oxygen (DO), salinity, turbidity, and concentrations of nutrients and potentially toxic elements. Depending on the local mineralogy, end pit lakes formed from gold mines may contain heavy metals, which may cause toxicity in fish if concentrations are high enough (Gammons et al. 2009). Availability of metals is predominantly controlled by pH. As a result, it has been generalized that end pit lakes with low to moderate acidity have a good chance of being restored to a beneficial ecological end use (Nixdorf et al. 2005). The rapid re-filling of end pit lakes after mining is recommended to reduce the time available for oxidation of the rock face, thereby decreasing potential for acidic conditions (Castro and Moore 2000).

Further impacts to aquatic life may result from differences in salinity, turbidity, DO, and nutrient concentrations. Many processes act together to control these components of water chemistry, and each has implications for fish populations in northern end pit lakes. For example, end pit lakes often have a higher chemical oxygen demand than natural lakes, due to dissociation of iron ions in the deep, anoxic monimolimnion, and oxidation in the hypolimnion (Gammons et al. 2009). As a result, fish in these lakes may be more susceptible to winterkill, when ice cover prevents oxygen exchange at the surface. Since each pit's morphology and mineral deposit is different, predictions of water quality parameters need to be made on a case-by-case basis.

As part of the mine water balance model, predictions were made for water quality in the end pit lakes during flooding and during long-term summer conditions (FEIS Volume 7, Section 7.4). At the end of mining, the end pit lakes will be actively flooded with water from Meliadine Lake to reduce the time lag to developing fish habitat in the end pit lakes. Predictions of end pit lake water quality have been made assuming fully mixed conditions. As the Project proceeds into detailed design, a more detailed model will be developed to predict mixing of water within the end pit lakes over time.

Based on the initial end pit lake predictions, water quality for all parameters, except copper in Tiriganiaq pit lake, will be below CCME aquatic life guidelines. Long-term average copper in Tiriganiaq pit lake is predicted to be

0.0028 milligrams per litre (mg/L) and is above the guideline of 0.002 mg/L. Although copper levels above guideline may produce olfactory impairment in fish, the predicted levels are orders of magnitude lower than acute levels (Mirza et al. 2009; McIntyre et al. 2012). Total dissolved phosphorus is predicted to be above the threshold of 0.004 mg/L for classification as ultra-oligotrophic lake to oligotrophic lake (CCME 2004) in the Pump and Discovery end pit lakes. The water quality predictions will be updated as the Project proceeds into detailed design phase.

Temperature and Sunlight

Northern climate conditions require specific considerations for end pit lakes in the Arctic region. Ice cover persists much longer in Arctic lakes than in temperate ones, and can increase chances of oxygen depletion, leading to fish winterkill, particularly if chemical oxygen demand is elevated as a result of anoxic conditions in the monimolimnion (Gammons et al. 2009). Further, ice formation can cause increased salinity in the deep pits through the process of thermohaline convection. Ice melting then intensifies the layer of lower-density water at the surface, resulting in density-stratification, and increasing the chances of meromictic conditions (Gammons et al. 2009). As described above, the predicted effects on fish populations in the Meliadine end pit lakes will be updated through modeling exercises for water quality and stratification processes, as the Project proceeds into the detailed design phase.

Ice cover also reduces the amount of solar radiation that reaches the water column, which already has extreme seasonal variability in the north. As a result, photosynthetic processes are slowed, and primary production, which supports the aquatic food web, declines. However, this phenomenon may actually be beneficial to end pit lake use in the north. While rates of primary production may initially be considered slow in temperate climate end pit lakes, northern lakes are commonly highly oligotrophic in their natural state (Gammons et al. 2009). Since local biota are adapted to nutrient- and light-depleted conditions, production in end pit lakes in this region would be expected to mimic surrounding large (>20 ha), deep lakes more rapidly.

Habitat Diversity

Since fish require different types of habitat for different life functions, the availability of diverse substrates and depth zones is important for maximum population productivity and diversity. In many end pit lakes studied to date, the low habitat diversity relative to nearby natural lakes is the biggest differentiating factor. Assuming adequate water quality, it is generally recommended that the successful restoration of pits for use as fish habitat needs to include provisions for habitat diversity. Suggested methods include such additions as logs, rock piles, macrophyte beds or artificial islands (Gammons et al. 2009). While the applicability of each of these methods is clear in temperate climates, many have limitations in Arctic regions. Of the reclamation strategies mentioned, rock fill presents the greatest utility and most common application in northern offsetting plans for mines (e.g., Diavik, Jericho, Doris North, Meadowbank). This typically occurs in the form of artificial reefs or shoals constructed in deep water, soft sediment basins in an effort to improve habitat quality. When constructing in-water rock features, consideration should be given to the substrate size preferences of the target fish species (Gammons et al. 2009).

Along with these additions, various methods for re-contouring pit dimensions have been suggested to produce more natural systems. These may include sloping pit walls, excavation of littoral bays, or pit backfilling (Gammons et al. 2009). While re-sloping pit walls and the construction of shallow littoral zones has been implemented in north-temperate regions (e.g., Brinker et al. 2011), and are feasible options farther north, no records of the use of these methods to date in the north were found. Similarly, backfilling deep pits to more natural depths with waste rock is a theoretically viable technique, depending on mine operations, but aside from being proposed for Meadowbank and Diavik, this method has not been reported in practice. Backfilling of some of the pits is proposed as part of the Project.

5.2 Lake and Pond Habitat Gains (Section 35 Authorization)

Habitat gains anticipated during post-closure were calculated in terms of surface area (ha) and HU by applying the same Meliadine HEP model used for calculating habitat losses. To simplify the accounting procedure, habitat gains were separated into the following components:

- Habitat Enhancement - Areas of lakes and ponds that will be **altered** from their pre-construction condition (through pit excavation, road construction, or permanent drawdown of surface water level) to become parts of end pit lakes or adjoining waterbodies after closure;
- Habitat Restoration - Parts of lakes and ponds that will be disrupted during operations (dewatered without altering bottom substrates or shorelines) and **restored** to their pre-construction condition after closure; and
- Habitat Creation - Terrestrial areas during pre-construction that will become aquatic habitats after closure, due to flooding of excavated open pits or the land adjacent to end pit lakes or waste rock storage facilities.

The total habitat gains resulting from the above components cover a total area of 406.39 ha, corresponding to 131.50 HU. The gains are summarized for the main waterbodies in Table 5-1 and are discussed below.

Table 5-1: Surface Area and Habitat Units of Waterbodies Affected by the Project after Closure

Lake / Pond / Pit	Surface Area (ha)				Habitat Units (HU)			
	Enhanced	Restored	Created	Total	Enhanced	Restored	Created	Total
Pond A2	-	2.36	-	**2.36**	-	0.42	-	**0.42**
Pond A2a	-	1.54	-	**1.54**	-	0.26	-	**0.26**
Pond A3	-	0.48	-	**0.48**	-	0.08	-	**0.08**
Pond A4	-	0.03	-	**0.03**	-	0.01	-	**0.01**
Pond A5	1.44	0.56	-	**2.00**	0.44	0.09	-	**0.52**
Lake A6	37.64	-	-	**37.64**	10.06	-	-	**10.06**
Lake A8	23.26	67.28	-	**90.54**	9.61	26.23	-	**35.84**
Lake B5	9.12	41.98	-	**51.10**	4.25	14.90	-	**19.15**
Terr Pits[a]	-	-	182.08	**182.08**	-	-	58.01	**58.01**
Flooding[b]	-	-	38.62	**38.62**	-	-	7.15	**7.15**
Total	**71.46**	**114.23**	**220.70**	**406.39**	**24.36**	**41.99**	**65.16**	**131.50**

[a] Terrestrial habitat converted to aquatic habitat through rehabilitation of open pits.

[b] Flooding of undisturbed land due to raised water level in Pump Pit #1 and in Lake 45/ Pond 44 to enable connections to Meliadine Lake.

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

5.2.1 Habitat Enhancement - Gains from Lake and Pond Habitat Alteration

The total area (71.46 ha) of habitat alterations in parts of Pond A5 and lakes A6, A8, and B5 will result in the total gain of 24.36 HU after closure. The waterbody-specific gains can be summarized as follows:

Pond A5

The south part of Pond A5 (approximately 0.37 ha) will be excavated to form part of F Zone pit #2, thus increasing the depth and altering the substrate in this part of the pond. This will result in a gain of 0.27 HU. The north and west parts of the pond (1.07 ha) will be covered with crushed rock to form the main access road to the F Zone pits and auxiliary roads to F Zone pit #2 and the A45 waste rock storage facility. When the pond is re-flooded and connected to the end pit lake on the south side of the pond, the altered substrate under the roads will result in the gain of 0.17 HU after closure.

Lake A6

The partial drawdown (i.e., water level lowered by approximately 1 m) of Lake A6 during the operations and closure phases will permanently alter depth characteristics in the parts of the lake that will remain submerged. The total area of the lake where depth will be altered is 34.96 ha, and corresponds to a reduction in habitat quality from 11.28 HU during pre-construction to 9.20 HU after closure.

In addition to lake drawdown, approximately 2.68 ha of the northeast bay of Lake A6 will be altered through excavation of the F Zone pit #1. This area will form the sloping sides of the end pit lake after re-flooding, resulting in a slight increase in habitat quality (from 0.73 HU in pre-construction to 0.86 HU after closure).

Lake A8

Habitat alterations and resulting habitat gains in Lake A8 will include the following:

- lake bottom excavations for Pump pit #2 in the south part of the lake (10.84 ha) will result in a gain of 3.93 HU after closure (compared to 2.96 HU during pre-construction);
- lake bottom excavations for Wesmeg pit #2 in the north part of the lake (4.81 ha) will result in a gain of 1.90 HU after closure (compared to 1.31 HU during pre-construction); and
- construction of approximately 1.9 km of access roads on the lake bottom drained during operations (7.61 ha) will result in altered substrate after re-flooding and a gain of 3.78 HU after closure (compared to 2.31 HU during pre-construction).

The total area of Lake A8 habitat that will be altered due to open pit excavation and road construction is 23.26 ha, resulting in habitat gains of 9.61 HU (compared to 6.58 HU during pre-construction).

Lake B5

Habitat alterations and resulting habitat gains in Lake B5 will include the following:

- lake bottom excavations for Tiriganiaq pit #1 in the east part of the lake (0.71 ha) will result in a gain of 0.45 HU after closure (compared to 0.16 HU during pre-construction);
- lake bottom excavations for Tiriganiaq pit #2 in the central part of the lake (4.71 ha) will result in a gain of 2.03 HU after closure (compared to 1.25 HU during pre-construction); and

- construction of approximately 1.1 km of access roads on the lake bottom drained during operations (3.70 ha) will result in altered substrate after re-flooding and a gain of 1.78 HU after closure (compared to 1.08 HU during pre-construction).

The total area of Lake B5 habitat that will be altered due to the excavation of open pits or road construction is 9.12 ha, resulting in habitat gains of 4.26 HU.

5.2.2 Habitat Restoration - Reestablishment of Disrupted Habitat

Aquatic habitat disrupted during the construction and operations phases of the Project includes entire waterbodies or parts of waterbodies that will be dewatered during mining activities, but no physical changes will be made to the substrate. After the end of mining, these disrupted habitats will be re-flooded and fully restored to their pre-operational form and functionality. In waterbodies such as A2, A2a, A3, A4, and A5 that are within the lower lake ecotype (see Section 3.2.4), the number of HU lost will be equal to the number of HU gained (i.e., no net change in HU). However, lakes A8 and B5 located in the upper lake ecotype will be connected to end pit lakes after closure, and as such, are expected to support a wider species assemblage than during pre-construction. This difference in species weightings results in a slight increase in HU after restoration, compared to pre-construction conditions.

The restored habitat encompasses 7 waterbodies and a total area of 114.23 ha, corresponding to 41.98 HU. Most of the restored habitat will comprise parts of Lake A8 (67.28 ha) and Lake B5 (41.98 ha) and will result in habitat gains of 26.23 HU and 14.90 HU, respectively. The remaining habitat restorations will occur in ponds A2, A2a, A3, A4, and A5, with a total area of 4.97 ha and a resulting habitat gain of 0.86 HU.

5.2.3 Habitat Creation - Gains from Terrestrial Habitat Changed to Aquatic Habitat

Habitat gains resulting from changing terrestrial habitats to aquatic habitats will be produced mainly through rehabilitation of end pit lakes; however, some gains will also be realized through flooding of undisturbed terrestrial areas adjacent to an end pit lake and/or waste rock storage facility. These 2 sources of terrestrial habitat gains are discussed below.

End Pit Lake Rehabilitation

There will be 8 open pits at the end of the operations phase of the Meliadine Project that are allocated to provide offsetting measures under Section 35(2) authorizations. They will range in size from 2.41 ha (Wesmeg pit #1) to 84.34 ha (Tiriganiaq pit #1) with the total surface area of 192.31 ha (Table 5-2). Most (95%) of the surface area of the open pits will comprise habitats that were terrestrial during pre-construction. Included in the terrestrial category are 13 ponds that were deemed as low–risk habitat through the risk characterization outlined in Section 2.3 and Appendix B. The total area of these ponds (7.72 ha) was considered at par with terrestrial habitat because of the low quality of this habitat type and its prevalence in the region.

Table 5-2: Surface Area of Terrestrial and Aquatic Components of End Pit Lakes

Zone	Pit	Maximum Depth (m)	Total Surface Area (ha)	Terrestrial Area (ha)	Aquatic Area (ha)	Affected Waterbody
Tiriganiaq	#1	194	84.34	83.63	0.71	Lake B5
	#2	64	4.71	-	4.71	Lake B5
Wesmeg	#1	39	2.41	2.41	-	-
	#2	154	39.22	34.41	4.81	Lake A8
	#3	99	10.98	10.98	-	-
	#4	39	3.09	3.09	-	-
	#5	49	3.38	3.38	-	-
Discovery	#1	190	44.18	44.18	-	-
		Total	**192.31**	**182.08**	**10.23**	**-**

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

The aquatic area (10.23 ha) presented in Table 5-2 corresponds to medium and high risk waterbodies that will be incorporated into end pit lakes. The habitat gains associated with these aquatic areas were already considered in Section 5.2.1 (gains from habitat alterations); therefore, the following discussion will be focussed on quantifying the habitat value of the originally terrestrial areas (182.08 ha) that will be transformed to end pit lakes.

To calculate habitat gains from the terrestrial areas transformed into end pit lakes, several assumptions were used:

- Ponds that were deemed as low risk habitat through the risk categorization outlined in Section 2.3 and Appendix B are accounted for by area as “terrestrial”.
- Post closure water quality in the end pit lakes will be suitable to support all life functions of fish.
- The development of a chemocline (i.e., transition zone between the top and bottom layers in a meromictic lake) was assumed at 20 m depth. This assumption will need to be confirmed through further modeling of the end pit lakes and observational data during monitoring.
- Substrate will be coarse throughout all end pit lakes (i.e., only habitat types HT3, HT6, HT9, and HT10 are considered).
- End pit lakes will be accessible to fish from Meliadine Lake and, due to their extensive overwintering habitat, can be used year-round by all species that are currently found in Meliadine Lake and the lower Peninsula lakes, including lake trout, Arctic char, and Arctic grayling. The species weightings for the end pit lakes are based on the lower Peninsula lake ecotype, regardless of the position of the end pit lake in relation to Meliadine Lake.
- All end pit lakes will be filled by active pumping from Meliadine Lake after closure.
- End pit lakes allocated to provide offsetting measures under Section 35(2) authorizations will not be backfilled with waste rock prior to flooding.

The area of each pit was subdivided into 4 depth zones (<2 m, 2 m to 4 m, 4 m to 20 m, and >20 m; Table 3-1) using 3-D profiles of the pits derived from engineering plans. The total number of aquatic habitat units gained from the excavated terrestrial areas of end pit lakes is 58.01 HU (Table 5-3). Most (61%) of habitat unit gains are due to the creation of HT 10 (<20 m in depth with no usable substrate below the chemocline); however, one-third (33%) of the gains in HU will be contributed by HT 9 (4 m to 20 m in depth with coarse substrate), which is suitable for overwintering, foraging, and spawning functions of lake trout. Most (85%) of habitat units gains will results from the creation of 3 large pits (Tiriganiaq pit #1, Wesmeg pit #2, and Discovery pit #1).

Table 5-3: Habitat Units Gained from Terrestrial Areas Changed into End Pit Lakes

Zone	Pit	Habitat Type				
		HT 3 (<2 m; coarse)	HT 6 (2 m to 4 m; coarse)	HT 9 (4 m to 20 m; coarse	HT 10 (>20 m; no substrate)	Total
Tiriganiaq	#1	0.12	1.08	6.67	16.91	**24.78**
	#2[a]	0.00	0.00	0.00	0.00	**0.00**
Wesmeg	#1	0.04	0.09	0.84	0.27	**1.24**
	#2	0.14	0.29	5.00	6.40	**11.83**
	#3	0.06	0.21	2.53	1.44	**4.23**
	#4	0.04	0.13	0.96	0.38	**1.51**
	#5	0.04	0.13	1.00	0.44	**1.61**
Discovery	#1	0.74	0.26	2.24	9.57	**12.81**
Total		**1.18**	**2.19**	**19.24**	**35.41**	**58.01**

[a] all of Tiriganiaq pit #2 is located within Lake B5; therefore there will be no changes from terrestrial to aquatic habitat associated with this end pit lake. Tiriganiaq pits #1 and #2 will be joined to form 1 large end pit lake after closure.

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Flooding of Undisturbed Terrestrial Areas

Flooding of undisturbed terrestrial areas will affect a total area 38.62 ha, resulting in the overall habitat gain of 7.15 HU. The flooding will occur at 2 locations:

- The construction of B4 waste rock storage facility will alter the natural outflow of Lake B45 (to B4) and raise its water level by approximately 0.5 m to allow diversion to Meliadine Lake through ponds B44, P3, P2, and Lake B2. This will result in inundation of 13.20 ha of peripheral areas of Lake B45 and Pond B44, producing an estimated habitat gain of 2.36 HU.
- The west margin of Pump pit #1 will be approximately 2 m lower in elevation than the proposed outlet of the flooded end pit lake through Lake B59. As such, raising the water level in this end pit lake will result in inundation of 25.42 ha of land that will be adjacent to the east end of the B4 waste rock storage facility. The resulting habitat gain of shallow habitat connected to a deep pit is estimated at 4.79 HU.

5.2.4 Complementary Offsetting Measures

Under the new Fisheries Productivity Investment Policy (DFO 2013a), complementary measures such as data collection and scientific research related to maintaining or enhancing the productivity of CRA fisheries may comprise up to 10% of the required effort of offsetting, particularly in areas where there are limited opportunities to offset fisheries productivity losses and where there is limited understanding on fisheries populations. To address this opportunity, AEM proposes that 10% of the offsetting measures be directed towards increasing knowledge and understanding of the fish resources in the area. The additional knowledge of the fish species inhabiting the area would help resource managers to establish appropriate objectives and policies, thus ultimately leading to the preservation and potential increase in productivity of the CRA fisheries.

AEM possesses a large amount of data collected during 1997 to 2012 aquatic studies related to proposed mine development. Whereas some of these data were analyzed and reported in the baseline reports for this Project, in depth analysis and dissemination to a wider scientific audience has not been attempted. As data of this nature are rare and lacking in peer-reviewed scientific literature, there are several opportunities to increase the knowledge about fish populations and their contribution to the productivity of the fishery in the study area by conducting rigorous analyses of the existing data and/or collecting additional information to publish the results so they can reach a wider audience. Some of these opportunities are briefly described below.

Arctic Char in the Meliadine River System

During 1997 to 1999 fish fence operations in the lower Meliadine River, more than 3000 Arctic char were captured and marked. The subsequent recaptures by the study team and the subsistence fishermen from Rankin Inlet provided a large data set on fish movements, harvest rates/locations, and growth rates of individual fish through multiple recaptures. The results of the fish fence program could be compared with the results of a radio telemetry program (1998 to 2001) and a similar fish fence study in the same location in 1990. The existence of such large, multi-decade data set on Arctic char is likely to be of use to scientists studying climate change and to current fisheries managers.

Productivity Estimates of Peninsula Lakes

Currently there are uncertainties in using HU as a surrogate for productivity. AEM has begun a comparison of productivity gains per HU in streams, small waterbodies and lakes, using field data collected during instream monitoring program and lake fishouts at the Meadowbank Mine site near Baker Lake. To date AEM has conducted a preliminary evaluation of Meadowbank Second Portage Lake Northwest Arm fishout (in 2008), which examined immature fish per HU in the lake, with changes in number of recruits after construction of spawning habitat as an offsetting measure.

To address the issue of uncertainties in using HU as a surrogate for productivity, AEM attempted to apply models of fish production using 2008 and 2010 Meadowbank fishout data by applying fish production models from Downing et al. (1990), who found that fish production (FP in kg/ha/yr) in lakes worldwide is significantly correlated with average annual primary production (PP in $gC{\bullet}m^{-2}{\bullet}yr^{-1}$), average annual total phosphorus concentration (TP in mg/L) and standing fish biomass (FB in kg/ha), as described by the following models:

$\log FP = 0.600 + 0.575 \log PP$ ($n=19$; $r^2 = 0.79$)

$\log FP = -0.42 + 1.084 \log FB$ ($n=23$; $r^2 = 0.67$)

$\log FP = 0.332 + 0.532 \log TP$ ($n=14$; $r^2 = 0.67$):

AEM proposes to evaluate data collected during the proposed fishouts of the Peninsula lakes near the Meliadine Project, and work with academic partners or aquatic researchers to determine a representative model for fish production and determine the relative contribution of the Peninsula lakes to the Meliadine Lake fishery.

Review of Habitat Suitability Indices

Habitat Suitability Indices (HSI) are commonly used to assist in evaluating the relative life history requirements for each species. As peer reviewed literature on Arctic species is limited, AEM proposes to review the current HSI models used at the Meliadine and Meadowbank projects by determining potentially suitable parameters for indices (e.g., maximum depth, lake volume, temperature, TP, substrate, and invertebrate and fish community composition) through a literature review and professional opinion on fish habitat preferences. AEM plans to pair this with an evaluation using observational data of fish habitat preferences through the measurement of selected indices along with total fish biomass and/or health index. Much of this information is already available from fishout data at Meadowbank or will be available from the proposed Meliadine fishout data. This type of analysis could be done for all species or 1 initially (i.e., Arctic grayling or ninespine stickleback). This may ultimately lead to revised calculations of HSI equations that could potentially improve the accuracy of model predictions in future offsetting plans to protect CRA fisheries in the Arctic.

Life History Studies of Stickleback

Ninespine stickleback is the most abundant and often the only species present in the numerous ponds, lakes, and streams near the proposed development within the Peninsula basins; however, this species is rarely found in Meliadine Lake. In contrast, threespine stickleback is abundant in Meliadine Lake, but almost nonexistent in the upper reaches of the Peninsula basins. This partitioning of habitat by the 2 species is not well understood, but may be related to ninespine stickleback's higher vulnerability to predation (due to smaller dorsal spines) and thus their need to seek habitat with few or no predators. To better understand this habitat selection and shed more light on their life history requirements (spawning, rearing, foraging, and overwintering), a complementary offsetting measure could be to conduct a detailed study of the 2 stickleback species in the Meliadine area. As ninespine stickleback will be the species most largely affected by the proposed development, increasing the knowledge of this fish should be in the spirit of the “in-kind” guideline of the DFO’s Fisheries Productivity Investment Policy (DFO 2013a). In addition, a large database on stickleback species captured during the baseline studies from 1997 to 2012 could be analyzed to support the new research project.

5.2.5 Offset Ratio for Lakes and Ponds (Section 35 Authorization)

The summary of habitat losses and gains for lakes and ponds that require Section 35(2) authorization is presented in Table 5-4. The total area of altered and disrupted habitats (185.70 ha) is equal for pre-construction and post-closure phases of the Project. The habitat value of these areas (as reflected by HU) increased from 56.27 HU to 66.34 HU, mainly due to the potential improvements of access for multiple fish species to deep-water habitat that was previously limited within the upper Peninsula waterbodies. By improving access and enhancing the habitat (i.e., creating overwintering areas and substituting fine substrates with coarse substrates), the upper lake ecotype species assemblage will be replaced by the lower lake ecotype species assemblage, resulting in the overall HU gains.

Table 5-4: Summary of Lake and Pond Habitat Losses and Gains for Section 35(2) Authorization

Type of Loss / Gain		Waterbodies Affected	Surface Area (ha)		Habitat Units (HU)	
			Loss	Gain	Loss	Gain
Altered	Open pits	A5, A6, A8, B5	24.12	24.12	6.48	9.44
	Access roads	A2a, A4, A5, A8, B5	12.38	12.38	3.55	5.72
	Drawdown	A6	34.96	34.96	11.28	9.20
	Disrupted / Restored	A2, A2a, A3, A4, A5, A8, B5	114.23	114.23	34.96	41.98
	Subtotal		**185.70**	**185.70**	**56.27**	**66.34**
Destroyed	Waste rock	B4, B5, B6, B7, B30, B31, E4, E5	113.28	-	29.85	-
	Plant pads[a]	H1, H2	1.29	-	0.27	-
	Access roads	A2a, A4, E4	0.76	-	0.14	-
	Drawdown	A6	17.64	-	4.18	-
	Intake jetty	Meliadine Lake	0.09	-	0.06	-
	Subtotal		**133.06**	**-**	**34.50**	**-**
Terrestrial Gains	End pit lakes	8 pits in Tiriganiaq, Wesmeg and Discovery zones	-	182.08	-	58.01
	Flooding	Pump Pit #1, B45/44	-	38.62	-	7.15
	Subtotal		**-**	**220.70**	**-**	**65.16**
Complementary Offsetting Measures (10% of HU gains)						13.15
Total			**318.75**	**406.39**	**90.77**	**144.65**
Offset ratio					**1.59 to 1**	

[a] includes Pond H1 (1.14 ha and 0.25 HU), which will be used as contact water sump for collecting contact waters.

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Although no physical changes are anticipated in disrupted habitats (i.e., lakes and ponds dewatered during construction and operations phases, and restored during closure), the duration of the disruptions may exceed a reasonable number of generation times to be considered temporary, as interpreted by DFO (Koops et al. 2013). As such, the disrupted habitats are included with altered habitats in the calculations of losses and gains, so that the impacts on CRA fisheries associated with the disruption of biological productivity are accounted for in the offsets.

The habitats destroyed by the Project through construction of waste rock storage facilities, pads for the plant and low-grade ore storage areas, access roads, attenuation ponds, and the drawdown of Lake A6 (total area of 133.06 ha, corresponding to 34.50 HU) will be offset mainly by terrestrial gains realized through rehabilitation of 8 end pit lakes and flooding of peripheral areas (total area of 220.70 ha, corresponding to 65.16 HU).

By comparing the total number of habitat units lost through alteration and destruction of habitat during mine construction and operations phases (90.77 HU) to the total number of habitat units gained through enhancement of existing aquatic habitat, creation of new aquatic habitat in previously terrestrial areas and implementation of complementary offsetting measures outlined in Section 5.2.4 (total gains of 144.65 HU), the overall offset ratio for the Meliadine Project lakes is estimated at **1.59 to 1.**

Offsetting Schedule

As currently planned, the Project construction and operation phases will occur during 13 years (2017 to 2029). It is estimated that filling of the open pits with water pumped from Meliadine Lake will take place over a 10-year period. Although some of the components of the offsetting measures will likely be implemented before all end pit lakes are filled, for the purposes of this Conceptual Fisheries Protection and Offsetting Plan, the initial benefits to the productivity of CRA fisheries are not anticipated to occur until post-closure, when end pit lakes are filled and connected to Meliadine Lake.

Offsetting Costs

The cost estimates for individual components of the offsetting plan for lakes and ponds will be prepared during the Type A Water Licence and DFO Authorization processes. The conceptual nature of the proposed options implies that the options need to be agreed on, before detailed engineering plans and costs are undertaken.

5.3 Stream Habitat Gains (Section 35 Authorization)

Most of the offsetting measures planned for lost stream habitat will involve construction of new channels for water diversions between altered watershed areas and allowing fish access to end pit lakes (Figure 5-1). These channels will be engineered to maximize the period of sustained flows and to provide suitable habitat for Arctic grayling spawning, and rearing habitat for juvenile Arctic grayling, lake trout, and Arctic char.

In addition to constructing new stream channels in previously terrestrial areas, 1 stream will be altered during closure and 6 streams will be disrupted during operations and then restored during closure, without changing the habitat.

5.3.1 Gains from Stream Habitat Alteration

The altered stream (B46-59) will be enhanced to allow for increased post-closure flows from a larger drainage area upstream, which will include the end pit lake created in Pump pit #1. Most of this area currently drains to Lake B4, but will be redirected to drain to Lake B45 though Lake B59. The channel will be altered to provide fish passage between Meliadine Lake and the upstream end pit lake, and will include gravel substrate for Arctic grayling spawning. The total channel length that will be altered is 145 m, corresponding to a gain of 54 HU.

5.3.2 Restored Stream Habitat

Disrupted stream habitat dewatered during mining activities will be re-flooded and re-connected to the existing stream systems after the end of mining. As no physical changes will be made to the channel and substrate, the disruptions will result in the loss of biological productivity during operations and are expected to be fully restored to their pre-construction form and functionality at post-closure.

The restored habitat will encompass 6 streams with a total length of 448 m. Approximately half of the restored habitat will comprise a stream system in lower reaches of Basin A (A2-2a, A2a-3, A3-4, and A4-5), with a total length of 237 m and a habitat gain of 75 HU. The remaining habitat restorations will occur in streams A6-7 and A7-8, which connect Lake A6 to Lake A8 through Pond A7. These streams will be dewatered during operations, but their function will be restored at closure when a large end pit lake, incorporating Pump pit #2, Wesmeg pit #2, and the restored Lake A8, becomes productive fish habitat. The total length of these 2 disrupted streams is 211 m, corresponding to a gain of 76 HU.

The capacity of these 6 streams to provide Arctic grayling spawning and rearing habitat and effective fish passage to upstream lakes will be restored during closure, resulting in the total habitat gain of 152 HU.

5.3.3 Gains from New Diversion Channels

The water management plan for the Project (SD 2-6) proposes construction of 12 new diversions channels between the altered watershed boundaries after closure (Table 5-5). The channels will vary from 73 to 654 m in length, and their total length is estimated at 2478 m. They will be engineered to maximize the period of sustained flows and to provide suitable habitat for Arctic grayling spawning and rearing habitat for juvenile Arctic grayling, lake trout, and Arctic char. In channels constructed to connect end pit lakes with the Meliadine Lake, priority will be placed on providing fish passage during at least part of the year. Rearing and spawning habitat construction will be implemented mainly in the larger channels that can sustain flow throughout the open water period (e.g., FP3-A6, P2-B44).

Table 5-5: Proposed Diversion Channels to be Constructed during Closure

Channel ID	Location	Channel Length (m)	Habitat Units (HU)
D7-B5	Lake B5 (Tiriganiaq pits #1 & #2) to Lake D7	163	57
B5-WP1	Wesmeg pit #1 to Lake B5 (Tiriganiaq pits #1 & #2)	71	25
P2-B44	Pond B44 to Pond P2	332	116
B44-45	Lake B45 to Pond B44	73	26
B2-P2	Pond P2 to Lake B2	87	30
B59-PP1	Pump pit #1 to Lake B59	97	34
FP3-A6	Lake A6 to F Zone pit #3	418	146
A30-WP4	Wesmeg pit #4 to Pond A30	149	52
A8-WP5	Wesmeg pit #5 to Lake A8	92	32
J8-WP3	Wesmeg pit #3 to Pond J8	120	42
H1-6[a]	Pond H6 to Pond H1	654	0
H6-17[a]	Pond H17 to Pond H6	152	0
CH6-DP	Discovery pit to Lake CH6 (Chickenhead)	70	24
	Total	**2478**	**560**

[a] diversion channels in Basin H will not be constructed to provide fish habitat, as this basin is not expected to be recolonized by fish after closure. No HU are assigned to channels H1-6 and H6-17 because they will be constructed mainly to convey water.

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

5.3.4 Offset Ratio for Streams (Section 35 Authorization)

The summary of habitat losses and gains for streams in the Project area is presented in Table 5-6. The total length of altered habitats (593 m) is equal for pre-construction and post-closure phases of the Project; however, the habitat value of these areas (as reflected by HU) increased slightly from 183 HU to 205 HU, mainly due to the enhanced stream habitat in the altered stream B46-59.

The stream habitats destroyed by the Project through construction of waste rock storage facilities, pads for the plant, open pits, attenuation ponds, and culverts under access roads (total length of 1385 m, corresponding to 373 HU) will be offset mainly by gains associated with the construction of new diversion channels (total length of 2478 m, corresponding to 560 HU).

Table 5-6: Summary of Stream Habitat Losses and Gains for Section 35(2) Authorization

Type of Loss / Gain		Streams Affected	Length (m)		Habitat Units (HU)	
			Loss	**Gain**	**Loss**	**Gain**
Altered	Increased flow	B46-59	145	145	19	54
	Disrupted / Restored	A2-2a, A2a-3, A3-4, A4-5, A6-7, A7-8	448	448	164	151
Destroyed	Waste rock	B4-5, B5-6, B5-31, B31-30, B30-6, B6-7	594	-	190	-
	Plant pads[a]	H0-1, H1-2	349	-	77	-
	Open pits	A5-6	407	-	91	-
	Culverts	A6-7	35	-	15	-
Terrestrial Gains	Diversions	13 new channels (see Table 5-5)	-	2478	-	560
Total			**1978**	**3071**	**556**	**765**
Offset ratio					**1.38 to 1**	

[a] includes Stream H0-1 (175 m and 54 HU), which will be lost downstream of a contact water sump (H1)

By comparing the total number of habitat units lost through alteration and destruction of stream habitat during the mine construction and operations phases (556 HU) to the total number of habitat units gained through alteration and restoration of existing streams and development of new aquatic habitat in the constructed diversion channels during post-closure (765 HU), the overall offset ratio for streams in the Project area is estimated at **1.38 to 1.**

Offset Schedule

As currently planned, the Project construction and operations phases will occur during 13 years (2017 to 2029). It is estimated that filling of the open pits with water pumped from Meliadine Lake will take place over a 10-year period. Although some of the components of the Fisheries Protection and Offsetting Plan for streams will be implemented during the operations phase (e.g., diversion channels between lakes B45 and B2), and many of the streams will provide access for fish to upstream lakes during operations, most of the benefits from the stream offsetting plan are not expected to occur until post-closure, when the end pit lakes are filled and the new drainage systems to Meliadine Lake are established.

Offset Costs

The cost estimates for individual components of the Fisheries Protection and Offsetting Plan for streams will be prepared during the Type A Water License and DFO Authorization processes.

5.4 End Pit Lake Habitat Gains (Amedment to Schedule 2 of MMER)

Habitat gains proposed as offsets for the loss of waterbodies that require an amendment to Schedule 2 of MMER are associated with terrestrial areas that will become aquatic habitats after closure, due to creation of

5 end pit lakes in the Pump and F Zone areas. Habitat gains associated with enhancement or alteration of existing aquatic habitat within these pits or gains due to flooding of adjacent tundra are not considered because they were already accounted for in Section 5.2.

Habitat gains anticipated during post-closure were calculated in terms of surface area (ha) and HUs by applying the same Meliadine HEP model used for calculating habitat losses in the TSF area.

5.4.1 Habitat Creation - Gains from Terrestrial Habitat Changed to Aquatic Habitat

The 5 open pits in the Pump and F Zone areas will range in size from 7.59 ha (F Zone pit #2) to 36.15 ha (Pump pit #1), with a total surface area of 83.76 ha at the end of the operations phase of the Meliadine Project (Table 5-7). Most (83%) of the surface area of these open pits will comprise habitats that were terrestrial during pre-construction. Included in the terrestrial category are 8 ponds that were deemed as low–risk habitat through the risk characterization outlined in Section 2.3 and Appendix B. The total area of these ponds (11.88 ha) was considered at par with terrestrial habitat because of the low quality of this habitat type and its prevalence in the region.

Table 5-7: Surface Area of Terrestrial and Aquatic Components of End Pit Lakes

Zone	Pit	Maximum Depth (m)	Total Surface Area (ha)	Terrestrial Area (ha)	Aquatic Area (ha)	Affected Waterbody
Pump	#1	98	36.15	36.15	-	-
	#2	113	13.50	2.66	10.84	Lake A8
F Zone	#1	43	9.83	9.83	-	-
	#2	63	7.59	7.22	0.37	Pond A5
	#3	145	16.69	14.01	2.68	Lake A6
		Total	**83.76**	**69.86**	**13.89**	-

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

The aquatic area (13.89 ha) presented in Table 5-7 corresponds to medium and high risk waterbodies that will be incorporated into end pit lakes. The habitat gains associated with these aquatic areas were already considered in Section 5.2.1 (gains from habitat enhancement or alteration); therefore the following discussion will be focussed on quantifying the habitat value of the originally terrestrial areas that will be transformed to end pit lakes.

To calculate habitat gains from the terrestrial areas transformed into end pit lakes, several assumptions were used:

- Ponds that were deemed as low risk habitat through the risk categorization outlined in Section 2.3 and Appendix B are accounted for by area as "terrestrial".
- Post closure water quality in the end pit lakes will be suitable to support all life functions of fish.
- The development of a chemocline (i.e., transition zone between the top and bottom layers in a meromictic lake) was assumed at 20 m depth. This assumption will need to be confirmed through further modeling of the end pit lakes and observational data during monitoring.

- Substrate will be coarse throughout all end pit lakes (i.e., only habitat types HT3, HT6, HT9, and HT10 are considered).
- End pit lakes will be accessible to fish from Meliadine Lake and, due to their extensive overwintering habitat, can be used year-round by all species that are currently found in Meliadine Lake and the lower Peninsula lakes, including lake trout, Arctic char and Arctic grayling. The species weightings for the end pit lakes are based on the lower Peninsula lake ecotype, regardless of the position of the end pit lake in relation to Meliadine Lake.
- Whereas all pits will be flooded by active pumping from Meliadine Lake after closure, 3 of the 5 pits (approximately 76% of total terrestrial area) will be backfilled with waste rock prior to flooding. As these backfilled end pit lakes are not expected to develop the monimolimnion layer, their productivity will be greater than the deeper end pit lakes with monimolimnion present (i.e., the entire lake area and water column will be suitable for fish, in contrast to end pit lakes with anoxic zones below the chemocline). Due to ongoing mine planning and underground mining feasibility studies, it is still not clear which pits will be selected for backfilling. As a result, for the purposes of this Conceptual Fisheries Protection and Offsetting Plan, it is assumed that the F Zone pits #1 and #2 and the Pump pit #1 will be backfilled, whereas the remaining pits will be flooded without backfilling.

The area of each pit was subdivided into 4 depth zones (<2 m, 2 m to 4 m, 4 m to 20 m, and >20 m; Table 3-1) using 3-D profiles of the pits derived from engineering plans. The number of habitat units gained for the terrestrial components of all end pit lakes is summarized in Table 5-8. Most (88%) of habitat unit gains are due to the creation of HT 9 (4m to 20 m in depth with coarse substrate). The contribution of this habitat type is most notable in the end pit lakes that are assumed to be backfilled (Pump pit #1 and F Zone pits #1 and #2). Habitat units resulting from HT 10 are predominant in F Zone pit #3 and Pump pit #2 because these pits will not be backfilled.

Table 5-8 Habitat Units Gained from Terrestrial Areas Changed into End Pit Lakes

Zone	Pit	Habitat Type				
		HT 3 (<2 m; coarse)	HT 6 (2 m to 4 m; coarse)	HT 9 (4 m to 20 m; coarse	HT 10 (>20 m; no substrate)	Total
Pump	#1[a]	0.10	0.23	18.70	0.00	**19.03**
	#2	0.01	0.03	0.42	0.51	**0.97**
F Zone	#1[a]	0.08	0.21	7.14	0.00	**7.43**
	#2[a]	0.06	0.16	5.24	0.00	**5.45**
	#3	0.35	0.05	0.91	2.71	**4.02**
Total		**0.60**	**0.68**	**32.41**	**3.22**	**36.90**

[a] assumed to be backfilled to approximately 20 m depth, so HT 10 will not apply

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

5.4.2 Offset Ratio for Lakes and Ponds (Amendment of Schedule 2 of MMER)

The summary of habitat losses and gains for lakes and ponds in the Project area is presented in Table 5-9. The habitats destroyed through construction of the TSF (total area of 59.61 ha, corresponding to 17.51 HU) will be offset by terrestrial gains realized through rehabilitation of end pit lakes in the Pump and F Zone areas (total area of 69.86 ha, corresponding to 36.90 HU).

Table 5-9: Summary of Lake and Pond Habitat Losses and Gains for TSF Ammendment of MMER

Type of Loss / Gain		Waterbodies Affected	Surface Area (ha)		Habitat Units (HU)	
			Loss	Gain	Loss	Gain
Destroyed Habitat	TSF	B7, B25, B28	59.61	-	17.51	-
Terrestrial Gains	End pit lakes	5 pits in Pump and F Zone areas	-	69.86	-	36.90
Complementary Offsetting Measures (10% of HU gains)						3.69
Total			**59.61**	**69.86**	**17.51**	**40.59**
Offset ratio					**2.32 to 1**	

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

By comparing the total number of habitat units lost through destruction of habitat under the TSF (17.51 HU) to the total number of habitat units gained through development of new aquatic habitat in previously terrestrial areas and implementation of complementary offsetting measures outlined in Section 5.2.4 (total gain of 40.59 HU), the overall offset ratio for the loss of waterbodies under the TSF footprint is estimated at **2.32 to 1.**

Offsetting Schedule

As currently planned, the Project construction and operations phases will occur during 13 years (2017 to 2029). It is estimated that filling of the open pits with water pumped from Meliadine Lake will take place over a 10-year period. Although some of the components of the offsetting measures will likely be implemented before all end pit lakes are filled, for the purposes of this Conceptual Fisheries Protection and Offsetting Plan, the initial benefits to the productivity of CRA fishery are not anticipated to occur until post-closure, when end pit lakes are filled and connected to Meliadine Lake.

Offsetting Costs

The cost estimates for individual components of the Fisheries Protection and Offsetting Plan for lakes and ponds will be prepared during the Type A Water License and DFO Authorization processes. The conceptual nature of the proposed options implies that the options need to be agreed on before detailed engineering plans and costs are undertaken.

6.0 CONTINGENCY OPTIONS

The offsetting measures proposed above are the primary options associated with enhancing the productivity of areas within the mine footprint of the Project as they play a supporting role in maintaining the Aboriginal fishery in Meliadine Lake. These measures will be refined and designed in detail as new data become available throughout the construction and operations phases of the Project. As a requirement of the DFO authorization, the success of these offsetting measures will be assessed through physical and biological monitoring programs (see Section 8 and SD 7-3 Aquatic Effects Monitoring Plan).

Due to the uncertainty about the performance of the reclaimed end pit lakes as productive fish habitats, contingency options were established to be implemented in the case that the primary plan fails, either due to inability to construct, or failure to meet the criteria for success established in the monitoring plan (see Section 8). The contingency offsetting projects described below will be implemented as required, and only in the event that they are deemed necessary in discussions with DFO.

Two contingency options are proposed at this time. One involves creation of a offset lake in Basin C on the Peninsula. The other proposes to remove a fish movement barrier in a watershed near Pistol Bay to allow Arctic char use of this system. Both of these options were discussed in a meeting with DFO on 18 November 2011, and were accepted in principle as potentially viable options. They are presented below as a concept. If these are deemed more suitable than the main offsetting measures by DFO and stakeholders, it should be recognized that further studies will be necessary to properly assess their potential benefits as offsets to the productivity of the CRA fishery.

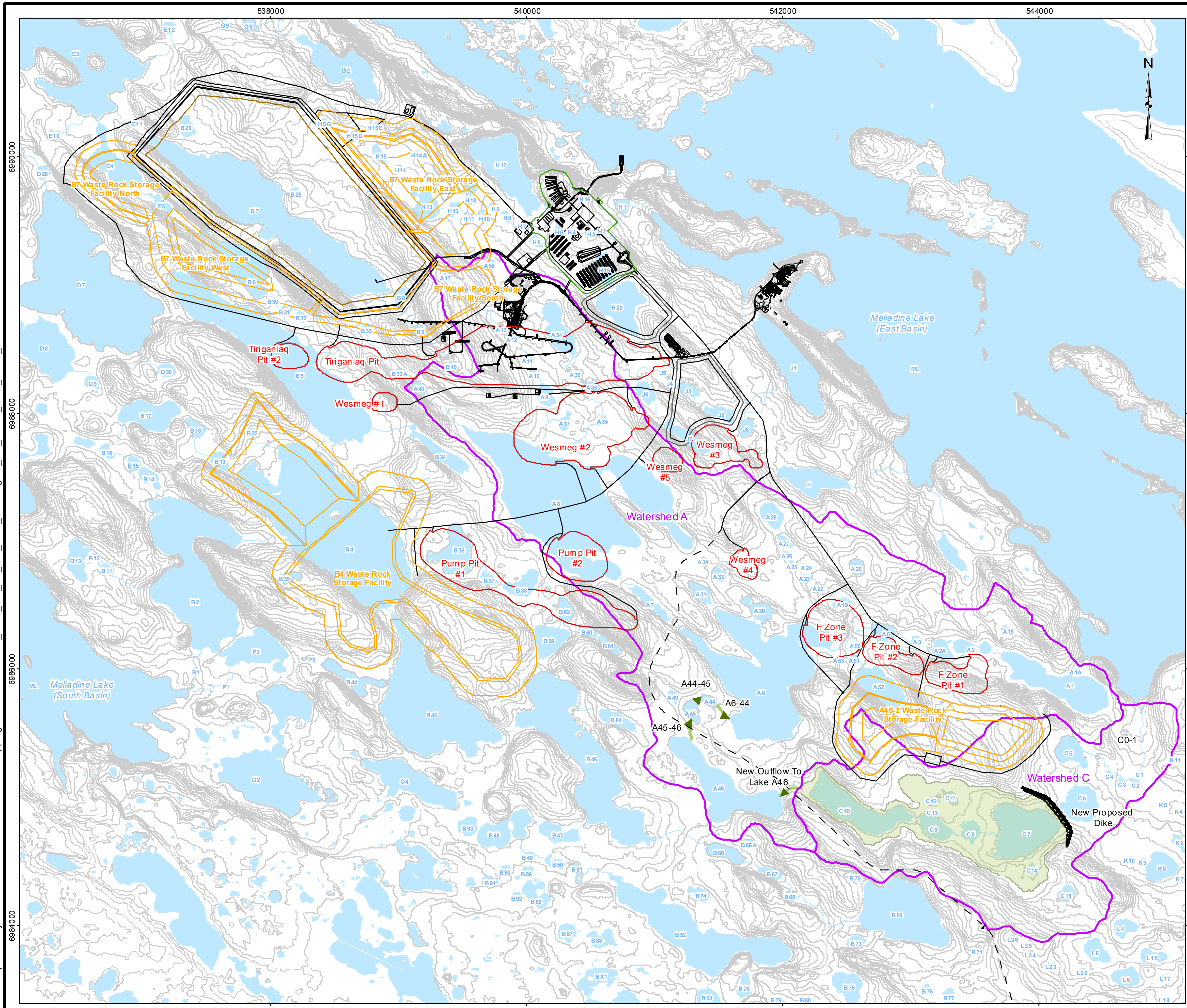
6.1 Offset Lake in Basin C

6.1.1 Background

At present, Basin C is a small (3.28 km^2) watershed that drains to the Meliadine Lake (East basin) immediately south of Basin A on the Peninsula (Figure 6-1). It contains 15 lakes and ponds, with a total area of 50.1 ha. Most (53%) of the ponds are small (<1 ha); however 3 waterbodies are larger than 5 ha, with the largest one (Pond C7) featuring 15.96 ha of surface area.

Fish and habitat surveys conducted in August 2011 confirmed that only 1 waterbody in Basic C is deeper than 1.8 m in maximum depth. This lake (C10) has a maximum depth of 2.9 m, a surface area of 13.89 ha (second largest waterbody in the basin) and is located in the upper part of the basin, near the watershed boundary with Basin A. Fish sampling using fyke nets, gill nets, and visual observations in 4 of the larger waterbodies within the basin (C6, C7, C9, C10) registered 354 fish, with ninespine stickleback contributing 99% to the catch and present in all sampled waterbodies. The only other species encountered was threespine stickleback (n=5), captured in Pond C7.

The absence of large-bodied species (e.g., Arctic grayling, cisco) that are present in Basin A immediately to the north is likely due to the smaller drainage area of Basin C, which results in lower flows to Meliadine Lake, and consequently, less defined stream systems with poor connectivity. The lowermost stream in this system (C0-1) is a long (615 m) connection featuring dispersed flows over multiple paths through tundra vegetation and wetlands. It lacks a defined channel for movements of large bodied fish and the predominantly silt/organic substrates do not provide spawning habitat for Arctic grayling from Meliadine Lake. As such, Basin C is inhabited only by stickleback species that seek refuge from predators in larger systems.



LEGEND

- Proposed Project Infrastructure
- All-weather Access Road (AWAR)
- Road - New
- Watercourse
- Offset Lake Outflow
- Offset Lake
- Tailings Storage Facility (TSF)
- Open Pit
- Plant Pad
- Pad for Low Grade Ore
- Waste Rock Storage Facility
- Waterbody
- Watershed Boundary

REFERENCE

Base data obtained from Agnico Eagle Mines Limited (AEM).
Datum: NAD 83 Projection: UTM Zone 15

600 0 600
METRES

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

OFFSETTING OPTION 1 – OFFSET LAKE IN BASIN C

Golder Associates

PROJECT NO.	10-1373-0076	FILE No.	
DESIGN	JP	06 Nov. 2012	SCALE AS SHOWN	REV. 0
GIS	KI	19 Feb. 2014	
CHECK	JP	18 Feb. 2014	FIGURE 6-1
REVIEW	DW	18 Feb. 2014	

6.1.2 Plans for Offset Lake

By constructing a 0.5-km long dike between Ponds C6 and C7, all flow to Meliadine Lake from the upstream waterbodies (C7 to C15) would be blocked. The resulting impoundment would inundate 8 waterbodies (C7 to C14) and create a single lake with a surface area of 91 ha. Raising the water in the new offset lake to 64.0 masl elevation would allow the creation of a new outflow from the upper Basin C drainage into Basin A through Lake A46 (Figure 6-1).

To raise the water level in the new impoundment to the required 64.0 masl elevation, the downstream dike would need to be about 6.0 m in height at its highest point (allowing for a 2.4 m crest above the maximum predicted water level). The water level in the existing Pond C7 would increase by about 3.1 m, whereas in the farther upstream Lake C10, the water level would increase by about 1.2 m. Considering the bathymetry of the existing waterbodies and the elevation data for the surrounding terrain, the area-depth curve of the new offset lake (Figure 6-2) indicates that 39.7 ha (43.7% of total lake area) will be deeper than 2 m, and 9.5 ha (10.4%) will be deeper than 4 m. The maximum depth of 4.4 m will be in close proximity to the dike.

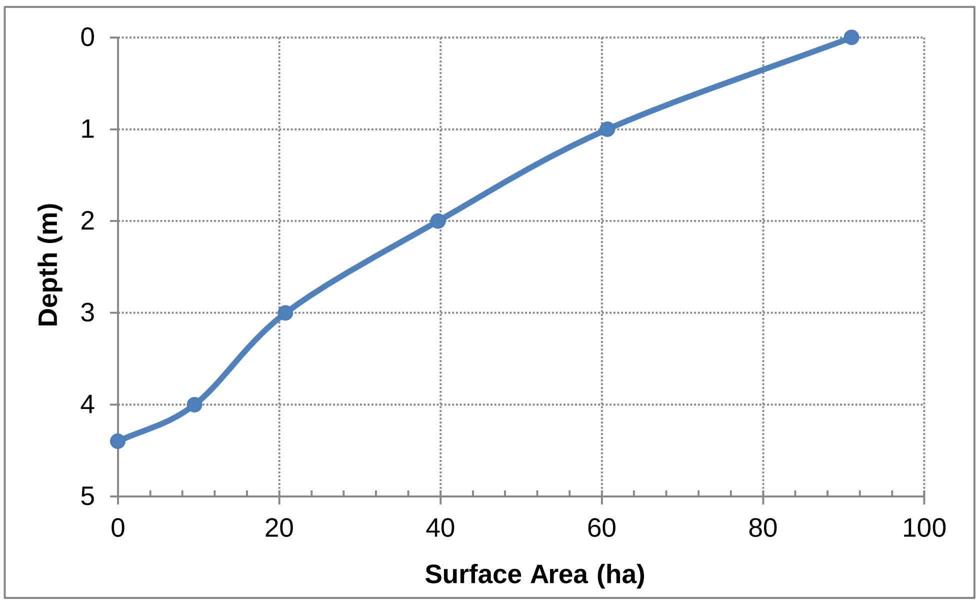


Figure 6-2: Area-depth Curve of the Contingency Offset Lake

Prior to the inundation of the contingency offset lake, habitat features to enhance lake productivity will be installed. These may include finger dikes to diversify rearing habitat in the shallow areas, rocky reefs in the deeper (>3 m) zones to provide spawning substrates for lake trout, and/or gravel beds to provide round whitefish and cisco spawning habitat.

The construction of the offset lake will require construction of an engineered stream channel to connect the lake (across the watershed boundary) to Lake A46 in Basin A, and improvements to the existing streams between lakes A46 and A6 (streams A6-44, A44-45 and A45-46). These streams will be constructed (or altered in the case the 3 streams in Basin A) to allow fish passage to the offset lake. In addition, spawning areas for Arctic grayling can be incorporated into the designed stream channels by adding gravel substrates and creating suitable microhabitats (e.g., pool-riffle sequences).

6.1.3 Estimation of Habitat Gains

To estimate net habitat gains resulting from the construction of the offset lake, the value of the existing (pre-construction) habitat must be calculated as offset to the total gain. The existing 8 waterbodies under the footprint of the proposed contingency offset lake encompass a total of 37.01 ha of surface area, which corresponds to 8.69 HU (Table 6-1). Most (91%) of the habitat units are associated with shallow (<2 m) areas. Shallow areas with coarse substrate (HT 3) predominate (62% of total HU), and as such, they are also expected to dominate in the deeper zones of the contingency offset lake after flooding (as HT 6).

Table 6-1: Surface Area and Pre-construction Habitat Units of Waterbodies in Upper Basin C Affected by Habitat Alteration due to Construction of an Offset Lake

Waterbody	Surface Area (ha)	Habitat Units (HU) per Habitat Type						
		HT 1 (<2 m; fines)	HT 2 (<2 m; mixed)	HT 3 (<2 m; coarse)	HT 4 (2 m to 4 m; fines)	HT 5 (2 m to 4 m; mixed)	HT 6 (2 m to 4 m; coarse)	Total
Pond C7	15.96	0.54	0.73	2.17	-	-	-	**3.43**
Pond C8	1.99	0.06	0.09	0.30	-	-	-	**0.44**
Pond C9	3.43	0.04	0.16	0.65	-	-	-	**0.85**
Lake C10	13.89	0.16	0.47	2.26	0.47	0.35	-	**3.71**
Pond C11	0.76	0.06	0.03	0.02	-	-	-	**0.11**
Pond C12	0.55	0.05	0.02	0.01	-	-	-	**0.08**
Pond C13	0.14	0.01	0.003	0.004	-	-	-	**0.02**
Pond C14	0.36	0.03	0.01	0.01	-	-	-	**0.05**
Total	**37.07**	**0.94**	**1.50**	**5.43**	**0.47**	**0.35**	**0.00**	**8.69**

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

The summary of habitat losses and gains associated with the construction of the offset lake is presented in Table 6-2. The total area of altered habitats (37.07 ha) is equal for pre-construction and post-closure phases of the Project; however, the habitat value of these areas (as reflected by HU) increased from 8.69 HU to 24.54 HU, mainly due to the potential use of these areas by a full species assemblage (i.e., lower lake ecotype species weightings were applied to the gained habitat), and the improvements in habitat quality due creation of overwintering habitats and substitution of fine substrates with coarse substrates. The new (previously terrestrial) habitat gained by the inundation of areas peripheral to the flooded waterbodies will be 53.93 ha in area, which corresponds to 17.81 HU.

Table 6-2: Summary of Habitat Losses and Gains related to Construction of an Offset Lake

Type of Loss / Gain		Waterbodies Affected	Surface Area (ha)		Habitat Units (HU)	
			Loss	Gain	Loss	Gain
Altered	Raised water level	C7 to C14	37.07	37.07	8.69	24.54
Terrestrial Gains	Flooded tundra	-	-	53.93	-	17.81
Total			37.07	91.00	8.69	42.35
				Net HU gain	**33.66**	

By comparing the total number of habitat units altered (i.e., lost) due to the creation of the offset lake (8.69 HU) to the total number of habitat units gained through alteration of existing aquatic habitat and the development of new aquatic habitat in previously terrestrial areas (42.35 HU), the net gain in habitat is estimated at 33.66 HU. This resulting net gain can potentially be applied to increase the offset ratio resulting from the main offsetting measures (i.e., rehabilitation of end pit lakes), in case the success of the reclaimed end pit lakes is lower than anticipated.

The creation of the offset lake offers certain advantages, primarily because it presents an opportunity to construct during the life of mine rather than during closure. This could be achieved by connecting Lake A46 (the receiving waterbody immediately downstream of the new lake) to Basin B through Pond B64 and Lake B46.

As a disadvantage, the construction of a dike in Basin C will require considerable initial and long-term maintenance costs and will require acceptance from stakeholders. As a result, this option is presented here as a contingency and will need to be evaluated further as the Project proceeds into the detailed design phase.

6.2 Improve Arctic Char Access Through Pistol Bay Falls

During informal discussions with the Kangliqlinik HTO in 2010 and 2011, concerns were raised about fish barriers (falls) on several nearby watersheds that may be preventing ocean-run Arctic char from overwintering in upstream lakes. To address this concern, and to explore potential opportunities for offsetting measures for the Project, reconnaissance visits were conducted at Josephine Falls and Pistol Bay Falls in September 2011. A follow-up visit to Pistol Bay on 16 August 2012 with AEM and DFO representatives, indicated that Pistol Bay may provide the best opportunity for opening up access for Arctic char to upstream areas that are otherwise limited due to natural barriers.

A detailed evaluation of potential habitat gains associated with improving fish passage at Pistol Bay Falls is presented in Appendix E. A summary description of the Pistol Bay watershed and the potential habitat gains (estimated by applying a modified HEP method) are provided below.

6.2.1 Pistol Bay Watershed

Pistol Bay Falls are located at a transition from freshwater to marine environment, approximately 65 km southwest of the Project and 25 km north of Whale Cove (Figure 2-1 in Appendix E). The falls are approximately 2 m in height and unlikely to be navigated by fish in an upstream direction. Upstream of the falls, a series of waterbodies connects to a chain of larger lakes (>50 ha) that likely provide overwintering habitat for fish. Total watershed area upstream of the falls is 9710 ha and contains 432 waterbodies, 45 of which are greater than 5 ha in area and account for 3054 ha combined. Five lakes, ranging from 23 to 1573 ha in area (total of 1887 ha), were selected for the purpose of conceptual habitat gains calculations, mainly because of their potential to provide overwintering (and possibly spawning) habitats for Arctic char, and the absence of additional barriers upstream of the Pistol Bay Falls.

6.2.2 Estimation of Habitat Gains

The Meliadine HEP model described in Section 3 was modified to include an access factor (as described in Appendix E). The use of the access factor was suggested in the review by Dr. Ken Minns and accepted by DFO as part of the NNLP for the Meadowbank Project. The usefulness in applying the access factor specifically for the Pistol Bay access option is intrinsic to the offsetting concept.

To estimate net habitat gains resulting from barrier removal at Pistol Bay Falls, the habitat value of the existing watershed was calculated as an offset to the total gain. Assuming that the current species assemblage in the Pistol Bay watershed includes lake trout, round whitefish, Arctic grayling, cisco, burbot, slimy sculpin, and ninespine stickleback, the existing number of habitat units in the 5 lakes under consideration (total area of 1887 ha) is estimated at 427.06 HU. The inclusion of Arctic char in the species assemblage during the post-offsetting scenario results in a total of 588.94 HU for the same 5 lakes. This resulting net gain of 161.88 HU can potentially be applied to increase the offset ratio resulting from the main offsetting measures (i.e., rehabilitation of end pit lakes), in case the success of the reclaimed end pit lakes is lower than anticipated.

If DFO is supportive of the concept of creating access from Pistol Bay to lakes upstream of the Pistol Bay Falls, AEM proposes to conduct detailed field studies on the upstream lakes that will focus on identifying presence/ absence of fish species, particularly Arctic char. If Arctic char are present in the system, strontium analysis will be conducted to determine if they are anadromous (i.e., the falls are not an absolute barrier to access) or land-locked (i.e., adapted to freshwater-only life cycle). Furthermore, AEM will conduct bathymetric and substrate surveys to produce habitat maps that will replace the habitat type assumptions used in this conceptual estimate of habitat gains. If the field studies indicate favourable conditions for offsetting by creating access to upstream lakes, AEM will consult the stakeholders (DFO, HTO, KIA) to determine their support for this project and the need to proceed with additional fisheries and design studies.

7.0 FISH-OUT PROTOCOLS

As discussed above, the Project will result in unavoidable whole or partial destruction of waterbodies, which creates a unique opportunity to collect detailed fish and fish habitat information from the lakes and ponds to be destroyed. For these types of projects, DFO recognized this unique opportunity to collect valuable information and implemented fish-out programs, which are currently a component of *Fisheries Act* Section 35 (2) authorizations for projects that result in habitat losses due to mine activity, and/or whole or partial lake destruction. Fish-out programs are designed to ensure that fish stocks in waterbodies to be destroyed are fully utilized. DFO have developed a general fish-out protocol that outlines a common framework and set of objectives to ensure consistent data collection during fish-outs from various projects (Tyson et al. 2011). Given the variety of projects and diversity of fish and fish habitat, a detailed protocol is not practical; therefore, a site specific work plan should be developed for every project.

If a fish-out is deemed necessary (i.e., adheres to the recently introduced changes to the *Fisheries Act*), a site specific fish-out work plan will be developed once the Project has been approved, in accordance with the fish-out protocols (Tyson et al. 2011) and any specific understandings/requirements agreed to by DFO and AEM for the Project. The work plan will clearly outline how the fish-out program will be implemented, and will include specific objectives, core components, project management organization, field methodology, and deliverables. This document presents a summary of the fish-out protocol (Tyson et al. 2011) and includes a general outline that will be incorporated in the work plan.

7.1 Objective and Components

The primary objective of the fish-out program will be to ensure that fish stocks in the lakes and ponds to be destroyed are fully utilized. If a fish-out program is deemed necessary, it will have 3 core components: fish recovery from the lakes and ponds (including fish transfer to other waterbodies), collection of biological data, and distribution of fish to local communities.

7.2 Project Management

For the fish-out program, a project team will be created to develop and implement the work plan. The project team will include a DFO biologist, a project manager, a project biologist, and field technicians. The work plan will outline the roles and responsibilities for each team member for each component as well as the lines of communication and decision makers. The DFO biologist will be the principal contact for AEM during development of the work plan and will provide advice to AEM as required. The project manager will represent AEM and will be responsible for managing the fish-out program including developing the work plan, communicating with DFO, and providing deliverables. The project biologist will be a qualified biologist, and will be responsible for the technical requirements of the fish-out program including aiding in the development of the work plan, training field staff, supervising field activities and data collection, quality assurance/quality control, data analysis, and preparing deliverables. The field technicians will conduct the fish-out and data collection under the supervision and guidance of the project biologist.

7.3 Fish Recovery

The fish recovery is composed of 2 phases: Catch-per-Unit-Effort (CPUE)/fish transfer, and final removal. The lakes or ponds will be isolated during both phases and the CPUE phase will be completed prior to dewatering. The waterbody will be protected and monitored for physical and chemical changes during the CPUE phase (i.e., water levels and water quality will be monitored to ensure the protection of the fish during dewatering, which may occur prior to, or in conjunction with the final removal phase). During the development of the work plan, a mark-recapture study may or may not be included in the fish-out program[2]. All harvested fish will be transferred to adjacent waterbodies or sacrificed and distributed in accordance with the distribution of fish component of the work plan.

7.3.1 Catch-Per-Unit-Effort / Fish Transfer Phase

The objective for the CPUE phase is to collect fish community CPUE data for each fish population in a lake. This will involve harvesting fish using a standard unit of effort for the duration of the phase. The equipment type, fishing methods, and fishing periods will remain the same within each waterbody for the duration of the phase;

[2] During the 2008 fish-out of Second Portage Northwest Arm at the AEM Meadowbank Mine, the CPUE phase and resulting data using the DeLury and Leslie regression models proved to be a more accurate predictor of population size than the mark-recapture phase. Consequently, AEM will need to discuss the utility of using a mark-recapture method at the Project during the development of a fish-out plan. By omitting mark-recapture, it will allow the field team to concentrate their efforts on the CPUE and final removal phases.

however, the fishing effort may be increased (i.e., set more of the same type of net). Either gill nets or fyke nets will be used throughout the phase.

With DFO approval, fish that appear healthy and capable of recovery during the CPUE phase will be transferred to adjacent waterbodies. The decision to transfer the fish will be a made in the field by fish technicians under the direction of the project biologist. Although considerable effort will be made to salvage and transfer as many fish as possible, the effectiveness of the salvage efforts will be evaluated in consultation with DFO[3]. It is expected that the greatest number of fish will be salvaged during the first week of the CPUE phase, while catch rates remain high. Healthy fish that appear unaffected by capture and handling (i.e., valued ecosystem components such as Arctic grayling, lake trout, or Arctic char) will be prioritized for salvage.

Specific methods and effort for each waterbody will be outlined in the work plan in accordance with the fish-out protocol (Tyson et al. 2011). The project biologist, project manager, and DFO biologist will determine the end of the CPUE phase with consideration of the time available, seasonal changes, and changes in catch rates.

7.3.2 Final Removal Phase

The objective of the final removal phase is to harvest all remaining fish to provide a fish community census. The phase will likely start after partial dewatering of the waterbody; this will concentrate the fish into a smaller volume of water. Harvesting may include using all available fish capture techniques, including methods not used in the CPUE phase. Every effort will be made to harvest every fish from the waterbody. The removal phase will be completed when the following occurs:

- no fish are caught for 48 hours, and then after a 24 hour break, no fish are caught for an additional 48 hours; or
- catch has declined to near zero and the total abundance and/or biomass has reached at least 95% of the estimated initial abundance from the CPUE data.

7.4 Data Collection

For the majority of lakes and ponds to be affected by the Project, an aquatic biology survey has already been completed. For lakes and ponds where this has not been done prior to the fish-out, an aquatic biology survey including physical limnology, habitat inventory, water quality / nutrients, chlorophyll *a*, zooplankton, and benthos surveys will be completed. Sampling methods will be developed in accordance with the aquatic baseline surveys and Tyson et al. (2011).

During the fish-out, all harvested fish will be given a unique fish number, counted, measured, classified, and, if necessary, sacrificed for detailed data collection, and then distributed to the community in accordance with the work plan. Detailed data collection for a sub-sample of smaller, younger fish and all of the larger, older fish will include the following: weight, length, sex, maturity, reproductive status, marks, and tags. Ageing structures and biological tissues will also be collected, where appropriate.

[3] A fish transfer was successfully implemented during the 2010 fish-out of Bay-Goose Basin at the AEM Meadowbank Mine

7.5 Distribution of Fish to Communities

In addition to transferring fish to other waterbodies, a core component of the fish-out protocol is to ensure that fish are not wasted. As such, a considerable effort will be made to transfer as many fish as possible and at the same time collect detailed data to meet the DFO requirements. Fish that were not transferred will be distributed to the local communities. The goal for this component will be to engage the local communities and to ensure that harvested fishes are fully utilized by traditional resource users (Tyson et al. 2011). Most communities in Nunavut harvest fish stocks, in particular Arctic char and lake trout, for subsistence and/or for dog food (Tyson et al. 2011). During development of the work plan, the project manager will engage the local communities, including but not limited to Rankin Inlet, Chesterfield Inlet, and Whale Cove, to determine their interest and to discuss their level of involvement in the different phases of the fish distribution, including harvesting, sorting, dressing, and delivering fish to the communities. The work plan will include an outline of each community's involvement in the fish distribution, a proposed schedule, and specific details of how, when, and where the fish will be distributed.

7.6 Deliverables

During the fish recovery component (i.e., CPUE and final removal phases), a daily CPUE report will be submitted to DFO. The report will include total daily fish count and fishing effort. This will aid in determining the transition between the phases and the completion of the final removal phase.

At the completion of the fish-out program, AEM will submit all data collected in paper and electronic format (i.e., in Microsoft Access), and a summary data report that will present and discuss the data collected in relation to the objectives. The report will include population estimates for each lake, comparison to baseline data (if available), and a life history analysis for each species.

8.0 MONITORING PLANS

An aquatic monitoring program is essential to ensuring that the main component of the offsetting program (i.e., rehabilitation of end pit lakes) proceeds successfully. As part of the DFO authorization, site-specific detailed monitoring programs will need to be prepared for the Project to monitor the offsetting measures within numerous environmental conditions (e.g., end pit lakes, stream channels, reflooded basins). The details of the monitoring plans will be consulted with DFO as the Project develops, to ensure that appropriate parameters are being monitored at appropriate frequency.

Monitoring programs for end pit lakes will be long-term commitments. Data collected for baseline programs and during operations will be used to update and refine the end pit lake models. While the mine is operational, but before the pit is ready to begin filling, monitoring will focus on the chemistry of anticipated inflows. As recommended by CEMA (2012), the objectives of monitoring during operations will be to verify that inputs are similar to what was predicted in the FEIS and to refine model inputs and assumptions where conditions deviate from expectations.

During the filling stage, water and sediment quality will be monitored in the end pit lakes from the start of the filling period to verify if the predicted parameters reflect actual conditions. If water quality is not developing as planned, adaptive management may be necessary.

Vertical profiles of pH, temperature, conductivity, and dissolved oxygen will be measured to monitor the development of vertical gradients within the lake. Water quality parameters will be collected at multiple depths at least seasonally. As biota becomes established, monitoring will be expanded to track the establishment of aquatic communities and provide early warnings of potential undesirable trajectories in ecosystem development. Biological monitoring endpoints will include species composition and abundance of aquatic communities and indicator species. Communities to be monitored include phytoplankton and zooplankton, benthic invertebrates, and aquatic and riparian plants. The intensity of lower trophic monitoring will be sufficient to collect representative data in each major habitat type (e.g., benthic, littoral, profundal). The frequency of monitoring will be determined in consultation with DFO and stakeholders. Throughout this period, monitoring conducted during the operational phase would be continued for all inflow sources that have not yet been adequately characterized.

After the end pit lakes become hydraulically connected to the receiving environment, monitoring requirements will be similar to the recommendations provided for the filling stage, with the addition of frequent chemical and biological monitoring downstream of the end pit lake discharge into the receiving environment. Once fish colonize the end pit lakes, monitoring will be conducted to determine the success or failure as new fish habitat. The duration and frequency of monitoring during post-closure will be determined in consultation with DFO and stakeholders.

The construction of new diversion channels at closure will require rigorous monitoring to ensure that the new channels create fish passage to upstream lakes. The establishment of effective migration pathways will be critical to the colonization of end pit lakes by fish. A proper design of the new channels will also provide an opportunity to establish productive rearing habitat for juveniles and spawning habitat for Arctic grayling. Monitoring of Arctic grayling spawning success in the new and re-established streams will be an important component of spring monitoring programs.

9.0 CLOSURE

We trust the information provided herein meets your current needs. If you have any questions, please do not hesitate to contact the undersigned.

Yours very truly,

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

ORIGINAL SIGNED

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APPENDIX A

Consultations with Regulatory Agencies/Stakeholders and Minutes from November 2013 Meetings with HTO and DFO

Table A1. Fisheries Protection and Offsetting Planning: Summary of Consultations

Date	Description	Participants
1-Sep-09	Meeting with DFO to discuss preliminary compensation options at Meliadine	DFO, Comaplex and Golder
30-May-11	Invitation to attend July 13th workshop to discuss options for compensation in the north. This invitation was primarily to discuss Meadowbank NNL Planning, but also discussed regional fish compensation ideas such as creating fish access	sent to: KIA, NWB, NIRB, HTO and DFO
11-12-Jul-11	DFO site visit to Meliadine	DFO, AEM and Golder
13-Jul-11	No Net Loss Planning Workshop - Primarily discussed Meadowbank NNL but also discussed Meliadine Lake connection concepts and Pistol Bay fish access	HTO, KIA, DFO, AEM, Consultants
15-Aug-11	DFO site visit to Meadowbank and Meliadine	DFO and AEM
Jul/Aug-11	Discussion with Rankin Inlet HTO members about Pistol Bay access	HTO and AEM
2-Nov-11	Community consultation in Repulse Bay - included discussion of fisheries compensation	Repulse Bay community members and AEM
11-Nov-11	Agenda sent for November 17th meeting in Ottawa	DFO and AEM
17-Nov-11	November 17th and 18th meetings in Ottawa - presented and discussed Meliadine methods of calculating HUs and compensation concepts	DFO, AEM and Golder
13-Dec-11	Follow-up teleconference - general agreement by DFO on Meliadine HEP methods	DFO, AEM and Golder
31-Jan-12	Technical Memorandum detailing a HEP method comparison using Meadowbank 2005 vs Meliadine method	DFO, AEM and Consultants
12-Feb-12	Exploratory meeting with DFO Science to discuss research opportunities	AEM, U of G researchers, DFO Habitat and DFO Science
15-17-Aug-12	Meliadine site visit- included a site tour, presentation and discussions on compensation ideas and the application of DFO Risk Management Framework to Meliadine Project	DFO and AEM
28-Aug-12	DFO site visit - summary and action Items	DFO and AEM
2-Oct-12	Technical memorandum sent to DFO, outlining the application of DFO risk management framework to Meliadine	DFO and AEM
2-Oct-12	Chesterfield Inlet community consultation - included a discussion of fisheries monitoring and offsetting measures	Chesterfield Inlet community members and AEM
3-Oct-12	Whale Cove community consultation - included a discussion of fishout and fisheries monitoring	Whale Cove community members and AEM
24-Oct-12	Whale Cove consultation - Pistol Bay access (see Appendix E)	Whale Cove community members and AEM
6-Nov-12	Follow-up teleconference - DFO had general agreement with the memo sent on 2-Oct-12, outling the approach to risk management as applied at Meliadine.	DFO response to AEM
6-Nov-13	Discussed Meliadine project updates and fisheries offset planning during a KHTO board meeting	KHTO and AEM
7-Nov-13	Meeting to discuss fish habitat management and proposed offsetting options	KHTO, DFO and AEM
28-Feb-14	Teleconference call to discuss changes to the final version of the Offsetting Plan for FEIS submission.	DFO, AEM and Golder

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ᑲᖏᖅᓱᓂᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᖑᖁᑦ ᐊᒻᒪ ᐊᒃᓅᑯᒃᑯᑦ – ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᓕᕆᐊᒧᑦ ᒫᓇᒧᓕᖕᒐᓕᖅᑐᐃᓂᖅ ᐊᒻᒪ ᐅᖃᓪᓚᖕᓃᑦ ᔪᓚᐱᕆ 6-ᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᖑᒃᑯᑦ ᑲᑎᒪᓂᖏᕆᔭᖏᓐᓂᑦ.

ᐅᐸᓗᖅ: ᔪᓚᐱᕆ 6, 2013 – 7-ᒥᑦ 9-ᒧᑦ ᐅᓐᓄᒃᑯᑦ.
ᐱᔾᔪᑕᐅᔪᖅ: ᕿᒥᕐᕈᓂᖅ, ᒫᓐᓇᒧᓕᖕᒐᓕᖅᑐᐃᓂᖅ ᐊᒻᒪ ᐅᖃᐅᓯᐅᑲᓐᓂᖅ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒨᑦᑐᓕᕆᓂᕐᒧᑦ ᐱᓕᕆᐊᒥᑦ ᐊᒻᒪ ᕿᓂᖅᓴᐃᓂᕐᒧᑦ ᖃᓄᐃᓕᐅᕈᓘᔾᔨᕐᓂᐅᔪᓄᑦ.
ᓇᓂ: ᑲᖏᖅᓱᓂᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᖑᖁᑦ ᑲᑎᒪᕝᕕᖕᒐᓐᓂᑦ.
ᐃᓚᐅᖃᑕᐅᔪᑦ: ᕈᐊᔾᔭᓐ ᕚᓐᐊᖏᓐ, ᓯᑎᕚᓐ ᕌᐳᑦ; ᐆᒪᔪᓕᕆᔨᐊᖑᖁᓐᓄᑦ ᑲᑎᒪᔩᑦ – ᔪᐊᒪᓐ ᕗᐊᑦ, ᐹᓪ ᑲᓇᔪᖅ, ᐅᐊᔅᓕ ᐃᓄᒃᓯᒃ, ᔮᓐ ᑕᐃᐸᓈᖅ, ᔮᓐ ᑕᑎ, ᐊᒻᒪ ᓛᑎᐊ ᑕᑎ.

ᒫᓐᓇᒧᓕᖕᒐᓕᖅᑐᐃᓂᖅ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᓕᕆᐊᒧᑦ ᑐᓂᔭᐅᔪᖅ ᓯᑎᕚᓐ ᕌᐳᑦ-ᒧᑦ ᐆᒪᔪᓕᕆᔨᐊᖑᖁᓐᓄᑦ, ᑲᑎᒪᓂᖅᑳᖅᑎᓪᓗᒋᑦ ᔪᓚᐱᕆ 6-ᒥᑦ. ᐅᑯᐊ ᕿᒥᕐᕈᔭᐅᓚᐅᖅᑐᑦ ᐅᖃᐅᓯᐅᐸᓗᑎᒡᓗ:

- ᕿᒥᕐᕈᓂᖅ ᑕᐅᑐᒐᕆᔭᐅᔪᒥᒃ ᐱᓕᕆᐊᒧᑦ,
- ᑐᒃᑐᐃᑦ ᓅᖃᑦᑕᕐᓂᖏᓐᓄᑦ ᑐᑭᓯᐅᒪᔾᔪᑏᑦ,
- ᐊᓇᕐᕖᑦ ᑯᕙᖅᑕᖅᑕᐅᓂᖏᓐᓄᑦ ᐊᐅᓚᑦᑎᓃᑦ,
- ᐊᑉᕐᑯᑏᑦ ᐊᒻᒪ ᓇᐃᑐᒥᑦ ᐃᖃᓗᐃᑦ ᒥᒃᓵᓄᑦ ᐸᕐᓇᐅᑎᓂᒃ ᐅᖃᐅᓯᖃᕐᓂᖅ.

ᐅᑯᐊ ᑲᑎᒪᔾᔪᑏᑦ ᓇᐃᓈᖅᓯᒪᔪᑦ ᐅᖃᐅᓯᐅᓗᒃᑖᕐᓚᓚᐅᖅᑐᓂᒃ ᐊᒻᒪ ᐊᐱᕐᑯᑏᑦ ᐃᓯᒫᓘᑕᐅᔪᓪᓘᓃᑦ ᐆᒪᔪᓕᕆᔨᐊᖑᖁᓐᓄᑦ.

ᐱᒋᐊᕐᓗᑕ, ᓇᓗᓇᐃᔭᐃᓚᐅᖅᑐᒍᑦ ᐅᕙᑎᖕᓂᑦ ᐊᒻᒪ (SR) ᐊᒃᓅᑯᒃᑯᓐᓂᑦ ᐅᖃᐅᓯᖃᓚᐅᖅᑐᖅ ᐃᑰᑕᕐᓂᕐᒥᒃ ᐊᒻᒪ ᕿᓂᖅᓴᐃᓂᐅᔪᓄᑦ ᐱᓕᕆᐊᓂᒃ/ᐃᓂᑭᔭᐅᔪᓄᑦ ᖃᓄᐃᓕᕐᓂᐅᔪᓂᒃ 2013-ᒥᑦ ᐊᒻᒪ ᐅᖃᖅᖁᓂ ᐆᒪᔪᓕᕆᔨᐊᖑᖁᓐᓄᑦ ᖃᐅᔪᖅᑭᒪᔭᕌᖕᒐᑦ ᑐᙵᓱᒃᑎᑕᐅᖏᓐᓇᕐᓂᖏᓐᓄᑦ.

ᔪᐊᒪᓐ ᕗᐊᑦ – ᖃᖕᒐᒃᑯᑦ ᐅᐸᓗᕐᒥᑦ ᑕᐃᑯᖕᒐᐅᔪᖕᓇᖅᐱᑕ?
ᐊᒃᓅᑯᒃᑯᑦ – ᐆᒪᔪᓕᕆᔨᐊᖑᖁᑦ ᑕᐃᑯᖕᒐᐅᓇᔭᖅᐸᑎ ᑎᓯᐱᕆᒥᑦ ᓈᒻᒪᒐᔭᖅᐸ?

ᓛᑎᐊ ᑕᑎ – ᖃᓄᐃᒪᑦ ᐊᐅᔭᒃᑯᑦ ᐱᓕᕆᔩᖅᑲᕐᓂᖅᓴᐅᖃᑦᑕᖅᐱᓯ?
ᐊᒃᓅᑯᒃᑯᑦ – ᑕᐃᒪᓐᓇᐃᓗᐊᖅᑐᖅ ᕿᓂᖅᓴᐃᓂᖅᓴᖅᑕᖃᕐᓂᖅᓴᐅᖃᑦᑕᕐᒪᑦ (ᐃᑰᑕᖅᑐᑦ); ᖁᓕᓂᒃ ᐃᓄᖕᓂᒃ ᐃᑰᑕᕐᓂᐊᖅᑐᓂᒃ ᐱᔭᕆᐊᖅᑲᖃᑦᑕᖁᑕ ᐊᒻᒪ 7-ᓂᒃ ᐊᐅᓛᖅᑐᓂᒃ ᐃᑰᑕᖃᓚᐅᖅᖢᑕ ᐊᐅᔭᖅ. ᒫᓐᓇᐅᔪᖅ ᐃᒥᔫᖏᓐᓂᖅᓴᓂᒃ ᐃᓄᖅᑐᒧᑦ ᔪᓇᓕᐊᓛᒥᑦ ᐱᑕᖅᑲᐊᖅᑲᖏᓐᓂᖅᓴᐅᖕᒪᑦ ᓴᓇᔭᐅᕙᓪᓕᐊᔪᒧᑦ.

ᐆᒪᔪᓕᕆᔨᐊᓛᑯᑦ ᐱᐅᒃᓴᓚᐅᖅᑐᑦ ᐱᕚᓕᕐᓂᐅᔪᒥᒃ ᐊᓇᖅᑕᐅᑎᓕᕆᔾᔪᑕᐅᔪᒥᒃ ᑕᓯᕐᔪᐊᕐᒥᑦ 2013-ᒥᑦ.

ᓄᐊᒪᓐ ᕗᐊᑦ – ᖃᒪᒃᑎᑉᐸᓪᓕᐊᔪᑦ ᐃᓕᔭᐅᖃᑦᑕᕐᓂᐊᕆᕙᑦ ᓄᓇᐅᑉ ᐊᑖᓄᑦ ᓴᓗᓇᐃᑎᑐᑦ?
ᐊᒡᓃᑯᒃᑯᑦ – ᓇᐅᒃ ᖃᒪᒃᑎᑉᐸᓪᓕᐊᔪᑦ [TSF]-ᒥᐅᓗᐊᖑᓂᐊᖅᑐᑦ ᐊᒪᓗ 30%-ᖓᑦ ᑐᖅᑯᖅᑕᐅᓗᑎᒃ ᓄᓇᐅᑉ ᐃᓗᐊᓄᑦ ᖃᑯᖕᒍᑦ ᐊᐅᓛᖅᑎᓪᓗᒋᑦ.

ᐹᓪ ᑲᓇᔪᖅ – ᑕᓯᕐᔪᐊᕐᒥᑦ ᐊᑉᖁᑎ ᖃᒪᓂᑦᑐᐊᖅᑎᑑᕐᓂᐊᖅᐸ? ᐳᔪᖃᑖᖅᑲᕐᓂᐊᖅᐸ ᖃᒪᓂᑦᑐᐊᑉ ᐊᑉᖁᑎᖏᑦᑎᑐᑦ?
ᐊᒡᓃᑯᒃᑯᑦ – ᐊᑕᐅᓯᖅ ᐊᔾᔨᙱᑦᑕᖓ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐊᑉᖁᑎᒧᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᓗᒃᑖᖃᔭᐃᑦ ᓄᓇᒥᙵᖅᑐᖅ ᑕᐃᒪᓐᓇᓗᐊᖅ ᐳᔪᖃᑖᖅᑲᑦᑕᙱᓐᓂᖅᓴᐅᑉᓗᓂ. ᐊᒡᓃᑯᒃᑯᑦ ᐊᑐᕐᓂᐊᖅᑐᑦ ᐃᒪᕐᒥᒃ ᐊᒪᓗ ᐳᔪᖃᑖᖅᑲᓗᐊᖅᑎᑦᑎᑦᑕᐃᓕᔾᔪᑎᒥᒃ ᑭᓯᐊᓂ ᖃᐅᔨᒪᔪᒍᑦ ᐳᔪᖃᑖᖅᑕᖅᑲᕐᓂᐊᖅᑐᖅ.

ᐹᓪ ᑲᓇᔪᖅ – ᐳᔪᖃᑖᖅᑲᓗᐊᖅᑕᐃᓕᖅᑲᕈᑎᓂᒃ ᐊᑐᕐᑯᔨᓇᔭᙱᑦᑐᖓ; ᐃᑲᔪᓗᐊᖕᒋᓐᓇᓯᒋᑲᑉᑯ.

(SR) ᐅᖃᖅᑐᖅ ᓄᓇᓕᖕᒧᑦ ᖃᓂᓛᖅ ᐃᑳᕿᑎ ᐋᖅᑕᐅᓂᖓ ᐊᒪᓗ ᐊᑉᖁᑎ ᐱᐊᓂᒻᒪᕆᓕᕐᓂᕋᖅᖢᓂᐅᒃ. ᐃᒃᐸᒃᓵᒍ ᓴᓇᑦᑕᐃᓕᐊᕿᓯᐅᑉ ᐱᖃᑖᓂᑦ, ᐊᑦᑕᓇᖅᑐᖃᖅᑕᐃᓕᒪᓕᕆᓂᖅ ᐊᒪᓗ ᓴᓇᔭᐅᕙᓪᓕᐊᓂᖅ ᐊᑉᖁᑎ ᐱᐊᓂᖕᓂᐊᖅᑐᖅ ᐊᒪᓗ ᐅᑉᖁᑎ ᐅᒃᑯᐃᖓᓕᕐᓗᓂ ᕼᐋᓐᑕᓄᑦ.

ᔫᓐ ᑕᑎ – ᐆᒪᔪᓕᕆᔨᐊᓛᑯᑦ ᖁᕝᕙᐊᓯᙱᑦᑐᒻᒪᕆᐅᓚᐅᖅᑐᑦ ᐊᑉᖁᑎ ᐊᑐᖅᑕᐅᑕᐃᓕᔭᕆᐊᖃᖅᑎᓪᓗᒍ ᑐᒃᑐᐃᑦ ᓅᑉᐸᓪᓕᐊᑎᓪᓗᒋᑦ. ᔫᓐ ᑕᑎ ᐅᖃᖅᑐᖅ ᐊᑐᖅᑕᐅᔪᖕᓇᕐᓂᖓ ᓴᐳᑎᓯᒪᓚᐅᕐᒪᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᑐᖃᕐᒥᑦ ᐊᑐᖅᑕᐅᔪᒪᓗᐊᖅᑎᓪᓗᒍ ᑐᒃᑐᐃᑦ ᓅᑉᐸᓪᓕᐊᑎᓪᓗᒋᑦ ᑲᖏᖅᖠᓂᐅᑉ ᖃᓂᑕᖓᓂᑦ. ᐆᒪᔪᓕᕆᔨᐊᓛᒃᑯᑦ ᐃᓯᒪᔪᑦ ᐊᒡᓃᑯᒃᑯᑦ ᓯᖁᒥᑦᑎᓂᖏᓐᓂᒃ ᐊᖏᖅᑲᑎᒌᒍᑎᒋᔭᖏᓐᓂᒃ.

(SR) ᑭᐅᔪᖅ ᐊᒡᓃᑯᒃᑯᑦ ᐅᒃᑯᐃᕐᓂᐊᖅᑕᖓᑦ ᐊᑉᖁᑎ ᕼᐋᓐᑕᓄᑦ ᐊᑐᖅᑕᐅᔪᖕᓇᖅᓯᓗᓂ ᓴᓇᔭᐅᓂᖅ ᐱᐊᓂᒃᐸᑦ ᐊᒪᓗ ᐊᑦᑕᓇᖅᑐᓄᑦ ᓇᓗᓇᐃᑯᑏᑦ, ᐊᕙᓗᐃᑦ ᑕᒪᒃᑯᐊᕋᓗᐃᑦ ᐃᓕᔭᐅᕌᓂᒃᐸᑕ. ᑕᐃᒪᓐᓇᐃᑐᖅ ᐊᑦᑕᓇᖅᑐᖅᑕᖃᖅᑕᐃᓕᒪᓂᕐᒧᑦ ᐱᓕᕆᔨᐅᔭᓄᑦ ᐊᒪᓗ ᒪᖃᐃᑎᓄᑦ ᐊᑉᖁᑎᒥᑦ. ᐊᕐᕌᓂ, ᐊᑉᖁᑕᐅᑉ ᐃᓚᖓ ᓴᓇᔭᐅᔪᑦ ᐊᖏᔪᒻᒪᕆᐊᓗᖕᓂᒃ ᓄᓇᒃᑰᕈᑎᖅᔪᐊᓂᒃ ᐊᑐᓇᐊᖃᓚᐅᖅᒪᑕ; ᐅᓗᓇᐊᓇᖅᑑᓚᐅᕐᒪᑦ ᒪᖃᐃᑎᓄᑦ ᐊᑐᖅᑕᐅᔭᕆᐊᒃᓴᖅ ᐊᑉᖁᑎ. ᐊᖏᖅᑲᑎᒌᒍᑎ ᐊᒡᓃᑯᒃᑯᓐᓄᑦ ᓄᓇᓕᖕᒧᓪᓗ ᓯᖁᒥᑕᐅᓚᐅᙱᑦᑐᖅ ᐊᑉᖁᑎ ᐱᐊᓂᓚᐅᙱᓪᒪᑦ. ᕿᐃᔭᓐ ᕚᓐᐃᖕᒐᓐ ᐅᖃᖅᑐᖅ ᐊᒡᓃᑯᒃᑯᑦ ᑲᔪᓯᓂᐊᕐᓂᖏᓐᓄᑦ ᐱᐅᓯᕚᓕᖅᑎᑦᑎᓂᕐᒥᒃ ᐅᖃᖃᑎᖃᑦᑕᐅᑎᓂᐅᔪᒥᒃ ᐆᒪᔪᓕᕆᔨᐊᓛᑯᓐᓄᑦ ᐊᒪᓗ ᑲᑎᒪᓇᔨᙵᑦᑕ ᐃᓚᖓ ᓴᖅᑭᑦᑎᔪᒪᓂᕐᒧᑦ ᐅᖃᖃᑎᒃᑲᑦᑕᐅᑎᓂᕆᔭᖏᑦ ᐱᐅᓯᒋᐊᑲᓐᓂᕐᓂᕐᒧᑦ. ᑕᒪᓐᓇᓗ ᐱᐅᓯᕚᓕᖅᑎᑦᑎᓂᐊᖅᑐᖅ ᐆᒪᔪᓕᕆᔨᐊᓛᑯᑦ ᐱᒋᐊᕈᓂᖅᔪᒃ [AWR]-ᒧᑦ ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᑦᒍ ᖃᐅᔨᓴᐃᓂᖅ.

ᓄᐊᒪᓐ ᕗᐊᑦ, ᔮᓐ ᑕᑎ ᐊᒻᒪ ᓯᑎᐊ ᑕᑎ – ᐅᖃᖃᑎᖃᑦᑕᐅᑎᓂᕐᒧᑦ ᐋᖏᕆᐊᕆᐊᖃᕐᓂᕋᐃᔦᑦ ᐃᓱᒪᒃᓴᖅᓯᐅᕈᑎᖃᓚᐅᕐᒪᑕ ᖃᑉᓯᐊᕐᔦᐃᑦ ᒪᖃᐃᑏᑦ ᐋᖏᒃᓱᐃᓂᕐᒧᑦ ᓈᒻᒪᒃᓴᙱᓐᓂᕐᒥᒃ ᑐᒃᑐᐃᑦ ᑎᑭᑉᐸᓪᓕᐊᓕᔫᖅᑎᓪᓗᒋᑦ ᐊᒥᓱᑦ ᒪᖃᐃᑏᑦ ᓄᓇᓕᖕᒥᑦ ᐊᓐᓂᑯᒃᑯᓐᓂᒃ ᓯᕐᑯᒥᑦᑎᓇᓱᒋᓐᓈᓚᐅᕐᒪᑕ ᐊᖏᖃᑎᒌᒍᑎᒥᒃ ᐊᑐᖅᑕᐅᔾᔪᓇᕐᓂᖅᓚᓄᑦ ᐊᑉᕐᑯᑎ ᒪᖃᐃᑎᓄᑦ.

(SR) ᑭᐅᔪᖅ ᐊᓐᓂᑯᒃᑯᑦ ᐱᓕᕆᖃᑎᖃᕐᓂᐊᖅᑐᑦ ᐆᒪᔪᓕᕆᔨᐊᓖᑯᓐᓂᑦ ᑕᐃᒪᓐᓇᐃᑲᓐᓂᕈᒪᖏᓐᓂᕐᒧᑦ ᓯᕗᓂᕐᒥᑦ ᐅᖃᖃᑎᖃᑦᑕᐅᑎᓂᖅ ᐱᕚᓪᓕᖅᑎᓪᓗᒍ. ᐊᓐᓂᑯᒃᑯᑦ ᐊᑐᕈᓐᓇᖅᑎᑦᑎᓂᐊᖅᑐᑦ ᒪᖃᐃᑎᓂᒃ ᐊᒻᒪ ᐅᑭᐅᙳᓚᐅᖅᑐᖅ ᐊᒥᓱᓂᒃ ᐃᓕᑦᑎᓂᖃᓚᐅᖅᓱᑎᒃ.

ᑐᒃᑐᐃᑦ ᓅᓐᓂᕆᔭᖏᑦ ᑕᓯᕐᔪᐊᑉ ᖃᓂᑕᖓᓂᑦ ᓇᓗᓇᐃᓚᐅᖅᑐᑦ ᑐᒃᑐᐃᑦ ᓅᑲᑕᒧᐊᓚᐅᕐᓂᖏᓐᓄᑦ ᖃᒪᓂᐅᑉ ᐱᖓᓐᓇᖓᒍᑦ ᐊᒻᒪ ᐃᓚᖏᑦ ᐃᑳᖅᓱᑎᒃ ᓯᕘᑐᙱᓐᓂᐊᒍᑦ ᑕᓯᕐᔪᐊᑉ ᐅᔭᕋᒃᑕᖓᐊᑉ ᖃᓂᑖᒍᑦ.

ᐹᓪ ᑲᓇᔪᖅ – ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᐅᔾᔨᕈᓯᓚᐅᖅᑐᑦ ᐊᒥᓱᑦ ᓄᓇᒃᑰᕈᐄᑦ ᓄᖃᖃᑦᑕᓚᐅᖏᓐᓂᖏᓐᓄᑦ ᐊᒻᒪ ᐃᓚᖏᑦ ᖃᑉᓗᓈᑦ ᓄᓇᓕᖕᒥᑦ ᐊᑐᕈᓐᓇᖅᑎᑕᐅᑉᓗᑎᒃ ᐊᑉᕐᑯᑎᒥᒃ ᓄᓇᒃᑰᕈᑎᑎᒃ ᐊᑐᕐᓗᒋᑦ ᒪᖃᐃᓂᕐᒧᑦ.
ᐊᓐᓂᑯᒃᑯᑦ – ᐊᓐᓂᑯᒃᑯᑦ ᐱᓕᕆᑦᑎᐊᕐᓂᖅᓴᐅᓂᐊᖅᑐᑦ ᓯᕗᓂᕐᒥᑦ ᐱᓕᕆᖃᑎᒋᓗᒋᑦ ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᑕᒪᓐᓇᐃᑦᑕᕆᐊᖃᖅᑎᑦᑎᖏᓐᓂᕐᒧᑦ.

ᔮᓐ ᑕᑎ – ᑐᒃᑐᐃᑦ ᐃᑳᖅᑐᑦ ᐅᔭᕋᒃᑕᖓᐊᑉ ᖃᓂᑕᖓᒍᑦ, ᐊᓐᓂᑯᒃᑯᑦ ᐊᑐᕈᓐᓇᖅᐸᑦ ᐊᕙᓗᒥᒃ ᓴᓇᓗᑎᓪᓘᓃᑦ ᐊᑉᕐᑯᑎᒋᔭᐅᓂᐊᖅᑐᒥᒃ ᑐᒃᑐᓄᑦ ᓅᓐᓂᖏᑦ ᑲᔪᓯᕐᑯᑉᓗᒋᑦ?
ᐊᓐᓂᑯᒃᑯᑦ – ᐃᓱᒪᒃᓴᖅᓯᐅᖅᐸᓪᓕᐊᔪᑦ ᓈᑎᓂᕐᒥᒃ ᐅᔭᕋᒃᑕᖓᐊᑉ ᐃᓂᖓᓂᑐᓂᒃ ᐱᕐᑯᑎᓂᒃ ᐅᐊᖕᓇᖅᐸᓯᖕᒧᑦ ᐊᑉᕐᑯᑎᒋᔭᐅᔫᑐᒪᙱᒧᑦ ᑐᒃᑐᓄᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᓯᕕᑭᓐᓂᐅᔪᓄᑦ.

(SR) ᐊᐱᕆᔪᖅ ᐆᒪᔪᓕᕆᔨᐊᓖᑯᓐᓂᑦ ᖁᓕᒥᒎᓕᖕᓄᑦ ᐃᓱᒫᓘᑎᑕᖃᓚᐅᕐᒪᖔᑕ 2013-ᒥᑦ? ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᐃᓱᒪᔪᑦ ᐱᐅᓯᕚᓪᓕᕐᓂᖅᑕᖃᓚᐅᕐᓂᖓᓂᒃ ᐊᒻᒪ ᐊᓐᓂᑯᒃᑯᑦ ᐃᒃᐱᒍᓱᖕᓂᖃᓚᐅᕐᓂᖏᓐᓄᑦ ᑐᒃᑐᐃᑦ ᓅᐸᓪᓕᐊᓂᕆᔭᖏᓐᓂᒃ ᐅᑭᐅᖕᒍᔪᖅ. ᐅᑭᐅᖕᒍᒥᑦ, ᐊᓐᓂᑯᒃᑯᑦ ᖁᓕᒥᒎᓕᖕᒋᑦ ᐃᒃᐱᒍᓱᖕᓂᖃᓚᐅᖅᑐᑦ ᓂᕐᔪᑎᓂᒃ ᐊᒻᒪ ᑐᒃᑐᓂᒃ; ᑕᒪᓐᓇ ᐱᕚᓪᓕᖅᑐᒻᒪᕆᐊᓗᒃ ᐊᓯᖏᓐᓂᒃ ᐅᑭᐅᖕᒍᔪᓂᑦ, ᐱᓗᐊᖅᑐᒥᑦ 2009-ᒥᑦ.

(RV) ᐊᓐᓂᑯᒃᑯᓐᓂᑦ ᐅᖃᐅᓯᖃᖅᑐᖅ ᐱᔭᕆᐊᖃᕐᓂᐅᔪᒥᒃ ᐊᓯᐅᔨᑦᑕᐃᓕᒪᓂᕐᒥᒃ ᐃᖃᓗᒋᔭᐅᔪᓂᒃ ᓄᓇᖃᖅᑳᖅᑐᑦ ᐃᓄᐃᑦ ᐃᓕᑕᕆᓯᒪᔭᙱᑦᑎᒍᑦ, ᐃᖃᓗᒃᓯᐅᕐᓂᑐᐃᓐᓇᖅ ᐊᒻᒪ ᑮᓇᐅᔭᓕᐅᕋᓱᒃᓱᑎᒃ ᐃᖃᓗᒃᓯᐅᕐᓂᖅ ᓇᓗᓇᐃᖅᑕᐅᔪᖅ ᓄᑖᒥᑦ ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᑦ ᐊᑐᐊᒐᙵᓐᓂᑦ. ᐊᓐᓂᑯᒃᑯᑦ ᐅᖃᐅᓯᖅᑎᑦᑎᓚᐅᖅᑐᑦ ᐊᒻᒪ ᑲᑎᖅᓱᐃᑉᓗᑎᒃ ᑐᑭᓯᐅᒪᔾᔪᑎᓂᒃ ᐆᒪᔪᓕᕆᔨᐊᓖᑯᓐᓂᑦ ᐃᖃᓗᐃᑦ ᐊᔾᔩᙱᑦᑐᑦ ᐊᒻᒪ ᐃᓄᐃᑦ ᐃᖃᓗᓕᕆᔾᔪᓯᖏᑦ ᒥᐊᓂᕆᔭᐅᖁᒧᑦ. ᐊᓐᓂᑯᒃᑯᑦ ᖃᐃᖃᑕᐅᖁᔨᓚᐅᖅᑐᑦ ᑲᑎᒪᓂᐅᓂᐊᖅᑐᒧᑦ ᓄᕕᐱᕆ 7-ᒥᑦ ᐅᖃᐅᓯᖃᕐᓂᐊᕐᓗᑎᒃ ᐃᖃᓗᖕᓂᒃ ᒥᐊᓂᖅᓯᓂᕐᒧᑦ ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᓐᓄᑦ ᐊᓐᓂᑯᒃᑯᑦ ᑎᑎᕋᕐᕕᖓᓐᓂ. ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ

AGNICO EAGLE

ᐊᒡᓃᑯ ᐄᒍ

ᐅᖃᐅᓯᖃᓗᐊᓚᐅᖅᑐᑦ ᒪᖃᐃᑏᑦ ᐃᖃᓗᒃᓯᐅᓗᐊᖃᑦᑕᕐᓂᖏᓐᓄᑦ ᐊᖏᓂᖅᓴᓂᒃ ᑕᓯᕐᓂᑦ, ᒥᑭᔪᓂᐅᖏᑦᑐᖅ. ᑕᓯᕐᔪᐊᖅ, ᖃᒪᓂᖅ ᑲᖏᓪᓕᖅ, ᖃᒪᓂᕐᓗ ᐃᓱᒪᒋᔭᐅᔪᑦ ᐱᒻᒪᕆᐅᓂᖏᓐᓄᑦ ᐊᒪᓗ ᒥᑭᓂᖅᓴᐃᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᓄᕗᖕᒐᓃᑐᑦ ᐱᒻᒪᕆᐅᓗᐊᖏᓗᑎᒃ. ᐅᑯᐊ ᐃᖃᓗᐃᑦ ᐱᒻᒪᕆᐅᒋᔭᐅᓗᐊᖅᑐᑦ ᐆᒪᔪᓕᕆᔨᐊᓖᒃᑯᓐᓄᑦ: ᓱᓗᒃᐸᐅᒐᐃᑦ, ᐅᓘᕋᐃᑦ ᐊᒪᓗ ᐃᖃᓗᒃᐲᑦ

ᓄᐊᒪᓐ ᕗᐊᑦ, ᓕᑎᐊ ᑕᑎ, ᔫᓐ ᑕᑎ – ᐱᔾᔨᑎᒋᑉᓗᒋᑦ ᐱᓕᕆᐊᖅᑕᖃᕈᓐᓇᕐᓂᖅ ᐱᓕᕆᐊᒃᓴᖃᕐᓂᕐᓗ, ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᑕᔫᑦ ᒥᑭᓂᖅᓴᐃᑦ ᐊᑐᕈᓐᓃᖅᓱᐊᖅᐸᑕ ᓱᕐᑯᑎᒃᓴᙱᑦᑐᑦ ᐅᔭᕋᒃᑕᓇᐊᑉ ᖃᓄᐃᑑᓂᐊᕐᓂᖓ ᑕᐅᑐᒃᓱᒍ.

ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᐃᓱᓕᓚᐅᖅᑕᖓᑦ ᑲᑎᒪᓂᖅ ᐊᒪᓗ ᐊᒡᓃᑯᒃᑯᑦ ᕿᔭᓐᓇᒦᖅᓱᑎᒃ ᑐᓂᓯᔪᒃᑖᓂᒃ ᐃᓱᒪᒋᔭᖏᓐᓂᒃ ᐊᒪᓗ ᐅᔭᕋᒃᑕᓇᐊᒍᙱᐅᓂᐊᕐᓂᖏᓐᓂᒃ ᑎᓯᐱᓇ 7-ᒥᑦ ᓂᓇᐅᑎᐊᖅᓱᑎᒃ.

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ᐅᖃᓘᑎᖓ: 819.759.3555   ᐊᑭᖃᙱᑦᑐᒃᑯᑦ: 1.888.822.6714 agnicoeagle.com

KHTO & AEM – Meliadine Project update and discussion during the Nov 6th HTO board meeting

Date: November 6th, 2013 – 7:00 pm to 9:00pm
Subject: Review, update and discussion of Meliadine Gold Project and Exploration activities
Location: Kangliqlinik Hunting and Trapping Organization board room
Participants from AEM -Ryan VanEngen, Stephane Robert; KHTO board members - Norman Ford, Paul Kanayok, Wesley Innkshuk, John Taipana, John Tatty, and Lydia Tatty,

An update on the Meliadine Project was provided by Stephane Robert (SR) to KHTO, during their board meeting on Nov 6th. The following topics were reviewed and discussed:

- a review of the focus on the project,
- caribou migration information,
- sewage discharge control measures,
- road access and a brief fisheries planning discussion.

The following minutes summarize most of the discussion and questions or concerns that were raised by the KHTO.

To begin, we introduced ourselves and SR of AEM described the drilling and exploration program/ site activities in 2013 and expressed to the KHTO that visits are always welcome.

Normand Ford (NF) – What day can we have a site visit?
AEM – will a visit work for the KHTO on Dec 7th?

Lydia Tatty (LT) – Why is there higher employment in the summer?
AEM- this is primarily due to higher exploration activity (more drills); we require around 10 persons per drill and we had > 7 drills running in the summer. At present we have fewer people because there is less camp support required for the ramp construction.

KHTO was impressed with the improvement of the sewage treatment at Meliadine in 2013.

NF- will tailings be deposited underground like in Yellowknife?

AEM- no the tailings will be mostly in TSF and 30% will be stored underground with concrete (paste backfill) during operation.

Paul Kanayok (PK) – will the Meliadine Road be like in Baker Lake? Will there be dust like on the Baker Lake road.
AEM - The one difference is that the majority of the material used for the Meliadine road is from natural esker material that is not as fine and should not produce as much dust. AEM will use water and dust suppression but we know there will be some dust.

PK- would not recommend calcium chloride; it is his opinion that this material doesn't work well.

SR described the hamlet bridge removal and road construction that is nearly finished. Within the next week, the safety measures and construction along the road will be completed and the road will be opened for ATVs.

John Tatty (JT) – KHTO was very upset regarding the road restrictions during peak caribou migration this year. JT expressed that the access was cut off of a common and traditional route during a critical time of the caribou migrating near Rankin Inlet. It was KHTO's opinion that AEM broke their agreement.

SR responded that AEM will open the road to ATVs once the construction is completed and safety signs, gates etc. are installed. This is to ensure safety for workers and hunters along the road. This past year, areas of the road were under construction with very large heavy equipment; it was unsafe for hunters to use the road. The agreement between AEM and the community was not broken as the road construction is not complete. Ryan VanEngen (RV) expressed that AEM will continue to improve our communication with the KHTO and that part of the meeting with the KHTO today is to establish better lines of communication. This will also improve once the KHTO begin the AWR monitoring surveys.

NF, JT and LT– we need to improve communication because there was consideration with a few hunters to organize a revolt during the peak migration as many hunters in the community felt that AEM had broken the agreement of providing road access to hunters.

SR responded that AEM will work with the KHTO to prevent this in the future by improving communication. AEM will provide full access to hunters and this past year has many lessons learned.

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Caribou migration patterns near the Meliadine Lake indicated that caribou were mostly passing west of Peter Lake and some passed thru the narrowing at Meliadine Lake near the mine site.

PK- KHTO noticed that many trucks did not stop and that some white folks in town were given permission to use the road with their trucks for hunting.
AEM- AEM will do a better job in the future in collaboration with the KHTO at enforcing this.

JT- if caribou pass near the site, could AEM use fence or create a safe pathway for caribou to continue their migration?
AEM- We are in the process of considering moving the mine infrastructure to the north to avoid the main pathway of the caribou near the Meliadine Lake narrows.

SR asked the KHTO if there were any helicopter concerns in 2013? KHTO thought there was a significant improvement and that AEM was respectful of caribou migration this year. Throughout the year, AEM choppers respected the wildlife and caribou; this is a significant improvement from other years, especially 2009.

RV of AEM discussed the need to conserve the local fisheries identified based on aboriginal (inuit), recreational and commercial fisheries defined by the new DFO policy. AEM led an informal discussion and collected information from KHTO to ensure fish species and inuit fisheries are protected. AEM also invited attendees to a meeting held Nov 7th to discuss fisheries protection with DFO at the AEM office. Overall, the KHTO commented that hunters fish primarily in large lakes, not small shallow lakes. Areas in Meliadine Lake, Peter Lake, Diane Lake are considered important and that smaller Meliadine peninsula lakes are not important. The following fish species are most important to the KHTO: Arctic grayling, lake trout and Arctic char

NF, LT, JT - for the benefit of jobs and employment, the KHTO is willing to sacrifice the loss of these small lakes lost due to the proposed mine footprint.

The KHTO board ended the meeting and AEM thanked everyone for their input and look forward to the site visit on Dec 7th.

Agnico Eagle - Meliadine Project

Meeting with HTO - November 6th, 2013; 7pm

Attendance List

Name	Signature	Organization
RYAN VANENGEN	[illegible]	AEM
Stephane Robert	[illegible]	AEM
Wesley Innukshuk	[illegible]	HTO
Paul Kanayok	P. K. ALAYOK	HTO
KOWMUK	6OL	
John Tatty	John Tatty	HTO
LYDIA TATTY	[illegible]	HTO
JOHN TAIPANA	[illegible]	H.T.O.

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ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᑦ, ᐆᒪᔪᓕᕆᔨᐊᓛᒃᑯᑦ [NRI]-ᑯᑦ ᐊᒻᒪ ᐊᒃᓂᑯᒃᑯᑦ – ᑕᓯᕐᔪᐊᕐᒥ ᐅᓴᕿᒃᑕᕆᐊᑦ ᐃᖃᓗᐃᑦ ᒥᒃᓵᓄᑦ ᐅᖃᖃᑎᖃᖃᑦᑕᐅᑎᓂᖅ

ᐅᐸᓗᖅ: ᓘᕕᐱᕆ 7, 2013 – 9-ᒥᑦ – 11:30ᒧᑦ ᐅᐸᓛᑯᑦ
ᐱᔾᔪᑕᐅᔪᖅ: ᕿᒥᕐᕈᓂᖅ ᐊᒻᒪ ᐅᖃᐅᓯᖃᕐᓂᖅ ᐃᖃᓗᖕᓂᒃ ᐃᓂᒋᓴᖕᒋᓐᓂᓪᓗ ᐊᒃᑐᖅᑕᐅᓯᒪᑐᐃᓐᓇᕆᐊᖃᖅᑐᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᓕᕆᐊᒧᑦ – ᕿᒥᕐᕈᓂᖅ ᐃᓄᐃᑦ (ᓄᓇᖃᖅᑳᖅᑐᑦ), ᐃᖃᓗᒃᓯᐅᒥᐊᖃᑦᑕᕐᓂᖏᓐᓂᒃ ᐊᒻᒪ ᑮᓇᐅᔭᓕᐅᕈᑎᒋᓴᐅᐸᓗᑎᒃ ᐃᖃᓗᐃᑦ.
ᓇᓂ: ᐊᒃᓂᑯᒃᑯᑦ ᑎᑎᕋᕐᕕᖓᓐᓂᑦ
ᐃᓚᐅᖃᑕᐅᔪᑦ: ᕈᐊᔭᓐ ᕚᓐᐊᖕᒋᓐ (ᐊᒃᓂᑯᒃᑯᓐᓂᑦ), ᓯᑎᕚᓐ ᖀᐳᑦ (ᐊᒃᓂᑯᒃᑯᓐᓂᑦ), ᐃᓕᓵ ᐸᑐᕉ (ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᑦ – ᐅᖃᔫᑎᒃᑯᑦ/ᕗᐃᐸᒃᔅ), ᔫᐊᒪᓐ ᕗᐊᑦ (ᑲᖏᖅᖠᓂᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᓛᒃᑯᓐᓂᑦ), ᐊᒻᒪ ᔮᓐ ᑕᐃᐸᓈᖅ (ᑲᖏᖅᖠᓂᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᓛᒃᑯᓐᓂᑦ).

ᓇᓗᓇᐃᔭᐃᓂᖅ - ᕈᐊᔭᓐ ᕚᓐᐊᖕᒋᓐ (RV) ᐊᒻᒪ ᓯᑎᕚᓐ ᖀᐳᑦ (SR)

(RV) ᕈᐊᔭᓐ ᕚᓐᐊᖕᒋᓐ ᕿᒥᕐᕈᔭᖕᒋᑦ ᐱᓕᕆᐊᖑᔪᒪᔪᑦ/ᑐᖃᒐᕆᔭᖕᒐ ᑲᑎᒪᓂᐅᑉ:

- ᕿᒥᕐᕈᓂᖅ ᐃᖃᓗᐃᑦ ᒥᒃᓵᓅᖓᔪᑦ ᓈᓴᐅᑏᑦ/ᑎᑎᖃᐃᑦ ᒨᓪᑐᒃᑯᓐᓄᑦ ᑲᑎᑕᐅᔪᑦ – ᐃᓕᑦᑕᖅᓯᓂᖅ ᐃᖃᓗᐃᑦ ᓇᓂᓴᐅᔪᓂᒃ ᓄᕗᓕᖕᓂᑦ ᑕᓯᕐᓂᑦ ᐊᒻᒪ ᑕᓯᕐᔪᐊᕐᒥᑦ
- ᐃᓕᑦᑕᖅᓯᓂᖅ ᐃᒃᐱᒋᔭᐅᔪᑦ ᐊᔾᔨᒌᖏᑦᑐᑦ ᐃᖃᓗᐃᑦ
- ᐅᖃᐅᓯᖃᕐᓂᖅ ᐃᓕᑦᑕᖅᓯᓂᕐᓗ ᑮᓇᐅᔭᓕᐅᕈᑎᒋᓴᐅᐸᓗᑎᒃ ᐃᖃᓗᐃᑦ, ᐃᖃᓗᒃᓯᐅᖅᑕᐅᒥᐊᖅᑐᓪᓗ ᐊᒻᒪ ᐃᓄᖕᓄᑦ ᐃᖃᓗᓕᕆᓃᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᓕᕆᐊᒦᖓᔪᓂᑦ

ᒫᓐᓇᒨᓕᖓᓕᖅᑐᖅᑕᐅᓚᐅᖅᑐᖅ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᓕᕆᐊᖅ ᑲᖏᖅᖠᓂᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᓛᑯᖕᒋᑦ ᑲᑎᒪᓂᖃᖅᑎᓪᓗᒋᑦ ᐊᒃᓂᑯᒃᑯᑦ ᐅᕐᓂᒃᓯᒪᓚᐅᖅᑕᖓᓐᓂᑦ ᓘᕕᐱᕆ 6-ᒥᑦ 7-ᒧᐊᖅᑎᓪᓗᒍ ᖃᐅᔨᓴᐅᑎ ᐅᓐᓄᒃᓴᒃᑯᑦ. ᑲᑎᒪᓂᕐᒥᑦ, ᐊᒃᓂᑯᒃᑯᑦ ᑐᑭᓯᐅᒪᔾᔪᑎᓂᒃ ᑕᑯᑎᑦᑎᓚᐅᖅᑐᑦ ᐅᑯᓂᖖᒐᑦ:

- ᐱᓕᕆᐊᒥᑦ ᒫᓇᒨᓕᖓᓕᖅᑐᐃᓂᖅ ᐊᒻᒪ ᓇᓃᓕᕐᓂᖓᑦ ᕿᓂᖅᓴᐃᓂᕆᔭᖕᒐᓐᓂᒃ,
- ᑐᒃᑐᐃᑦ ᓅᖃᑦᑕᕐᓂᕆᔭᖕᒋᑦᑕ ᑐᑭᓯᐅᒪᔾᔪᑎᓂᒃ
- ᐊᓇᕐᕖᑦ ᑯᕕᖅᑕᖅᑕᐅᓂᖏᓐᓄᑦ ᐊᐅᓚᑦᑎᓅᑦ,
- ᐊᐸᕐᑯᑎ ᐊᑐᖅᑕᐅᔪᖕᓇᕐᓂᖓ, ᐊᒻᒪ
- ᓇᐃᑐᒥᒃ ᐃᖃᓗᐃᑦ ᒥᒃᓵᓅᖓᔪᓂᒃ ᐸᕐᓇᐃᓂᕐᒧᑦ ᐅᖃᐅᓯᖃᕐᓂᖅ.

ᓯᑎᕚᓐ ᖀᐳᑦ (SR) ᐅᖃᓚᐅᖅᑐᖅ ᐆᒪᔪᓕᕆᔨᐊᓛᒃᑯᓐᓄᑦ ᐅᖃᐅᓰᑦ ᐱᔭᐅᕙᒌᖅᑐᑦ [NIRB PHC]-ᑯᓂᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᓕᕆᐊᒧᑦ ᑐᙵᓱᒃᑎᑕᐅᔪᑦ ᓘᕕᐱᕆ 22-ᖑᖅᓴᓂᖓᓄᑦ. ᑎᓯᐱᕆ 2-ᒥᑦ 5-ᒧᑦ [PHC]-ᑯᑦ ᐱᕕᖃᖅᑎᑦᑎᓂᐊᖅᑐᑦ ᑕᒪᐃᓐᓄᒃᑖᖅ ᐅᖃᐅᓯᖃᕐᓂᕐᒥᒃ ᐊᕙᑎᒥᑦ ᐊᒻᒪ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᐅᖃᐅᓯᖅ-ᒥᑦ [DEIS]-ᒥᑦ ᐊᒻᒪ ᓄᓇᓕᖕᒥᐅᑦ ᐃᓚᐅᑎᓕᕐᓗᒋᑦ ᓴᓇᑦᑕᐃᓕᐊᕈᓯᕐᒥᑦ ᖃᐃᔪᒥᑦ.

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ᓄᐊᒪᓐ ᔪᐊᑦ (NF) – ᐆᒪᔪᓕᕆᔨᐊᓛᑯᓐᓂᑦ ᑐᓂᓯᓚᐅᖅᑐᖅ ᐅᖃᐅᓯᕆᔭᑉᑎᖕᓂᑦ ᐊᕙᑎᒥᑦ ᐊᒻᒪ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᐅᖃᐅᓯᖅ-ᐅᑉ [DEIS] ᒥᒃᓵᓄᑦ [NIRB]-ᑯᓐᓄᑦ
ᐊᒡᓃᑯᒃᑯᑦ – [IR]-ᑯᑦ ᑭᐅᔾᔪᓯᖏᑦ ᐊᐅᓚᖅᑎᑕᐅᓚᐅᖅᑐᑦ [NIRB]-ᑯᓐᓄᑦ ᐊᒻᒪ ᑲᖏᖅᖠᓂᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᓛᑯᓐᓄᑦ. (SR) ᐊᐅᓚᖅᑎᓐᓂᐊᖅᑕᖏᑦ ᑭᐅᔾᔪᑕᐅᔪᑦ [IR]-ᑯᓐᓂᑦ ᑲᖏᖅᖠᓂᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᓛᑯᓐᓄᑦ ᖃᓇᑕᐅᔭᒃᑯᑦ.
ᓄᐊᒪᓐ ᔪᐊᑦ ᐊᐱᕆᔪᖅ – ᖃᑯᒍ ᐅᒥᐊᖅ ᐊᑐᓕᖅᑎᑕᐅᓂᐊᖅᐸ.
ᐊᒡᓃᑯᒃᑯᑦ – ᐱᐊᓂᒃᓵᖏᑦᑐᖅ ᑭᓯᐊᓂ [NIRB]-ᑯᓐᓄᑦ ᓈᒻᒪᒋᔭᐅᕘᓂᒃᐸᑦ ᐊᒻᒪ ᑐᒡᓕᕆᔭᖓᓂᒃ [AWR] ᓴᓇᔭᐅᕘᓂᒃᐸᑦ. ᑐᒡᓕᕆᔭᖓᓂᑦ ᐊᑉᖁᑎᓕᐊᕐᒥᑦ ᐃᓚᐅᓂᐊᖅᑐᖅ [discovery] ᐊᑉᖁᑎ ᑕᕐᔪᐊᑉ ᖃᓂᑕᖓᓂᑦ ᓂᒋᖅᐸᓯᐊᓄᑦ.

ᑲᖏᖅᖠᓂᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᓛᑯᑦ – ᓇᓕᖏᑦ ᑕᓰᑦ ᐊᓯᐅᔨᔭᐅᓯᒪᐃᓐᓇᓕᖅᑑᓂᐊᖅᐸᑦ?
ᐊᒡᓃᑯᒃᑯᑦ – ᐅᖃᖅᓯᒪᓂᖓᑐᑦ ᐊᕙᑎᒥᑦ ᐊᒻᒪ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᐅᖃᐅᓯᖅ-ᒥᑦ [DEIS]-ᒥᑦ, B4, B7 ᐊᒻᒪ B5.

ᓄᐊᒪᓐ ᔪᐊᑦ – ᐅᖃᖅᑐᖅ ᓄᔪᐃᑦ ᐃᖃᓗᒃᓯᐅᕝᕕᐅᓗᐊᖃᑦᑕᖏᓐᓂᖏᓐᓄᑦ. ᐆᒻᒪᔪᓕᕆᔨᐊᓛᒃᑯᑦ "ᓴᑉᑯᑦᑐᒪᔪᖕᓇᖅᑕᖏᑦ" ᑕᓲᑦ ᓄᔪᖕᒦᑐᑦ ᐅᔭᕋᒃᑕᕆᐊᓕᐊᖑᔪᒪᔫᑐᑦ ᐱᓕᕆᑎᑦᑎᓂᖅ ᐊᒻᒪ ᐱᓕᕆᐊᓄᑦ ᐅᔭᕋᒃᑕᕆᐊᖅ ᓴᖅᑭᑎᑦᑎᓐᓂᐊᖅᐸᑦ ᑲᖏᖅᖠᓂᕐᒥᑦ.

ᐃᓕᓴᐱᑦ ᐸᑐᕉ ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᓐᓂᑦ ᐅᖃᖅᑐᖅ ᐃᒪᕐᒥᐅᑕᓕᕆᓂᕐᒧᑦ ᐱᖁᔭᕐᒥᑦ ᐊᓯᐊᖑᕐᓃᑦ ᐊᑐᕐᓂᐊᖅᑐᑦ ᑕᓯᕐᔪᐊᒥᑦ ᐱᓕᕆᐊᒧᑦ. ᓄᑖᖅ ᐊᑐᐊᒐᖅ ᐊᑐᓕᕐᓂᐊᖅᑐᖅ ᓄᕕᐱᕆ 25-ᒥᑦ ᑕᐅᑐᒐᖅᑯᓂ ᓇᓗᓇᐃᖅᓯᓂᕐᒥᒃ ᐃᖃᓗᓕᕆᓂᕐᒧᑦ (ᓄᓇᖃᖅᑳᖅᑐᑦ) ᐃᓄᖕᓂᒃ, ᐃᖃᓗᒃᓯᐅᑐᐃᓐᓇᕐᓂᕐᒧᑦ ᐅᕙᓘᓃᑦ ᐃᖃᓗᒃᓯᐅᕐᓂᖅ ᑮᓇᐊᔭᕆᐅᕈᑎᒋᔭᐅᓂᕐᒧᑦ (ARC). ᑲᓄᐃᓕᐅᕐᓂᓕᔭᖓᑦ – ᐊᑐᐊᒐᒥᑦ, ᐊᑐᖅᑎᓪᓗᒍ ᑕᓯᕐᔪᐊᒥᑦ ᐱᓕᕆᐊᒧᑦ, ᓇᓗᓇᙱᓐᓂᖅᓴᐅᓂᐊᖅᑐᖅ ᑲᑎᒪᓂᖅᑳᖅᑎᓪᓗᒋᑦ ᐊᒻᒪ ᐃᓕᓐᓂᐊᖅᑎᑦᑎᓂᖅ ᐱᐊᓂᒃᐸᑦ ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᖏᓐᓄᑦ, ᑎᓯᐱᕆ 3 ᐊᒻᒪ 4-ᒥᐅᓇᔭᖅᑐᖅ [ON]-ᒥᑦ. ᑭᓯᐊᓂ ᑖᒻᓇ ᐃᓚᐃᓗᑕᐅᔪᖅ ᑲᑎᒪᑎᑦᑎᓂᐅᓂᐊᖅᑐᒥᑦ.

ᕿᒥᕐᕈᓂᖅ ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᑦ ᑭᒡᓕᓕᐅᕐᓂᕐᒧᑦ ᓈᓴᐅᑎᖏᑦ/ᑎᑎᖅᑲᖏᑦ ᐊᒻᒪ ᐊᓯᐅᔨᖏᓐᓂᕐᒧᑦ ᐸᕐᓇᐅᑎ – ᕈᐊᔨ (RV) - ᐊᒡᓃᑯᒃᑯᑦ
ᐊᒡᓃᑯᒃᑯᑦ ᕿᒥᕐᕈᓚᐅᖅᑐᑦ ᐃᓄᐃᑦ ᖃᐅᔨᒪᓂᕆᔭᖏᓐᓂᒃ ᐃᖃᓗᐃᑦ ᒥᒃᓵᓄᑦ

- ᐃᓕᑕᖅᓯᓂᖅ ᐃᖃᓗᖕᓂᒃ ᓄᔪᖕᓃᑐᓂᒃ ᑕᓯᕐᓂᑦ
- ᕿᒥᕐᕈᓗᒋᑦ ᐃᖃᓗᖕᓄᑦ ᐃᓂᒋᔭᐅᔪᓄᑦ ᐊᓯᐅᔨᓂᐅᓂᖅᑕᐅᔪᑦ, ᐅᑎᖅᑎᑦᑎᓂᖅ ᐊᒻᒪ ᐃᖃᓗᖕᓂᒃ ᖃᐅᔨᒋᐊᖅᑕᖃᑦᑕᕐᓂᖅ ᑕᓯᕐᔪᐊᒥᑦ ᐊᒻᒪ ᐃᓚᖏᓐᓂᒃ ᐊᑦᑎᖕᓂᖅᓴᓂᑦ ᓄᔪᖕᒦᑐᓂᒃ

- ᐊᒡᓃᑯᒃᑯᑦ ᑕᐅᑐᒐᖅᑲᓂᐊᖅᑐᑦ ᒥᐊᓂᖅᓯᓂᕐᒧᑦ ᐊᒻᒪ ᐱᐅᓯᕚᓕᖅᑎᑦᑎᓂᕐᒥᒃ ᐃᖃᓗᓕᕆᓂᖅ ᑕᓯᕐᔪᐊᑉ ᖃᓂᑕᙵᓂᒃ (ᓄᓇᖃᖅᑳᖅᑐᑦ) ᐃᓄᐃᑦ ᐱᓕᕆᖃᑎᒋᓗᒋᑦ, ᑮᓇᐅᔭᓕᐅᕈᑕᐅᑉᓗᑎᒃ ᐃᖃᓗᒃᓯᐅᕐᓃᑦ ᐊᒻᒪ ᐃᖃᓗᒃᓯᐅᑐᐃᓄᕐᓂᕐᒧᑦ ᐃᒃᐱᒋᔭᐅᔪᑦ.
    - ᑐᕌᖓᔪᓄᑦ ᐅᑎᖅᑎᑦᑎᓂᕐᒧᑦ ᐱᓕᕆᐊᓂᑦ ᐃᓚᐅᔪᑦ ᐃᓗᑦᑐᖅᑎᕆᓂᖅ ᓄᓇᒥᑦ [Fzone]-ᒥᑦ ᐊᒻᒪ ᑯᕕᖅᑕᕐᕕᖕᒥᑦ ᓄᓈᑉ ᖃᓂᑕᙵᓂᑦ ᓴᖅᑭᑦᑎᓂᐊᖅᑐᖅ ᓄᑖᒥᒃ ᐃᓂᒋᔭᐅᔪᒥᑦ ᑎᑭᐅᑎᔭᐅᔪᓐᓇᕐᓗᓂᓗ ᐃᓅᓚᓄᑦ ᐃᖃᓗᒃᐱᖕᓄᓪᓗ ᑕᓯᕐᔪᐊᕐᒥᑦ. ᑕᒪᓐᓇᓗᒃᑖᖅ ᓇᐃᑑᓚᓗᐊᒥᒃ ᑐᑯᒃᓴᐅᑎᑕᐅᓚᐅᖅᑐᖅ ᐊᒻᒪ ᐅᖃᐅᓯᐅᓯᒪᑉᓗᓂ ᐊᕙᑎᒥᑦ ᐊᒻᒪ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᐅᖃᐅᓯᖅ-ᒥᑦ [DEIS]-ᒥᑦ.
    - ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᑦ ᑕᐅᑐᒐᖅᑲᓂᐊᖅᑐᑦ ᒥᐊᓂᖅᓯᓂᕐᒥᒃ ᐃᖃᓗᖕᓂᒃ, ᐃᖃᓗᐃᑦ ᓂᕆᔾᔪᑎᖏᓐᓂᒃ, ᐃᒪᐅᑉ ᖃᓄᐃᖓᓂᕆᔭᙱᓐᓂᒃ ᐃᒪᐅᑉ ᓇᑎᐊᓄᐊᖃᑦᑕᖅᑐᑦ ᖃᓄᐃᓂᖏᓐᓂᒃ ᑕᓯᕐᔪᐊᕐᒥᑦ. ᑕᐃᒪᓐᓇᐃᓕᐅᕐᓂᐊᖅᑐᑦ ᖃᑉᓯᑲᓪᓚᖕᓄᑦ ᖃᐅᔨᒋᐊᖅᑕᐅᖃᑦᑕᖅᑐᓕᕆᓂᒃᑯᑦ ᐱᔭᕆᐊᖃᖅᑎᑕᐅᔪᑦ ᐃᒪᕐᒥᐊᑕᓕᕆᔨᒃᑯᖕᓂᑦ, [EC], ᐊᒻᒪ [NWB] ᓚᐃᓴᓐᓯᑎᒍᑦ/ᐱᑎᑕᐅᔪᓐᓇᕐᓂᒃᑯᑦ.

ᑲᖕᒋᖅᓭᓂᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᓛᑯᑦ ᐅᖃᖅᑐᑦ ᐃᓅᓚᐃᑦ, ᐃᖃᓗᒃᐲᑦ ᐊᒻᒪ ᓱᓗᒃᐸᐅᓚᐃᑦ ᐱᒻᒪᕆᐅᕆᔭᐅᔪᑦ ᐃᓄᖕᓄᑦ, ᑮᓇᐅᔭᓕᐅᕈᑕᐅᓂᕐᒧᓪᓕ ᐱᖁᓯᐅᓂᒃᑯᓪᓗᓕ ᐆᒪᔪᓕᕆᔨᐊᓛᑯᓐᓄᑦ. ᐃᓚᖕᒋᑦ ᐃᓐᓇᕆᔭᐅᔪᑦ ᓂᕆᔪᒪᑦᑕᕐᒥᔪᑦ ᐊᒥᖁᕐᓗᒃᑐᓂᒃ. ᐃᖃᓗᒃᐲᑦ ᐃᖃᓗᒃᓯᐅᖅᑕᐅᓚᔪᓗᐊᖅᑐᑦ ᖃᒪᓂᖅ ᑲᖕᒋᓪᓕᕐᒥᑦ ᐊᒻᒪ ᖃᒪᓂᕐᒥᑦ; ᐃᓅᕋᖅᑕᖃᐅᕐᓂᖅᓴᖅ ᑕᓯᕐᔪᐊᕐᒥᑦ. ᐊᖏᓂᖅᓴᐃᑦ ᑕᓲᑦ ᐃᖃᓗᒃᓯᐅᕖᐅᓗᐊᖃᑦᑕᖅᑐᑦ ᐃᓄᖕᓄᑦ. ᐃᓚᖕᒋᑦ ᐃᓐᓇᕆᔭᐅᔪᑦ ᒥᑭᓂᖅᓴᓄᑦ ᑕᓯᕐᓄᐊᖃᑦᑕᖅᑐᑦ (ᓲᕐᓗ ᓄᕗᒃᐸᓯᖕᒦᑐᓂᑦ) ᐃᖃᓗᖃᕐᒪᖔᑖ ᖃᐅᔨᔪᒪᑉᓗᑎᒃ ᑭᓯᐊᓂ ᓄᕗᒃᐸᓯᖕᒦᑐᑦ ᐃᖃᓗᒃᓯᐅᕖᐅᓗᐊᖃᑦᑕᙱᑦᑐᑦ. ᐆᒪᔪᓕᕆᔨᐊᓛᑯᑦ ᐃᓱᒫᓘᑎᖃᓗᐊᖅᑐᑦ ᒥᐊᓂᖅᓯᓂᕐᒥᒃ ᑕᓯᕐᔪᐊᕐᒥᑦ.

ᐅᖃᐅᓯᖃᖅᑎᓪᓗᒋᑦ ᐃᓱᒪᒋᔭᐅᔪᓂᒃ ᐅᑎᖅᑎᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᒃ, ᐆᒪᔪᓕᕆᔨᐊᓛᑯᑦ ᐅᖃᐅᓯᖃᓚᐅᖅᑐᑦ ᐃᓱᒫᓘᑎᒋᔭᕐᒥᖕᓂᒃ ᒥᐊᓂᖅᓯᓂᕐᒥᒃ ᑐᒃᑐᓂᒃ ᑕᓯᕐᔪᐊᖅᑎᒍᑦ ᐃᑳᖃᑦᑕᖅᑐᓂᒃ ᐅᔭᕋᒃᑕᓕᐊᓕᐊᖑᔪᒪᔫᑉ ᖃᓂᑕᙵᓂᑦ. ᐊᒡᓃᑯᒃᑯᑦ ᐅᖃᖅᑐᑦ ᐅᔭᕋᒃᑕᓕᐊ ᐃᓂᖓ ᓈᒻᒪᒃᓴᖅᑐᑦ ᐊᕙᓗᒥᒃ ᐊᑐᖅᐸᑕ ᐅᕙᓗᓃᑦ ᐊᓯᖏᓐᓂᒃ ᑐᒃᑐᐃᑦ ᐃᑳᑦᑎᐊᕈᓐᓇᑐᐊᖅᐸᑕ ᐅᔭᕋᒃᑕᓕᐊᑉ ᖃᓂᑕᙵᓂᑦ. ᑕᒪᓐᓇ ᐅᖃᐅᓯᐅᑲᓐᓂᖃᑦᑕᐊᖃᖅᑐᖅ ᐆᒪᔪᓕᕆᔨᐊᓛᑯᓐᓄᑦ ᐃᓚᐅᓂᑕᔪᙶᓗ ᐊᑉᑯᓯᕆᓂᕐᒥᒃ ᐊᒻᒪ ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᐅᔪᒥᒃ ᐱᕚᓕᖅᑎᑦᑎᓂᕐᒧᑦ ᐅᖃᖃᑎᖃᖃᑦᑕᐅᑎᓂᔭᙱᓄᑦ.

ᓄᐊᒪᓐ ᕗᐊᑦ ᐊᒻᒪ ᔮᓐ ᑕᐃᐸᓈᖅ – ᐆᒪᔪᓕᕆᔨᐊᓛᑯᑦ ᐃᓗᐊᖅᓴᙱᑦᑐᑦ ᓱᐸᓗᑐᐃᓂᒃ ᑕᓯᕐᔪᐊᑉ ᖃᓂᑕᙵᓂᑦ ᓴᖑᑎᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᓚᐅᐱᓪᓚᖕᓂᐊᕐᓂᕐᒧᑦ. ᐆᒪᔪᓕᕆᔨᐊᓛᑯᑦ ᐊᑐᕐᑯᔨᖕᖠᖅᑐᑦ ᑰᓕᐊᖑᔪᒥᒃ ᐱᓕᕆᐊᖅ ᐱᓕᕆᐊᖑᕕᓪᓕᐊᓕᕝᕕᓐᖓᓂᑦ ᐃᖃᓗᐃᑦ ᐃᑳᕈᖕᓇᕐᓂᐊᕐᒪᑕ A5-ᒥᑦ A6-

ᒧᑦ. ᐊᒡᓃᑯᒃᑯᑦ ᐊᒻᒪ ᐃᒪᕐᒥᐅᑕᓕᕆᔩᒃᑯᑦ ᑕᒪᓐᓇ ᐃᓱᒪᒃᓴᖅᓯᐅᕈᑎᒋᓂᐊᖅᑕᖓᑦ ᐸᕐᓇᐃᓂᖃᖅᑎᓪᓗᒋᑦ ᐃᖃᓗᓕᕆᓂᕐᒥᑦ ᐃᖢᐃᓗᑦᑎᐃᑎᔪᓐᓇᖅᑐᓂᒃ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᓕᕆᐊᒧᑦ.

ᓄᐊᒪᓐ ᕗᐊᑦ – ᐃᓚᐅᖃᑕᐅᔪᓐᓇᕋᔭᖅᐱᑕ ᐃᖃᓗᓕᕆᓂᕐᒥᑦ. ᐊᒡᓃᑯᒃᑯᑦ ᐊᔪᕐᓇᖏᓐᓂᐊᕋᓯᒋᔭᖓᑦ ᐊᒻᒪ ᐱᓕᕆᖃᑎᖃᕈᒪᑉᓗᑎᒃ ᐆᒪᔪᓕᕆᔨᐊᓖᑯᓐᓂᒃ ᐱᓕᕆᐊᖅ ᐱᔾᔪᑎᒋᓗᒍ.

ᓄᐊᒪᓐ ᕗᐊᑦ – ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᐃᓱᒫᓘᑎᖃᖅᑐᑦ ᑕᒪᐃᓂᒃ ᐃᑳᖅᑕᕐᕕᖕᓂᒃ ᐊᒻᒪ ᐃᓂᒋᔭᐅᔪᑦ ᐊᐸᕐᑯᑎᒧᑦ ᖃᓂᑦᑐᑦ ᐳᔪᖃᑖᖅ ᐱᔾᔪᑎᒋᑉᓗᒍ. ᐃᒪᖅ ᑕᓯᕐᔪᐊᕐᒥᑦ ᑎᐱᖓ ᐊᔾᔨᐅᖏᑦᑐᕐᒪᑦ ᐊᒻᒪ ᕿᕐᓂᕈᔪᖕᓂᖅᓴᐅᓕᖅᖢᓂ. ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᐃᓱᒪᔪᑦ ᑕᐃᒪᓐᓇᐃᓂᖓᓂᒃ ᐊᐸᕐᑯᑎᒥᖖᒑᖅᑐᓂᒃ ᐳᔪᖅ ᐱᔾᔪᑎᒋᑉᓗᒍ.
ᐊᒡᓃᑯᒃᑯᑦ – ᐊᒡᓃᑯᒃᑯᑦ ᒫᓐᓇᐅᔪᖅ ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᖃᖅᑐᑦ ᐳᔪᕐᒥᑦ ᐊᐸᕐᑯᑏᑦ ᖃᓂᑕᖓᓐᓂᑦ ᐊᒻᒪ ᐱᕙᓪᓕᐊᑉᓗᑎᒃ ᖃᐅᔨᒋᐊᖃᑦᑕᑦᑎᐊᕐᓂᐅᔪᒧᑦ ᐸᕐᓇᐅᑎᒥᒃ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᓕᕆᐊᒧᑦ.
ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᐅᔪᒥᒃ ᐱᕐᑯᓯᓚᐅᖅᑐᑦ ᑕᓯᑦᓈᕐᒧᑦ, [Char River] ᐊᒻᒪ ᐃᖃᓗᒫᕐᔪᖕᒧᑦ ᖃᐅᔨᔪᒪᑉᓗᑎᒃ ᐊᒃᑐᖅᓯᓂᐅᔪᓐᓇᖅᑐᒥᒃ ᐊᐸᕐᑯᑎᒥᑦ.
ᐊᒡᓃᑯᒃᑯᑦ – ᐊᒡᓃᑯᒃᑯᑦ ᐃᓱᒪᒃᓴᖅᓯᐅᕈᑎᖃᕐᓂᐊᖅᑐᑦ ᐃᓚᓯᒃᑲᓐᓂᕐᓂᕐᒥᒃ ᐃᒪᑉᑕ ᖃᓄᐃᓐᓂᕆᔭᖓᓂᒃ ᖃᐅᔨᒋᐊᖃᑦᑕᖃᑦᑕᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᒥᑦ ᑕᒪᒃᑯᐊ ᐃᓚᐅᑎᓐᓂᐊᕐᓗᒋᑦ.
ᓄᐊᒪᓐ ᕗᐊᑦ – ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᐱᐅᒃᓴᖅᑐᑦ ᐊᓇᖅᑕᐅᑎᓕᓇᔾᔪᑕᐅᔪᒥᒃ ᐊᒻᒪ ᐃᒪᐅᑉ ᖃᓄᐃᓂᕆᔭᖓ ᒥᐊᓂᕆᔭᐅᓂᕆᔭᖓᓂᒃ ᐅᑯᐅᖑᔪᖅ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᓕᕆᐊᒥᑦ. ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᑕᑯᔪᒪᔪᑦ ᓄᓇᓕᒃ ᒥᐊᓂᖅᓯᓂᖓᓂᒃ ᑕᓯᑦᓈᕐᒥᑦ ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᐃᓱᒪᖓᒪᑕ [DW] ᑕᓯᕐᔪᐊᕐᒥᑦ ᐱᐅᓂᖅᓴᐅᓂᖓᓄᑦ ᑲᖏᖅᓱᓂᕐᒥᐅᖓᓂᑦ.

ᑲᑎᒪᓂᕐᒥᑦ ᐅᖃᐅᓯᖃᕐᓂᖅ ᐊᒻᒪ ᓇᐃᓈᖅᓯᒪᔪᓕᕆᓂᖅ – (RV) ᐊᒻᒪ (SR) ᐊᒡᓃᑯᒃᑯᓐᓂᑦ

ᐃᒪᕐᒥᐅᑕᓕᕆᔩᒃᑯᑦ ᑐᒃᓯᕋᓚᐅᖅᑐᑦ ᓇᐃᓈᖅᓯᒪᔪᒥᒃ ᐃᖃᓗᐃᑦ ᐊᑐᖅᑕᐅᓂᖏᓐᓂᒃ ᐆᒪᔪᓕᕆᔨᐊᓖᑯᓐᓂᑦ.

ᓄᐊᒪᓐ ᕗᐊᑦ, ᔫᓐ ᑕᐃᐸᓈᖅ, ᐅᐊᔅᓕ ᐃᓄᒃᓱᒃ – ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᐃᓱᒪᒋᔭᖓᑦ ᓱᓗᒃᐸᐅᓚᐃᑦ, ᐃᖃᓗᒃᐲᑦ ᐊᒻᒪ ᐃᖣᕋᐃᑦ ᐱᖅᑯᓯᐅᓂᕐᒧᑦ ᐅᔾᔨᕐᓂᕐᓂᖏᓐᓄᑦ ᐊᒻᒪ ᐃᖃᓗᒃᓯᐅᖅᑕᐅᖃᑦᑕᕐᓂᖏᑦ ᐊᖏᓂᖅᓴᐃᑦ ᑕᔫᑦ. ᐃᓐᓇᓇᔭᐅᔪᑦ ᐃᖃᓗᒃᓯᐅᖃᑦᑕᕐᒥᔪᑦ ᐊᒥᕋᕐᓗᒃᑐᓂᒃ. ᐆᒪᔪᓕᕆᔨᐊᓖᑯᑦ ᐅᖃᖃᑎᖃᒃᑲᓂᕆᐊᖃᖅᑐᑦ ᐊᓯᖏᓐᓂᒃ ᑕᒪᒃᑯᓂᖖᒐᑦ ᐃᓱᒫᓘᑕᐅᔪᓂᒃ ᐱᔾᔪᑎᓕᖕᓂᒃ ᒥᑭᓂᖅᓴᓂᒃ ᐃᖃᓗᖕᓂᒃ (ᐃᖃᓗᐊᓘᓂᒃ), [burbot] ᐊᒻᒪ [cisco].

ᐃᒪᕐᒥᐅᑕᓕᕆᔩᒃᑯᑦ ᓇᐃᓈᖅᓯᒃᑲᓂᓚᐅᖅᑐᑦ ᐊᓯᐊᖑᖅᓯᓂᐅᔪᑦ ᐃᒪᕐᒥᐅᑕᓕᕆᓂᕐᒧᑦ ᐱᕐᑯᔭᓂᒃ ᐊᒻᒪ ᐃᖃᓗᐃᑦ ᒥᐊᓂᕆᔭᐅᓂᖏᓐᓄᑦ ᐱᓕᕆᐊᖅ ᑕᐅᑐᒐᖅᑲᕐᓂᐊᖅᑐᖅ [ARC]-ᓂᒃ. ᓄᑖᖅ ᐊᑐᐊᒐᖅ ᐃᓱᒪᒋᔭᖃᕐᓂᐊᖅᑐᖅ ᐃᓄᐃᑦ ᐃᓱᒪᒋᔭᖏᓐᓂᒃ, ᐃᖃᓗᒃᓯᐅᑐᐃᓐᓇᕐᓂᕐᒧᑦ ᐃᒪᓐᓈᖅᑐᖅᑕᐅᓂᖅ, ᓯᕗᓂᕐᒥᒃ ᐃᖃᓗᐃᑦ ᒥᒃᓵᓄᑦ ᐅᖃᐅᓯᖃᕐᓂᖅ ᐊᒻᒪ ᑎᑭᐅᑎᓂᕐᒥᒃ ᐃᖃᓗᓕᕆᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐱᓕᕆᐊᖑᔪᒪᔪᓂᒃ/ ᑎᑭᐅᑎᔭᐅᔪᒪᔪᓂᒃ. ᓯᕗᓪᒧᒡᓗᓂ,

AGNICO EAGLE

ᐊᒡᓃᑯ ᐄᒍ

ᐱᓕᕆᐊᕆᔭᐅᔪᒃᓴᐃᑦ ᐃᓕᔭᐅᓂᐊᖅᑐᑦ ᑐᒃᓯᕋᕐᓗᑎᒃ ᕿᒥᕐᕈᓂᐅᔪᓂᒃ, ᐱᔭᕆᐊᖃᖅᑎᓪᓗᒋᑦ ᑎᑎᖃᑎᒍᑦ ᓈᒻᒪᒋᔭᐅᓂᕐᒧᑦ ᐊᒻᒪ ᑕᑯᒃᓴᐅᑎᑦᑎᓗᑎᒃ ᐱᓇᓱᖕᓂᖃᓚᐅᕐᓂᐅᔪᑦ ᐃᓕᑕᖅᓯᓂᕐᒧᑦ ᐃᖃᓗᖕᓂᒃ ᐃᖃᓗᐃᓗ ᐃᓕᑕᕆᔭᐅᔪᓂᒃ. ᐃᓚᒋᔭᐅᔪᖅ ᐱᔭᕆᐊᖃᖅᑎᑦᑎᓂᐊᖅᑐᖅ ᑕᑯᒃᓴᐅᑎᑦᑎᓗᓂ 1) ᐱᑦᑕᐃᓕᓂᖅ 2) ᒥᒃᓴᓯᒪᑎᑦᑎᒋᐊᕐᓂᖅ, ᐊᒻᒪ 3) ᐃᖃᓗᖕᓂᒃ ᐊᓯᐅᕌᑎᑦᑎᑕᐃᓕᒪᓂᕐᒥᒃ. ᓄᑖᖅ ᐊᑐᐊᒐᖅ ᑕᐅᑐᒐᖃᖅᑐᖅ ᐃᓄᐃᑦ ᐃᖃᓗᓕᕆᓂᕆᖃᑦᑕᖅᑕᖏᓐᓂᒃ.

ᐆᒪᔪᓕᕆᔨᐊᕌᖓᑦ – ᐅᖃᖅᑐᑦ ᐃᓱᒫᓘᑎᒋᔭᕐᒥᖕᓂᒃ ᑕᒪᒃᑯᓂᙶᑦ ᐊᓯᐊᖑᖅᓯᓂᐅᔪᓂᒃ ᐊᒻᒪ ᑕᑯᒋᐊᖅᑕᐅᑲᓐᓂᕆᐊᖃᕐᓂᖓ ᐊᕙᑎᒥᑦ ᐊᒻᒪ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᐅᖃᐅᓯᖅ-ᒧᑦ [DEIS]-ᒧᑦ ᑐᓂᔭᐅᔪᑦ ᓄᑖᖅ ᐊᑐᐊᒐᒧᑦ ᐊᓯᐅᖑᖅᓯᓂᐅᔪᓂᒃ. ᐱᕕᒃᓴᒃᑲᓐᓂᑲᓪᓚᖃᕆᐊᖅᑕᕐᓂᐊᖅᑐᑦ ᐆᒪᔪᓕᕆᔨᐊᕌᖓᑦ ᕿᒥᕐᕈᓂᕐᒧᑦ ᐃᖃᓗᓕᕆᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᒃ ᑕᓯᕐᔪᐊᕐᒥᑦ.

ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᑦ ᐊᓯᐊᖑᖅᓯᓂᖃᕆᐊᖃᕐᓂᐊᕐᓂᕋᐃᔪᑦ ᐊᒡᓃᑯᒃᑯᑦ ᑐᓂᔭᖕᒐᓂᒃ ᑭᖑᓪᓕᖅᐹᒃᑯᑦ ᐊᕙᑎᒧᑦ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᐅᖃᐅᓯᐅᔪᖅ-ᒥᑦ [FEIS]-ᒧᑦ ᐊᒻᒪ ᐱᒋᐊᕈᖕᓇᖅᑎᑕᐅᓂᕐᒧᑦ ᐱᕙᓪᓕᐊᑎᓪᓗᒋᑦ.

ᐊᓯᖖᒋᓂᒃ ᐅᖃᐅᓯᖃᒃᑲᓐᓂᓚᐅᖏᑦᑐᑦ ᐅᕙᓘᓃᑦ ᐃᓱᒫᓘᑕᐅᔪᓂᒃ ᓴᖅᑭᑦᑎᓚᐅᖏᑦᑐᑦ, ᑲᑎᒪᓂᖅ ᓄᖅᑲᓚᐅᖅᑐᖅ 11:30-ᒥᑦ ᐅᑉᓛᒃᑯᑦ.

ᑕᒪᑉᓯ ᖁᔭᓐᓇᒦᒃ, ᑐᓂᔭᑉᓯᖕᓄᑦ ᐊᒻᒪ ᐃᓚᐅᖃᑕᐅᓂᑉᓯᖕᓂᑦ.

AGNICO EAGLE

DFO, HTO, KIA, NRI & AEM - Meliadine Mine Fisheries Consultation

Date: November 7, 2013 – 9:00 to 11:30am
Subject: Review and discussion of fish and fish habitat potentially impacted by the Meliadine project – review of Inuit (aboriginal), recreational and commercial fisheries.
Location: AEM office
Participants: Ryan VanEngen (AEM), Stephane Robert (AEM), Elizabeth Patreau (DFO – by teleconference/ webex), Norman Ford (KHTO), Wesley Innkshuk (KHTO), and John Taipana (KHTO).

Introductions – Ryan VanEngen (RV) and Stephane Robert (SR)

RV reviewed the objectives/ goals of this meeting:

- Review fisheries data that Golder has collected - identify fish found within the peninsula lakes and Meliadine Lake
- Identify valued fish species
- Discuss and identify commercial, recreational and aboriginal fisheries within the Meliadine Project footprint.

An update on the Meliadine Project was provided to KHTO during the KHTO board meeting that AEM attended on Nov 6th at 7pm. At the meeting, AEM presented information on:

- project updates and status on exploration activities,
- caribou migration information,
- sewage discharge control measures,
- road access, and
- a brief fisheries planning discussion.

SR expressed to KHTO that comments in advance of the NIRB PHC for the Meliadine Project are invited until Nov 22nd. On Dec 2-5th the PHC will provide an opportunity for all parties to discuss the DEIS and a community session will be held the week after.

Norman Ford (NF) - KHTO has submitted our comments on the DEIS to NIRB
AEM – The IR's response was sent to NIRB and to KHTO. SR will send the response of the IR's to KHTO by email.
NF – When will the boat launch be made.

AEM- it will not be completed until the project is accepted by NIRB and the Phase II of the AWR is built. The phase II of the road will include the discovery road access near Meliadine Lake south basin.

KHTO – Which lakes will be permanent lost?
AEM- As per the DEIS, B4, B7 and B5.

NF - expressed that the peninsula lakes are not commonly fished. KHTO is willing to "sacrifice" the lakes within the peninsula that are under the proposed mine footprint for the employment and jobs that the mine will bring for the community of Rankin Inlet.

Elizabeth Patreau (DFO) explained the Fisheries Act Changes that will apply to the Meliadine Project. The new policy will be active on November 25th that will focus on defining a fishery based on Aboriginal (Inuit), Recreational or Commercial (ARC) fishery. The role- out of the policy, as it applies to Meliadine Project, will be clearer after the pre-hearing conference and after training has been completed by DFO practitioners, which is scheduled for December 3rd and 4th in ON. This unfortunately conflicts with the prehearing conference.

Review of Fisheries Baseline data and No Net Loss Planning – RV (AEM)
AEM reviewed Traditional Knowledge of the fishery

- Identify fish species found within the peninsula lakes
- Review proposed fish habitat losses, compensation and fisheries monitoring in Meliadine Lake and some of the lower reaches within the peninsula
- AEM will focus on protecting and enhancing fisheries near Meliadine Lake with Aboriginal (Inuit), Commercial and Recreational value.
    - Specific compensation projects include backfilling pits in FZone and Pump Pit within the peninsula will create new habitat and access for lake trout and arctic char from Meliadine Lake. All of this was briefly presented and is outlined in the DEIS.
    - Monitoring programs will be focused on protecting the fish, fish food sources, water quality and sediment quality in Meliadine Lake. This will be done through a number of monitoring programs that are required under DFO, EC and NWB licenses/ authorizations.

KHTO expressed that lake trout, arctic char and arctic grayling are important socially, recreationally and culturally to the KHTO. Some elders also like to eat whitefish. Char are typically harvested from Peter Lake and Diane Lake; lake trout are fished predominantly in Meliadine Lake. The larger lakes are most often fished by Inuit. Some elders will periodically cast into smaller lakes (such as those in the peninsula) to see if there are fish in them but it is unlikely that the peninsula lakes are fished regularly. KHTO is mostly concerned with protecting Meliadine Lake.

During the discussion of the conceptual offset/ compensation plan, the KHTO discussed their concerns with protecting caribou that cross at the Meliadine Lake narrows near the proposed mine site. AEM expressed that the mine site could be moved slightly for improved caribou passage at the narrows and southward. KHTO is comfortable with using fencing or other means to ensure caribou can safely pass by the mine site. This needs to be discussed with KHTO regularly and their involvement in the road and site monitoring will improve communications.

NF and John Taipana (JP) – the KHTO is not comfortable with piping near Meliadine Lake for temporary water diversion. KHTO would prefer that a channel is constructed earlier in the project to promote fish passage from A5 to A6. Pipes are perceived to also deter caribou. AEM and DFO will take this into consideration when planning fisheries offsets for the Meliadine Project.

NF- could we participate in the fishout. AEM thought this would be a possibility and looks forward to working with KHTO on this project.

NF – KHTO are concerned with all bridge crossings and areas along the road due to dust. The water in Meliadine river tastes different and darker. KHTO think that it may have come from the dust on the road.
AEM - AEM is currently monitoring dust along the road and developing a thorough monitoring plan for the Meliadine Project.
KHTO wanted that we do a monitoring program for Nippisar Lake, Char River and Meliadine River to know the impact from the road.
AEM – AEM will consider to extend our water quality monitoring program to include theses area.
NF- KHTO is impressed with the high standard of sewage treatment and water quality protection this year at the Meliadine Project. KHTO would like to see the hamlet protect Nippisar Lake as KHTO thinks the DW is better at Meliadine than in Rankin Inlet.

Round Table Discussion and summary–RV and SR (AEM)

DFO requested a summary of fisheries use from the KHTO.

NF, JP, Wesley Innukshuk (WI) – KHTO considers arctic grayling, arctic char and lake trout as culturally significant and focuses fishing on larger lakes. Elders also fish for whitefish. KHTO will have to discuss with others about the concerns over smaller fish (minnows), burbot and cisco.

DFO re-summarized the changes to the fisheries act and fish protection program which will focus on ARCs. The new policy will consider public interests, recreational fishing guidance, future fishery decisions and meeting fisheries management objectives/goals. Going forward, the responsibility will be placed on the proponent that will request reviews, be required to have letters of credit and will need to demonstrate what efforts were made to identify species and areas that support the identified fishery. The proponent will be required to demonstration 1) avoidance, 2) mitigation, and 3) offsetting of fisheries losses. The new policy is focused on human interaction in a fishery.

KHTO- expressed concerns with these changes and will need to re-evaluate the DEIS submission in light of the new policy changes. A lot more time will be required for KHTO to review the fisheries planning at Meliadine.

DFO suggested that changes will need to be made to AEM's submission in advance of the FEIS submission and during the authorization phase.

No other comments or concerns were brought up, the meeting adjourned at 11:30am.

Thank you to all, for your input and participation.

Agnico Eagle - Meliadine Project

Meeting with HTO - November 6th, 2013; 7pm

Attendance List

Name	Signature	Organization
RYAN VANENGEN		AEM
Stephane Robert	Steph Rob	AEM
Wesley Innukshuk		HTO
Paul Kanayok	P. K. ANAYOK	HTO
KOWMUK	60L	
John Tatty	John tatty	HTO
LYDIA TATTY	Watt	HTO
JOHN TAIPANA		H.T.O.

Meeting Nov 7th, 2013
Fisheries Consultation
HTO, KIA, DFO, AEM

Attendee	Signature	HTO / AEM / KIA
RYAN VANENGEN		AEM
NORMAN W. FORD		KHTO
Wesley Innukshuk		HTO
John Taipana	John Taipana	H.T.O.
Liz Patreau	By teleconference/ webex	DFO

APPENDIX B

Fisheries Risk Assessment through Application of the DFO Risk Management Framework

TECHNICAL MEMORANDUM

Agnico-Eagle Mines Ltd: Meliadine Gold Project
Rankin Inlet, Nunavut, X0C 0B0

Date: October 30th, 2012 (revised February 19, 2014)
Subject: Meliadine Gold Project - Fisheries Risk Assessment and Application of the DFO Risk Management Framework
From: Ryan VanEngen (AEM Environment), Leilan Baxter (AEM Environment Consultant), and Jack Patalas (Golder and Associates).

Executive Summary

This memo has adopted the main components of the DFO Risk Management Framework (RMF), which includes Aquatic Effects Assessment and Risk Assessment to categorize the risk of the proposed project on aquatic habitat (DFO 2010). Waterbodies under the Tailings Storage Facility footprint (most of Lake B7 and Ponds B25 and B28), proposed as Schedule 2 (DFO Section 36 authorizations) listings, were not considered as part of this analysis due to differences in definitions between Environment Canada MMER and DFO Section 35(2). All remaining waterbodies, identified as having a medium and high risk using the RMF, require the proponent to address habitat compensation through the Fisheries Protection and Offsetting Plan in support of future *Fisheries Act* authorizations under Section 35(2).

Decision trees were used to determine the sensitivity of fish and fish habitat as low, medium or high and to determine the scale of negative effects as low, moderate or high. The results of the assessment of each waterbody within the proposed project footprint were integrated to produce a risk categorization within the DFO RMF matrix. This method is consistent with the new Fisheries Protection Policy Statement (DFO 2013), which evaluates the risk of the associated changes to the fishery and affected species or habitats due to proposed works/undertakings/activities (referred to as projects).

Overall, sixty three (63) waterbodies were categorized as low risk within the DFO RMF matrix (DFO 2010). It is recommended that these low risk waterbodies do not require further evaluation, should be streamlined, and will be managed by AEM using best management practices during construction and operation at the proposed Meliadine Gold Project. Seventeen (17) waterbodies potentially affected by the project footprint are deemed medium or high risk. Seven (7) are stream-like-corridors located in the lower reaches of watershed A and H (A2, A2a,

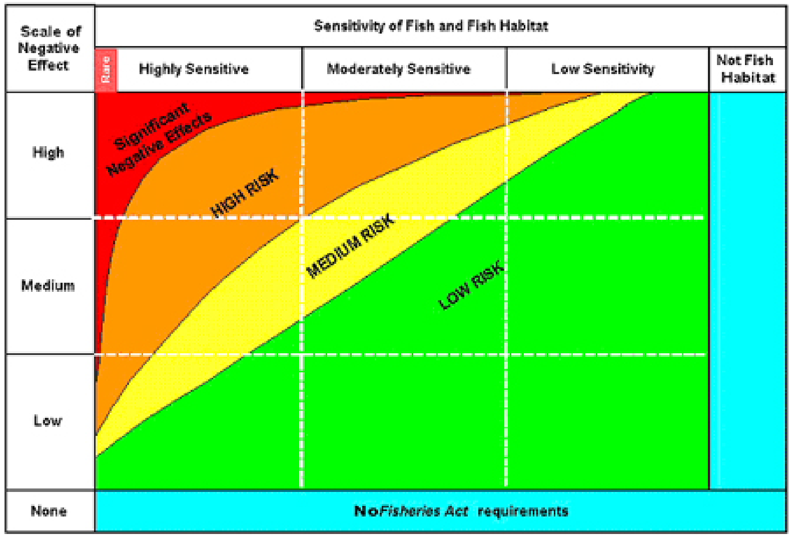
A3, A4, A5, H1, and H2), B30 and B31 are stream-like corridors between waterbodies B5 and B6, and the remaining 8 waterbodies (A6, A8, B4, B5, B6, B7, E4 and E5) are multi-species lakes (Arctic grayling, cisco, burbot, and/or ninespine stickleback). Many are greater than 10 ha in area, many are seasonally connected to Meliadine Lake, and many provide adequate overwintering for these species. Habitat in these 17 waterbodies may be considered rare within the Meliadine peninsula watershed, but not necessarily rare at a regional level. As a result of this site specific analysis, 17 waterbodies will be accounted for in the main Fisheries Protection and Offsetting Plan to reduce the residual serious harm to fish in support of a *Fisheries Act* authorization.

1 Introduction

The Department of Fisheries and Oceans (DFO) have adopted a Risk Management Framework (RMF) to assist habitat management practitioners in decision-making for a range of projects throughout Canada. The DFO document "Practitioner's Guide to the Risk Management Framework for DFO Habitat Management Staff, Version 1.0" (DFO 2010) specifies that risk occurring due to habitat alteration, disruption or destruction (HADD) may be classified using a matrix based on the "*sensitivity of fish and fish habitat*" and "*scale of negative effect*" (see Figure 1-1) and managed accordingly. The new Fisheries Protection Policy Statement (DFO 2013) follows the same principals and considers the evaluation of risk associated with changes to affected species or habitats due to proposed works/undertakings/activities (referred to as projects). The *"department will also be guided by the application of precaution and a risk-based approach to decision making"* (DFO 2013). Furthermore, DFO intends to evaluate projects based on "*the relationship between the productivity of the fishery and the state of the affected species or habitats…. can inform management decisions about risks associated with changes to the state of the affected species or habitats*" (Koops et al. 2013).

This assessment and risk categorization attempts to evaluate the overall contribution of the project lakes, within a regional perspective, and relies on prior knowledge of the regional distribution of fish populations, fish species present in the study area, fish use patterns, and general habitat type preferences. The analysis takes into account the works, undertakings and activities of the project (i.e. a defined project footprint of proposed infrastructure and supporting structures) and its overlap with fish habitat types affected by the project.

Figure 1-1- Risk assessment matrix used to illustrate various categories of risk

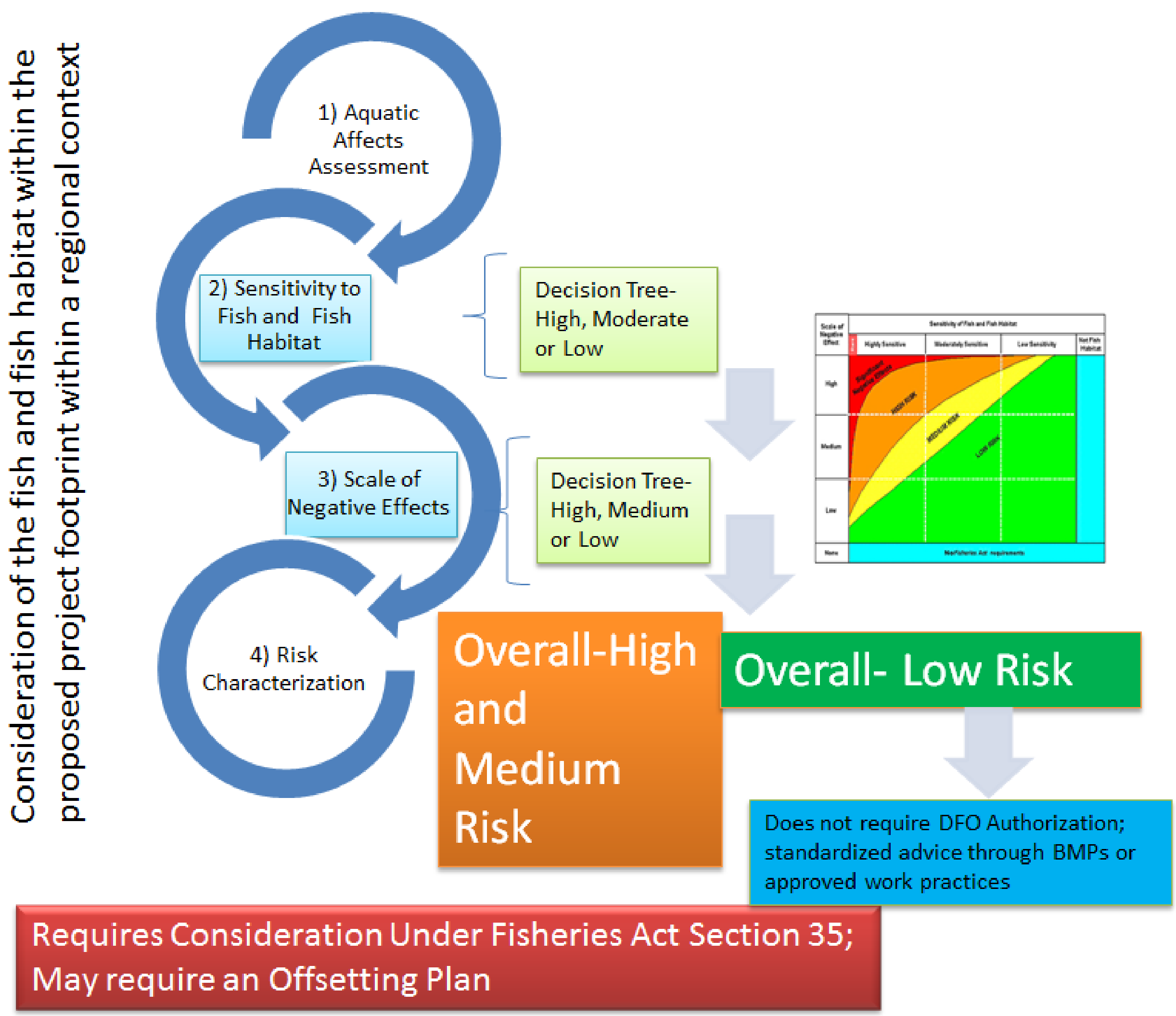


This memo has adopted the main components of the DFO Risk Management Framework (DFO 2010), which includes Aquatic Effects Assessment and Risk Assessment within a regional fisheries context and proposes predictable and coherent decision-making tools (decision trees) to evaluate the risk. In agreement with the DFO guidance, low risk waterbodies would not require consideration under the *Fisheries Act* Section 35(1) or 36 (3), provided that appropriate mitigation measures and best management practices are applied.

An outline of the assessment and methods to determine the risk categorization is presented in Figure 1-2. The analysis uses a decision tree to evaluate the sensitivity of fish and fish habitat (X axis in Figure 1-1). Independent of the sensitivity of fish and fish habitat categorization, a decision tree is used to determine the scale of negative effects (Y axis in Figure 1-1). The results of these analyses are then integrated to produce a risk categorization of the proposed project according to the RMF matrix. According to Koops et al. (2013) “the current risk management framework, currently used in the Habitat Management Program to classify projects… facilitates the placement of individual projects in risk categories”.

AEM proposes that waterbodies identified as overall medium and high risk within the RMF would require a Fisheries Act authorization under Section 35(2), which requires the proponent to address residual serious harm to fish through an offsetting plan. As previously discussed with the DFO, the No Net Loss Plan for the Meliadine Gold Project (now referred to as the conceptual fisheries protection and offsetting plan) will be submitted as part of a Final Environmental Impact Statement (FEIS) and will follow a habitat evaluation procedure (HEP) method that calculates fish habitat losses and gains in terms of habitat units (HU). The objective of this technical memorandum is to apply DFO's risk assessment, categorization and risk management framework to the Meliadine Gold Project by proposing a method to characterize low, medium or high risk fish habitat according to the DFO (2010) categorization of risk. This memo presents the methods and results of the risk assessment for the Meliadine Gold Project in support of the Conceptual Fisheries Protection and Offsetting Plan.

Figure 1-2- General approach of the risk categorization using the DFO risk management framework



2 Regional Assessment

The concepts of habitat rarity and habitat dependence outlined in the risk management framework (DFO 2010) were applied by comparing local waterbodies near the mine footprint to all waterbodies at a regional scale. The prevalence of waterbody types, based on area and depth characteristics, were determined for several watersheds near the project. Using the baseline morphometric data of the Meliadine peninsula lakes (Golder 2012), a geographic information system (GIS)-based approach was used to evaluate lake area and determine the relative prevalence of large (i.e. >5ha) lakes as compared to small waterbodies at a regional ecosystem level.

Lake morphometry, and in particular mean depth and area, have long been used to predict productive capacity and the ecological potential of waterbodies (Kalff 2001; Downing et al. 1990; Hershey et al. 2006). Various researchers have used morphometry, water quality and biological parameters as correlates, and have found fish biomass and presence/absence of fish to be closely linked to both area and depth. More specifically, Hershey et al. (2006), studied landscape variables in 168 Alaskan lakes and developed models to predict presence/absence of Arctic fish. Using regression tree analysis, depth accurately predicted presence for lake trout, Arctic char, slimy sculpin and Arctic grayling (Hershey et al. 2006). Perimeter and elevation were also highly predictive of presence of Arctic species.

The following sections use GIS data (primarily number of waterbodies and their area) from the Meliadine region to quantify the prevalence of waterbodies of defined size-classes within various nearby watersheds. This information is then combined with field-based data on water depth and fish presence/absence in the surveyed Peninsula waterbodies to determine habitat attributes such as size of the waterbodies, prevalence of ponds without overwintering, lakes with overwintering potential, and lakes that are potentially large enough to support large-bodied, multispecies assemblages of fish. The results of these analyses support the assessment and risk categorization presented in sections 4, 5 and 6 of this memo.

2.1 Peninsula Watersheds in a Regional Perspective

A desk-top GIS exercise was conducted to determine the occurrence and frequency of Peninsula lakes and ponds. Using baseline data from the 1:50,000 scaled National Topographic Service (NTS) maps, the regional study area was divided into 5 separate watershed drainages (see Figure 2-1):

- Peninsula watersheds - include basins A to J and several small basins bounded by the Meliadine Lake shoreline;
- Meliadine Lake watershed – includes Meliadine Lake and areas upstream of its 2 outlets, but excludes the Peninsula watersheds and areas downstream of the outlets;

- Meliadine River – drainage area between Meliadine Lake south outlet and Hudson Bay
- Atulik watershed – drainage includes Atulik Lake and drains to Hudson Bay via Atulik River;
- Diana River watershed – from Meliadine Lake west outlet to Diana River mouth in Hudson Bay (includes Peter Lake).

For each watershed, the following parameters were calculated:

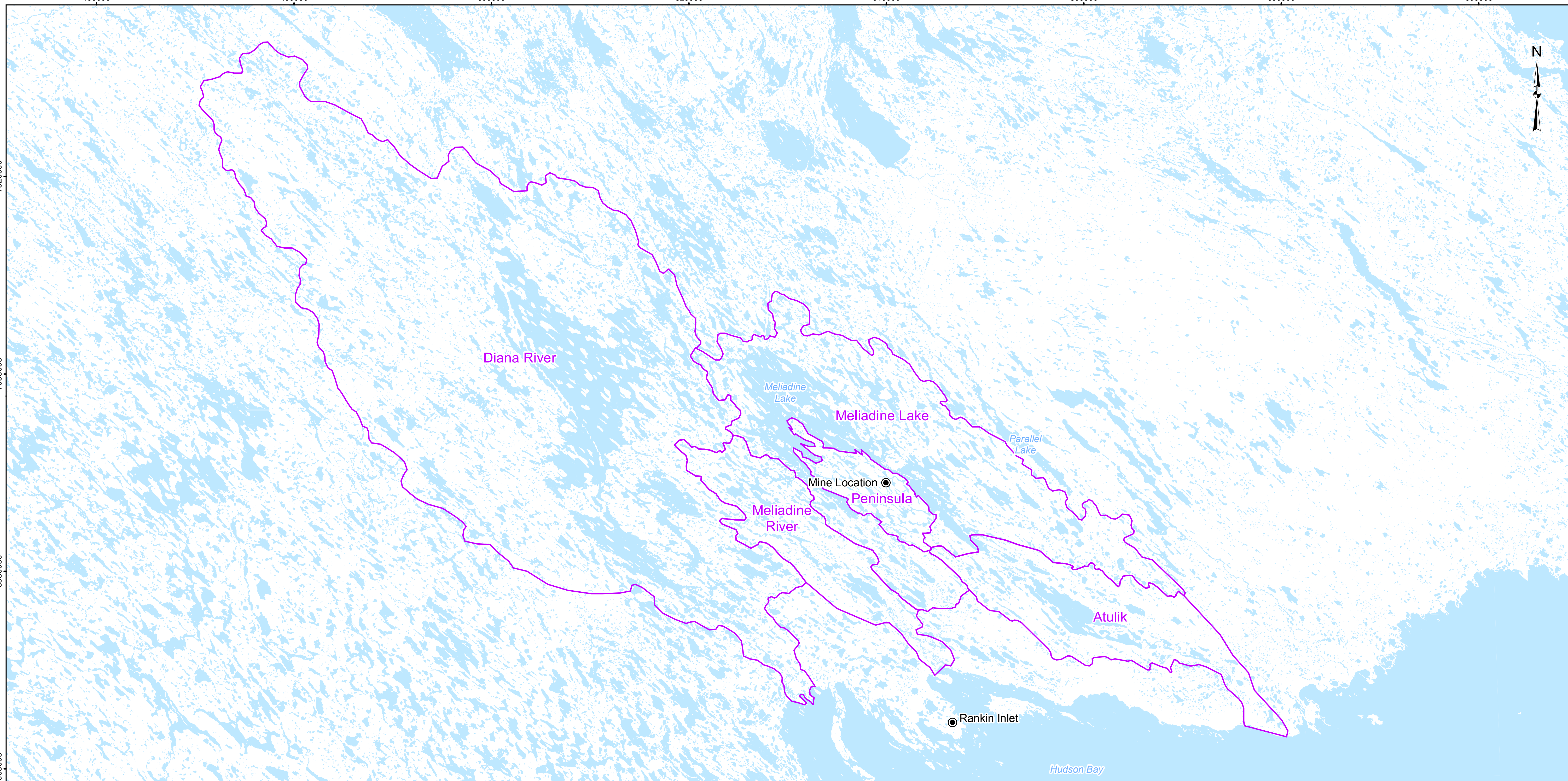
- Total drainage area; and
- Number and area of lakes and ponds by 6 size categories (<1, 1-5, 5-10, 10-20, 20-100, and >100 ha).

Due to the predominantly flat topography and permafrost conditions, the regional study area is characterized by numerous lakes and ponds (Table 2-1). The total surface area of these waterbodies comprise almost 30% of the total drainage area (i.e., 70% is terrestrial). The contributions of aquatic habitat to the total drainage areas of the Peninsula, Meliadine River, and Atulik watersheds are lower (around 20 to 25%) than in the Meliadine Lake watershed, where almost 38% of the area is comprised of water (due to the large size of Meliadine Lake itself and several mid-sized lakes in the northeast part of the watershed).

Table 2-1: Number, area, and size of lakes and ponds in the main watersheds of the regional study area.

Watershed	Drainage area (km^2)	Total lake and pond area (km^2)	Water as % of drainage area	Number of lakes and ponds	Mean density of lakes and ponds (#/km^2)	Mean lake and pond area (ha)	Median lake and pond area (ha)
Peninsula	68.1	13.2	19.5	368	5.4	3.6	0.5
Meliadine Lake[a]	491.1	184.3	37.5	1714	3.7	9.5	0.5
Meliadine River	210.2	52.2	24.8	843	4.0	6.2	0.8
Atulik	207.0	48.1	23.2	1067	5.2	4.5	0.4
Diana River	1682.0	485.2	28.8	6091	3.6	8.0	0.6
Total	**2658.3**	**783.0**	**29.5**	**10083**	**3.8**	**7.3**	**0.6**

[a] Excluding the Peninsula watersheds



N:\Bur-Graphics\Projects\2013\1428\13-1428-0007\GIS\Mapping\MXD\FEIS\Volume_07\SD_7-4_No_Net_Loss_Plan\Figure_2-1_Main_Watersheds_Meliadine.mxd

LEGEND

Watercourse
Watershed Boundary
Waterbody

REFERENCE

Base data obtained from Agnico Eagle Mines Limited (AEM).
Datum: NAD 83 Projection: UTM Zone 15

PROJECT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

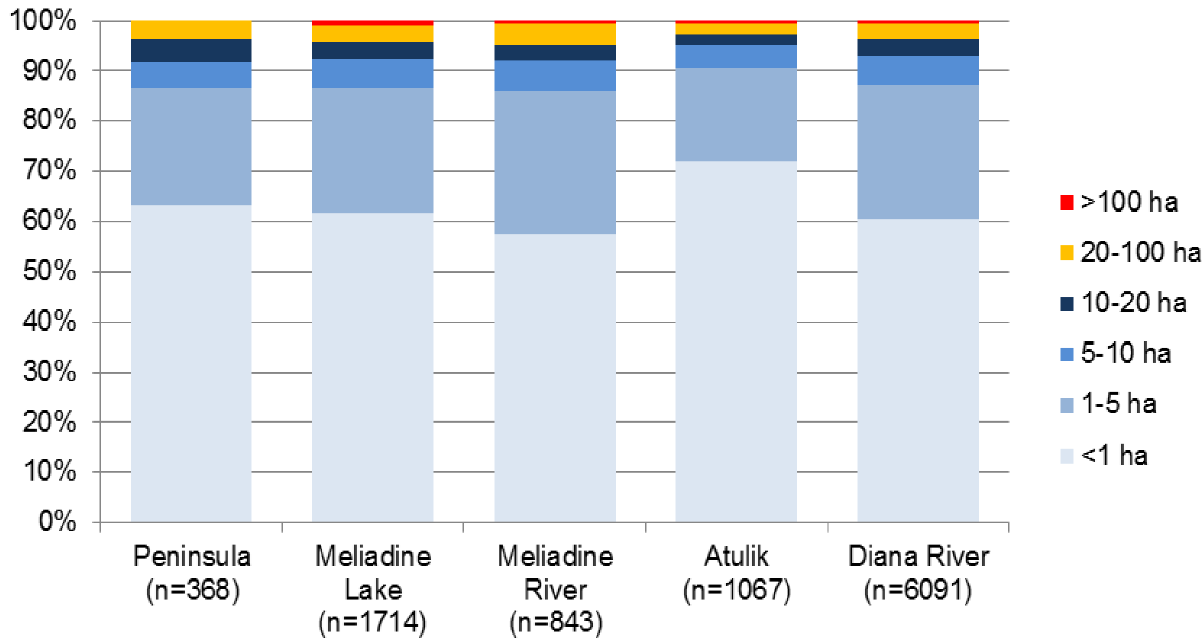
TITLE
MAIN WATERSHEDS IN MELIADINE LAKE REGION

Golder Associates

PROJECT NO.	10-1373-0076		FILE No.	
DESIGN	JP	30 May 2012	SCALE AS SHOWN	REV. 0
GIS	KI	19 Feb. 2014		
CHECK	NS	18 Feb. 2014	FIGURE 2-1	
REVIEW	DW	18 Feb. 2014		

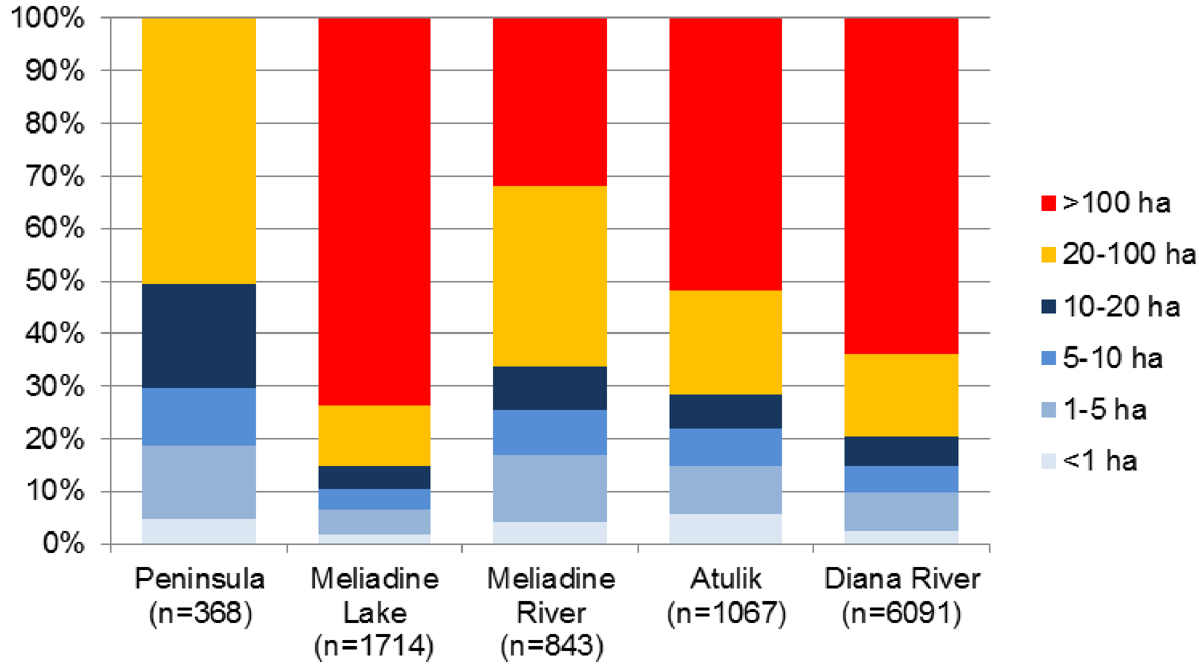
The distribution of waterbody size classes is markedly similar among the compared watersheds. Waterbodies (mainly ponds) smaller than 5 ha in surface area predominate in all watersheds and contribute between 86% (Meliadine River) and 91% (Atulik) to the total number of waterbodies present (Figure 2-2). Lakes exceeding 20 ha in area are relatively rare, contributing between 2 to 5% to the total number of waterbodies. For example, among 368 waterbodies enumerated within the Peninsula watersheds, only 13 are larger than 20 ha in area and the largest one is 90 ha.

Figure 2-2. Contribution of various sizes of waterbodies to the total number of lakes and ponds within the main watersheds in the regional study area.



In terms of the contribution of different size categories of waterbodies to the overall water surface area within each watershed, the larger lakes (>20 ha) account for more than half of the water surface area in all watersheds (Figure 2-3). However, this proportion is considerably lower in the Peninsula watersheds (51%) than in the other watersheds (66 to 85%).

Figure 2-3. Contribution of various sizes of waterbodies to the total area of lakes and ponds within the main watersheds in the regional study area.

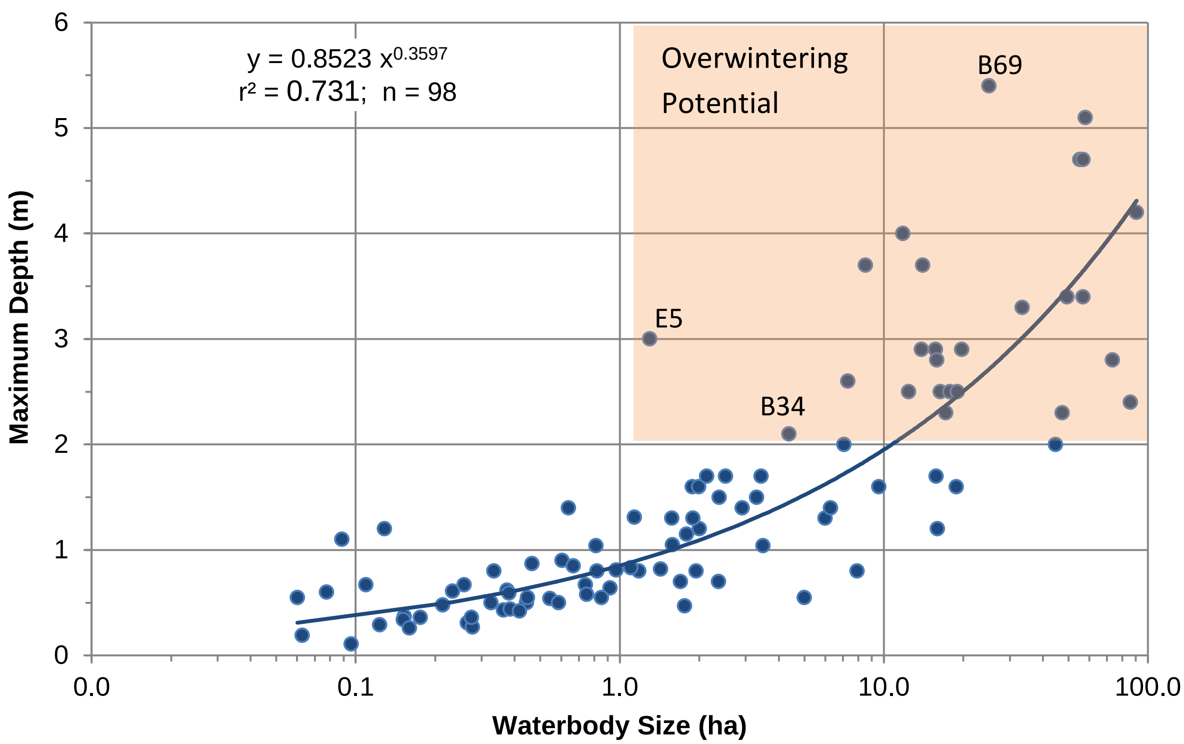


2.2 Size and Depth of Peninsula Waterbodies

To determine the relationship between waterbody size and maximum depth, data from 122 lakes and ponds that were surveyed in the Meliadine Peninsula watersheds from 1997 to 2011 were examined; the results are plotted in Figure 2-4. As expected, the larger lakes are generally deeper than the small ponds. With the exception of Lake E5 (1.3 ha in size with maximum depth of 3.0 m) and Lake B34 (4.4 ha with maximum depth of 2.1 m), none of remaining 63 small (<5 ha) waterbodies surveyed in the Peninsula watersheds exceeded 1.7 m in maximum depth. Considering that ice thickness commonly reaches up to 2 m in late winter, most of these ponds likely freeze to the bottom and do not provide overwintering habitat.

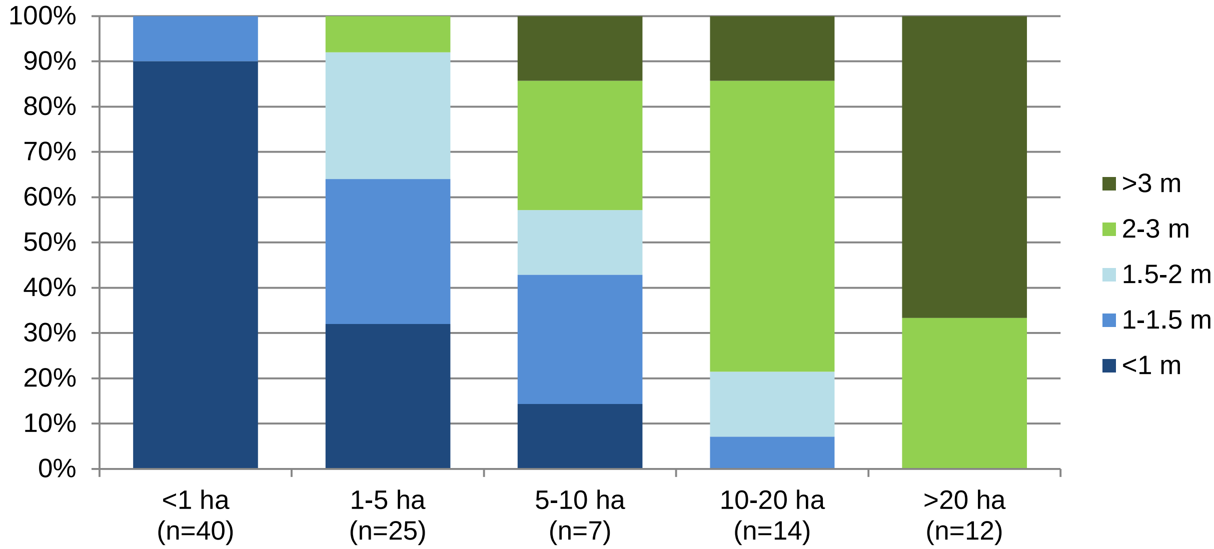
Although the exact depth that provides minimum conditions required by fish to overwinter is variable (i.e., depends on dissolved oxygen (DO) levels under ice); for this assessment, the depth-based classification of overwintering habitat was conservatively set at 2 m maximum depth. In contrast, the deeper waterbodies (within the shaded rectangle in Figure 2-4) could provide overwintering conditions for fish due to the inferred maximum depth from their surface area. These waterbodies are less common and have the greatest potential to provide habitat to multispecies assemblages of large-bodied fish. At a regional level, these deeper waterbodies may be considered uncommon, and if the scale of negative effects is high, these larger waterbodies may have a higher relative risk (as compared to prevalent lakes) and therefore require specific compensation in the event of a HADD (based on DFO 2010). The waterbodies potentially impacted by the Meliadine project will be described and evaluated on an individual basis using the assessment methods presented in sections 4, 5 and 6 of this memorandum.

Figure 2-4. Relationship between waterbody size and maximum depth in lakes and ponds in the Peninsula watersheds.



The data plotted in Figure 2-4 were grouped in discrete categories of waterbody size and maximum depth to illustrate more clearly the trend of increasing maximum depth with waterbody size (Figure 2-5). Although some of the larger (10-20 ha) waterbodies have a maximum depth of less than 2 m, most (79%) are deeper. The highest maximum depth in the Peninsula watersheds (5.4 m) was recorded in Lake B69, which is 25 ha in area.

Figure 2-5. Proportion of maximum depth categories within size-classes of lakes and ponds on the Meliadine Peninsula.



The above indicates that the small and shallow ponds in the Meliadine Peninsula watersheds are the predominant waterbody type in the region. The similarities in the abundance and density of this habitat type between the peninsula watersheds and the other watersheds in the region suggest that the peninsula watersheds are representative of regional conditions in this regard. Based on the DFO risk characterization matrix, this factor should be taken into account when evaluating the need for offsetting measures in the event of a serious harm to fish.

3 Aquatic Effects Assessment

3.1 Project Footprint

The GIS evaluation determined that within the Meliadine Lake Peninsula there are approximately 368 waterbodies. The Project footprint, excluding the tailings storage facility (TFS) that requires a separate authorization under Section 36 of the *Fisheries Act*, will directly affect 80 waterbodies in basins A, B, D, E, H, and J in the Peninsula watersheds (see Figure 2-1 in the main text of the Fisheries Protection and Offsetting Plan). The direct effects range from temporary disruption of waterbodies through water transfers, diversions and/or draining to permanent habitat alteration (e.g., excavation of lake bottom within open pits) and habitat destruction (e.g., waterbodies covered by waste rock facilities, multi-use storage pads, or mill and other project infrastructure).

Although the waterbodies range widely in size (0.06 to 90.5 ha), 92% of the waterbodies directly impacted by the project footprint are smaller than 10 ha in size and 56% are smaller than 1 ha in size. Furthermore, 89% of the waterbodies directly impacted by the project footprint are less than 2m in depth, and likely freeze to the bottom. The size, depth, dissolved oxygen concentrations, connectivity to Meliadine Lake, and fish capture data for all lakes and ponds directly impacted by the proposed project footprint are presented in Attachment A of this memorandum.

3.2 Identification of Major and Minor Activities

The Meliadine Gold Project consists of several gold-bearing deposits that are planned to be mined over approximately a 10 year period. The Meliadine Gold Project is proposed to include open-pit and underground mining that will provide ore to the mill. The project includes infrastructure such as the mill, camp, powerhouse, tank farm, tailings impoundment area, waste rock and overburden management areas, water supply intake, and sewage treatment plant, which are integral components of this project. At this time, five gold deposits have been identified on the Meliadine property, of which Tiriganiaq is the most significant. The other deposits are F Zone, Discovery, Pump and Wesmeg. Underground mining is planned for Tiriganiaq and possibly Wesmeg and F Zone. Underground mining at the other deposits cannot be discounted, and will be subject to more exploration drilling and the completion of the feasibility study.

Much of the pit development is located in close proximity to the mill, office and lodging infrastructure, with the exception of the Discovery Pit. Under the current design plans, a portion of some of the pits, infrastructure and rock storage are proposed to occur in lacustrine environment. As a result, some waterbodies are to be covered and/or altered and their connectivity to nearby waterbodies may be eliminated; others will undergo partial or complete dewatering during mine operations; still others will be re-established and may provide improved access to adjacent lakes (including potentially improved access to Meliadine Lake) and to overwintering fish habitat that was otherwise limited, through the flooding and backfilling of pits.

3.2.1 Identification of Common Stressors, Mitigation and Monitoring

The layout of the Meliadine Project has been developed to reduce the disturbance on nearby lakes that are culturally and ecologically significant or rare (namely, protecting and mitigating against effects on lakes nearest to Meliadine Lake, considered an Aboriginal and recreational fishery under the new act). Although there are catchments within the Peninsula lakes that may be destroyed or disturbed during construction and operations, the activities will be managed to protect surface water quality by reducing the footprint of the mine, diverting non-contact water, and managing contact water (i.e. water that has been in contact with mine processes).

Due to the predominance of waterbodies within the Peninsula, mine operations require the dewatering and construction of waste rock storage facilities (e.g., Lake B4) and site infrastructure (e.g., Ponds H1, H2 and H3). During construction and operations, as much as possible, all activities near waterbodies that may potentially affect sensitive habitat will be managed to protect adjacent waterbodies (i.e., construction may be completed during ice-cover and/or water quality control measures will be implemented in accordance with regulatory approvals). Sumps will be installed to control drainage, the mine will monitor water collection systems, and prevent contact water from entering receiving waterbodies. Management plans and construction timing will use best management practices to reduce all pathways of effects receiving water environments and ensure the protection of Meliadine Lake and the nearby waterbodies that are seasonally connected to it. The identification of common stressors, mitigation, and monitoring will be thoroughly detailed in the FEIS.

4 Assessment of the Sensitivity of Fish and Fish Habitat

4.1 Overview

Within the DFO risk management framework, sensitivity of fish and fish habitat is to be characterized as high, moderate or low, in consideration of the risks posed by proposed projects and their potential to alter regional productive capacity (DFO 2010). The DFO practitioner's guide suggests a few attributes for the characterization of the sensitivity of fish and fish habitat; these include: habitat dependence, habitat resiliency, species rarity, species sensitivity and habitat type rarity (DFO 2010). The decision tree presented in this section (Figure 4-1) was developed by AEM/Golder as a screening tool to classify the sensitivity of fish and fish habitat as high, moderate or low (X axis in Figure 1-1). The 80 waterbodies that are proposed to be impacted by the project (excluding ponds B25 and B28 that are proposed to be covered by the TSF) were independently evaluated as high, moderate or low sensitivity to fish and fish habitat and separately assessed through the scale of negative effects decision tree, which is presented in Section 5 of this report.

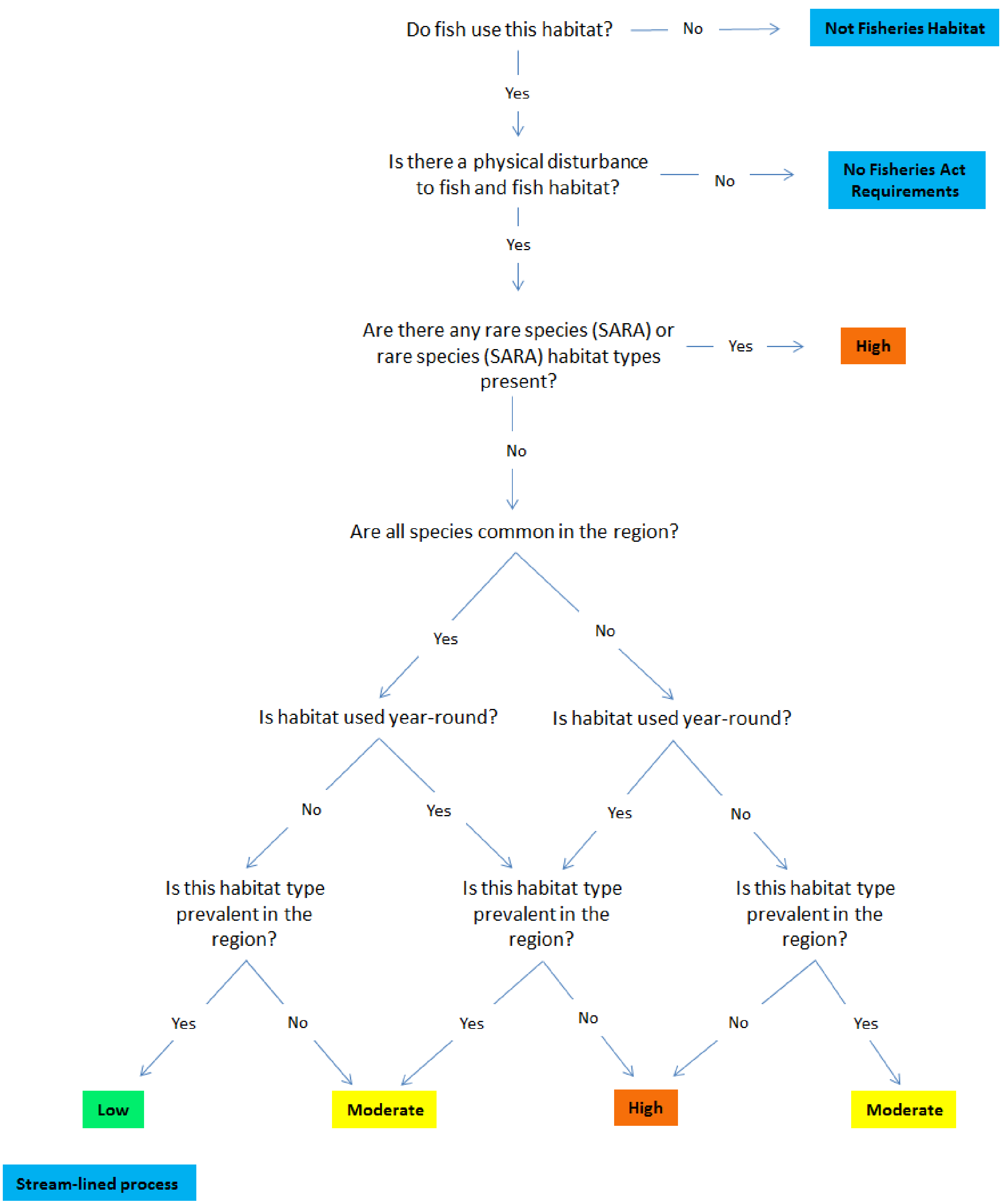
4.2 Decision Tree

The decision tree for the assessment of the sensitivity of fish and fish habitat uses a series of "yes or no" questions to clearly communicate and provide a predictable and repeatable decision making process. The relationship between these questions and the DFO-suggested attribute categories are shown in Attachment B of this memorandum. This decision tree was developed in consideration of project's location in northern ecozones and considers all possible combinations of responses to ultimately provide a classification of low, moderate or highly sensitive of fish and fish habitat. Figure 4-1 presents the decision tree for the classification of sensitivity of fish and fish habitat.

As presented in the decision tree, the following questions are to be answered for each proposed waterbody potentially impacted by the project to classify the sensitivity of fish and fish habitat as low, moderate or high. This assessment is supported by baseline data and the regional GIS assessment.

1) Do fish use this habitat? If not, it is classified as "not fisheries habitat" and therefore you do not proceed with following questions.
2) Describe the impacts of the project on the waterbody. Will there be a physical disturbance? This includes the alteration of water quality that will not otherwise be managed. If not, there is no HADD, and it is classified as not requiring the application of the *Fisheries Act*.
3) Describe the species present in the specific waterbody and the general distribution of their population in the region. Are they common (in the majority of lakes/streams in the region) or rare/endangered (e.g., SARA-listed)?
4) Describe the habitat to be altered, and its distribution within the region. Is it prevalent or uncommon (little or no similar habitat within the region)? Is it used seasonally or year-round?

Figure 4-1- Sensitivity of fish and fish habitat decision tree for the classification of low, moderate or highly sensitivity.



4.3 Results and Discussion

The following section presents a general overview of the waterbodies and summarizes the results of the assessment of low, moderate or highly sensitivity of fish and fish habitat and provides a thorough discussion for specific waterbodies that did not follow a common trend within the decision tree. All waterbodies were evaluated using the decision tree by applying the fish presence and fish species distributions by waterbody based on the Meliadine Gold Project Aquatic Synthesis Report (Golder 2012), which is summarized in Attachment A of this memorandum. SARA listed species were not documented within the Meliadine Peninsula or in the region.

The seasonal versus year-round use of habitat determination was based on Golder (2012) and the GIS data presented in Section 2 of this memorandum provided the information to determine the prevalence of the habitat within the region. Pond habitat that is connected to other waterbodies during the open water months, but freeze to the bottom during winter was considered “not year-round habitat”. As previously discussed, all of the waterbodies deeper than 2 m were identified as having a potential to provide overwintering habitat; however, overwintering potential is typically dependant on presence of water (i.e., not frozen to bottom) and dissolved oxygen (DO) levels that are suitable to support the fish species present. In the region, waterbodies greater than 2 m in depth generally do not freeze completely, but DO levels in the thin under-ice layer become very low in late winter and in some cases do not support fish. Many of these waterbodies within the Meliadine Peninsula that freeze to the bottom were identified using GIS are also isolated and not well connected to Meliadine Lake. Most of these waterbodies are connected by ephemeral streams that typically drain through the tundra by dispersed flow during freshet and after heavy rainfall events. The few waterbodies within the “mainstem” of lakes are seasonally well-connected to Meliadine Lake and are discussed below, as the fish and fish habitat within these stems is rare within the Peninsula watershed.

In total, 80 waterbodies will be potentially affected by the footprint of the project. Most (89%) of the waterbodies are ponds without overwintering habitat (i.e., depths <2m; see Attachment A) and often limited to one species (ninespine stickleback). Sixty five (63) of these waterbodies are poorly connected and/or are completely isolated or offline. This type of habitat is considered prevalent within the region and based on the results of the decision tree, the sensitivity of fish and fish habitat is low for these waterbodies within the project footprint.

The remaining 17 waterbodies were either high or medium within the decision tree and are discussed more thoroughly as part of the evaluation. Site specific field observations, hydraulic evaluations and fish data collected since 1997 informed the evaluation of all of the lakes and specifically assisted in the evaluation of the seasonality of the lakes and ponds to provide corridors for fish passage and/or year-round habitat. This evaluation was primarily based on the presence of a stream outflow with defined channel bed and banks and also on the collection of fish along the corridors. Generally, the waterbodies along the “main stem” of each basin featured good or moderate seasonal connectivity to Meliadine Lake. Therefore, 17 of the waterbodies within the project footprint are considered good or moderately connected to Meliadine Lake and/or provide overwintering habitat and, as such, are not prevalent within the peninsula. Eight (8) of the 17 waterbodies are very small (~<2 ha in area) and freeze to the bottom; however they provide important seasonal habitat, mainly due to their locations in the lower reaches of Basins A and H.

In Basin A, adult and juvenile Arctic grayling, one juvenile Arctic char and a few juvenile lake trout were recorded in the streams between lakes A1 and A6. Consequently, it is assumed that the chain of small and shallow ponds (A2, A2a, A3, A4, and A5) are part of a stream-like-corridor, providing seasonal habitat for these species and migration corridors between streams from A6 and A5 thru to A2 and ultimately into Meliadine Lake. The proximity of the lowermost ponds in Basin A to Meliadine Lake is an important attribute to their suitability for providing habitat to species other than stickleback. These small, but well-connected waterbodies are considered uncommon within the peninsula and arguably within the region. Therefore, the sensitivity of fish and fish habitat in these waterbodies is deemed moderate. As for BasinH, although no large-bodied fish were collected, captures of young-of-the-year (yoy) Arctic grayling in Pond H2 suggest that this species may occasionally use the lowermost ponds in Basin H for spawning and rearing. Similar to the lower chain of ponds in Basin A, ponds H1 and H2 were considered medium sensitivity of fish and fish habitat. All ponds upstream of H2 (i.e. H3, H4 and H5) were poorly or moderately connected, with only ninespine stickleback collected in them, and therefore classified as low sensitivity to fish and fish habitat due to their prevalence in the Peninsula.

In summary, 17 waterbodies potentially affected by the project footprint were classified as medium or high sensitivity to fish and fish habitat (Table 4-1). Of these, 7 are stream-like-corridors located in the lower reaches of basins A and H (A2, A2a, A3, A4, A5, H1, and H2), B30 and B31 are stream-like corridors between lakes B5 and B6, and the remaining 8 waterbodies (A6, A8, B4, B5, B6, B7, E4 and E5) are multi-species lakes (Arctic grayling, cisco, burbot, and/or ninespine stickleback). Many are greater than 10 ha in area, many are seasonally connected to Meliadine Lake, and many provide adequate overwintering for these species. Therefore, these waterbodies are considered rare within the Peninsula and as such, are high or medium sensitivity to fish and fish habitat.

Table 4.1- Summary of the sensitivity of fish and fish habitat assessment

Water-bod	Total Area (ha	Max Depth (m	DO (mg/L) in Apr 1998 or Apr 20	Species Present (red text indicates presence implied by catches upstream)	Seasonal Connectivity to Meliadine La	Sensitivity to Fish and Fish Habit	Discussion
A2	2.36	0.7		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor
A2a	1.95	0.8		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor
A3	0.48	1.0		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor
A4	0.07	0.5		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor
A5	2.00	1.2		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor
A6	55.28	4.7	0.7 - 3.4	ARGR, CISC, NNST, THST	good	High	Multispecies
A8	90.54	4.2	2.0 - 4.5	ARGR, NNST	good	Moderate	Multispecies
B4	85.82	2.4	0.3 - 0.8	ARGR, BURB, NNST	good	Moderate	Migration corridor
B5	56.74	3.4	2.4 - 5.0	ARGR, BURB, NNST	good	High	Multispecies
B6	11.80	4.0	5.3 - 5.8	ARGR, CISC, NNST	good	High	Multispecies
B7	57.88	5.1	2.5 - 5.6	ARGR, CISC, BURB, NNST	good	High	Multispecies
B30	0.09	1.1		ARGR, NNST	good	Moderate	Stream-like corridor
B31	0.13	1.2		ARGR, NNST	good	Moderate	Stream-like corridor
E4	8.52	3.7	0.4 - 1.4	ARGR, NNST	good	Moderate	
E5	1.30	3.0		-	moderate	Moderate	
H1	1.14	1.3		ARGR, NNST	good	Moderate	Stream-like corridor
H2	0.16	0.3		ARGR, NNST	good	Moderate	Stream-like corridor

5 Assessment of the Scale of Negative Effects

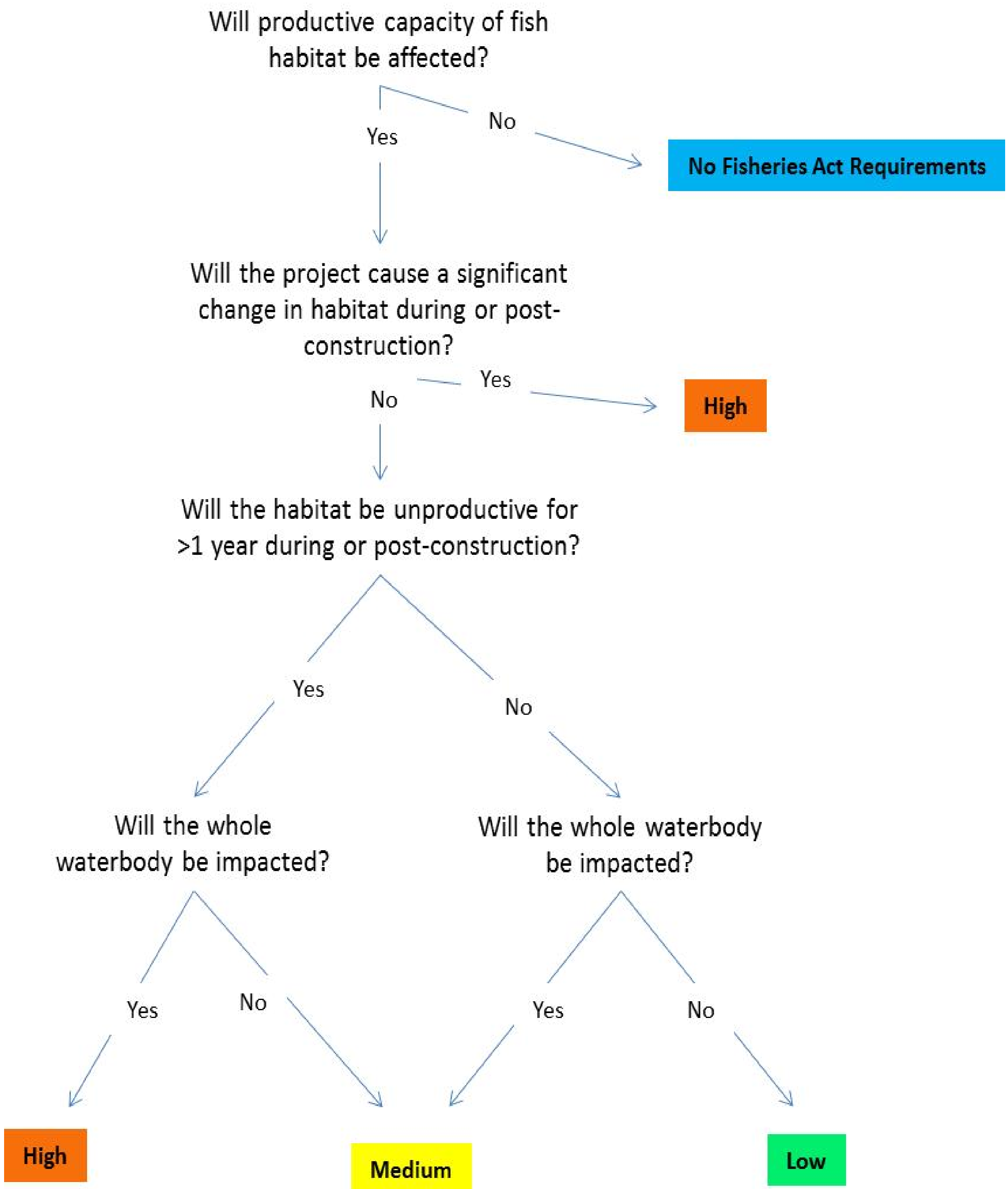
5.1 Overview

Separate from the sensitivity of fish and fish habitat categorization, the 80 waterbodies within the project footprint were assessed with respect to the expected scale of negative effects on the fish habitat due to the proposed project (y-axis Figure 1.1- DFO (2010) matrix). This evaluation considered three attributes outlined in DFO (2010): extent, duration, and intensity. The extent of the project was evaluated based on the proposed project footprint potentially impacting a segment of a waterbody, or if the waterbody was entirely covered by mine infrastructure, pits or operations. Duration and intensity were also considered within this assessment (the amount of time that a residual effect will persist, e.g., greater than 1 year).

5.2 Decision Tree

Similar to the sensitivity of fish and fish habitat decision tree, the assessment of the scale of negative effects uses a decision tree with a series of “yes or no” questions to clearly communicate and provide a predictable and repeatable decision making process. Figure 5-1 presents the decision tree for the categorization of the scale of negative effects, which considers all possible combinations of responses to ultimately categorize the scale of negative effects as low, medium or high. As an example, if a waterbody within the Meliadine peninsula was only partially covered by mine infrastructure for greater than 1 year, and the remaining habitat within that waterbody was maintained during mining operations, the habitat quantity and quality would not be significantly reduced, and therefore the scale of negative effects would be categorized as medium. As another example, if a waterbody seasonally connected to Meliadine Lake was to be permanently destroyed due to proposed mine operations, the scale of negative effects would be categorized as high.

Figure 5.1- Scale of negative effects for the classification of scale of negative effects



5.3 Results and Discussion

The assessment determined that 34 waterbodies were assessed as having a medium scale of negative effects; for many of these only a portion of the waterbody will be impacted or the habitat will be temporarily altered. A few of the waterbodies categorized in the previous section as having high or moderate sensitivity of fish and fish habitat are discussed as examples of the scale of negative effects decision tree results. As an example, the stream-like corridor of small ponds in watershed A (e.g. A2, A2a, A3, A4, and A5) may be temporarily altered during mining through alterations in water levels. Although, it is possible that water levels within the lower reaches of this chain of lakes may be maintained depending on mine sequence and water management, for the purposes of this assessment the water was assumed to be partially drawn-down. The habitat within this chain of ponds will remain intact and re-flooding is likely to occur after mine closure. As a result, the scale of negative effects on these ponds is conservatively characterized as medium. Likewise, portions of lakes A8 and B5 are impacted by mine operations as the pits are proposed to expand partially into the lake and/or the pit requires partial draw down as it will be used as an attenuation pond. Although a portion of their habitat will be impacted during operations, productive capacity of the lakes will be re-established after mine closure (within 10 years) and therefore the scale of negative effects for these waterbodies is medium.

Forty-five (45) waterbodies were classified as a high scale of negative effects. Most (91%) of these are ponds that completely freeze during the winter. However, the habitat in four (4) of these watebodies do not freeze to the bottom (B6, B7, E4 and E5) and will be significantly altered or destroyed during construction and operations. The results of the classification of the scale of negative effects are presented in Attachment A of this memorandum.

6 Risk Categorization

6.1 Results and Discussion

To determine the risk categorization within the DFO (2010) matrix, the scale of negative effects assessment results were integrated with the sensitivity of fish and fish habitat assessment results for all of the waterbodies. Overall, sixty three (63) waterbodies were categorized as low risk within the DFO matrix (see Attachment A and Figure 6-1). It is recommended that these low risk waterbodies do not require further evaluation, should be streamlined, and will be managed by AEM using best management practices during construction and operation at the Meliadine Gold Project. Fifteen (15) waterbodies were assessed as a medium risk and two (B6 and B7) as a high risk, and therefore require consideration under Section 35(2) of the *Fisheries Act* (see Table 6.1).

Figure 6.1 –Risk categorization for waterbodies within the proposed Meliadine Gold Project

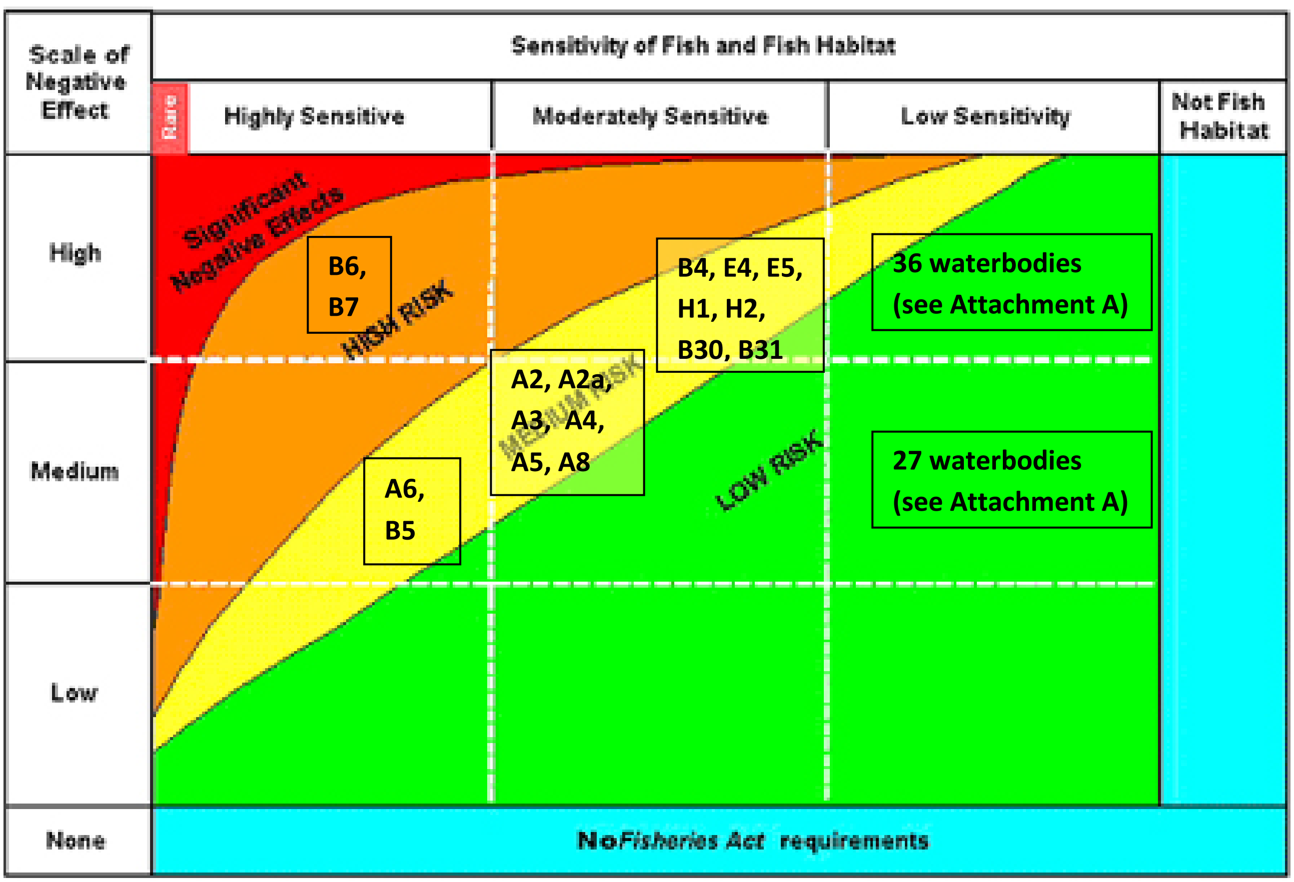


Table 6.1- Summary of risk characterization for medium and small risk waterbodies

Waterbody	Sensitivity to Fish and Fish Habitat	Discussion	Scale of Negative Effects	Discussion	Overall Risk
A2	Moderate	Stream-like corridor	Medium	Water draw-down	Medium
A2a	Moderate	Stream-like corridor	Medium	Water draw-down	Medium
A3	Moderate	Stream-like corridor	Medium	Water draw-down	Medium
A4	Moderate	Stream-like corridor	Medium	Water draw-down	Medium
A5	Moderate	Stream-like corridor	Medium	Portion of pond	Medium
A6	High	Multispecies	Medium	Portion of lake	Medium
A8	Moderate	Multispecies	Medium	Portion of lake	Medium
B4	Moderate	Migration corridor	High	Destruction	Medium
B5	High	Multispecies	Medium	Portion of lake	Medium
B6	High	Multispecies	High	Destruction	High
B7	High	Multispecies	High	Destruction	High
B30	Moderate	Stream-like corridor	High	Destruction	Medium
B31	Moderate	Stream-like corridor	High	Destruction	Medium
E4	Moderate		High	Destruction	Medium
E5	Moderate		High	Destruction	Medium
H1	Moderate	Stream-like corridor	High	Destruction	Medium
H2	Moderate	Stream-like corridor	High	Destruction	Medium

Habitat in these 17 waterbodies may be considered rare within the Peninsula watersheds and the fish present in these waterbodies have greater dependence on the habitat. Where the scale of negative effects and sensitivity to fish and fish habitat is high, these larger waterbodies may have a higher relative risk as compared to prevalent lakes. The loss of productivity of these 17 waterbodies will be accounted for in the Fisheries Protection and Offsetting Plan to offset for residual serious harm to fish habitat.

6.2 Sources of Uncertainty

The regional GIS evaluation results presented in Section 2 indicate that the small and shallow ponds in the Peninsula watersheds are decisively the predominant waterbody type within the region. The similarities in the abundance and density of this habitat type between the peninsula watershed and the other regional watersheds suggest that the small ponds with less than 2m depth are highly prevalent in the Meliadine Peninsula. Although maximum depth data are not available on the regional scale, it is likely that the relationship between waterbody size and maximum depth derived from 98 waterbodies in the Meliadine peninsula watershed is an appropriate assumption to be applied at a regional level ($r^2 = 0.731$). Without additional data collection, depth of the waterbodies outside of the Meladine Peninsula area is assumed to be similar.

In general, estimates of waterbody depth required for overwintering may vary depending on lake morphology, species present, water quality, and annual hydrologic fluctuations. Although it is generally accepted that if a lake freezes throughout (approximately 1.8 to 2 m freeze depth) it cannot support fish[1], there have been evidence at the Meliadine Project of stickleback found in ponds that have insufficient water for drawing. Furthermore, April 2011 data from Lake B53 (Peninsula lake outside of the project footprint) indicated a moderate DO concentration (3.2 mg/L) despite shallow maximum depth (2.9 m), ninespine stickleback were observed in the drilled holes at lakes B45 (outside the project footprint) and E4, where under-ice DO levels were <1.5 mg/L. Based on these data and in consideration of the uncertainty regarding minimum conditions required by fish to overwinter, the depth-based classification of overwintering habitat was conservatively set at 2 m depth.

The evaluation of the scale of negative effects, and specifically extent and intensity, is based on the most current mine planning and is subject to change. The mine is presently undergoing feasibility studies and therefore the extent and intensity of changes to fish habitat and the resulting effects in areas of the entire project are uncertain and may change prior to construction and operations.

7 Recommendations and Application of the Risk Management

Excluding three waterbodies proposed to be authorized under Section 36 (most of Lake B7 and ponds B25 and B28), and based on the detailed analysis and in accordance with the DFO Risk Management Framework (2010 DFO), it is recommended that 63 waterbodies be classified as having low risk and therefore not require a formal *Fisheries Act* authorization. AEM will continue to reduce the mine-footprint of the project, where possible, and will ensure best management practices are applied to reduce pathways of effect to the receiving environment. Seventeen (17) waterbodies that may be impacted by the proposed Meliadine Gold Project, require consideration under Section 35(2) of the *Fisheries Act* and therefore are further described in the Fisheries Protection and Offsetting Plan, which has been prepared and will be presented in the FEIS for subsequent review by the DFO.

[1] For instance, no fish were collected in ponds at Meadowbank Mine waterbodies with less than 2m and in one specific case, an isolated pond that has a maximum depth of 3.8m did not have fish present.

8 References

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Attachment A - Summary of baseline data collection and risk assessment results by waterbody.

Water-body	Associated Infrastructure	Total Area (ha)	Max Depth (m)	DO (mg/L) in Apr 1998 or Apr 2011	Species Present (red text indicates presence implied by catches upstream)	Seasonal Connectivity to Meliadine Lake	Sensitivity to Fish and Fish Habitat	Discussion	Scale of Negative Effects	Discussion	Overall Risk within Meliadine Peninsula
A2	disrupted (F1)	2.36	0.7		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor	Medium	Water draw-down	Medium
A2a	disrupted (F1)	1.95	0.8		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor	Medium	Water draw-down	Medium
A3	disrupted (F1)	0.48	1.0		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor	Medium	Water draw-down	Medium
A4	disrupted (F2)	0.07	0.5		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor	Medium	Water draw-down	Medium
A5	pit (F2)	2.00	1.2		ARCH, LKTR, ARGR, NNST, THST	good	Moderate	Stream-like corridor	Medium	Portion of pond	Medium
A6	pit (F3)	55.28	4.7	0.7 - 3.4	ARGR, CISC, NNST, THST	good	High	Multispecies	Medium	Portion of lake	Medium
A8	pit (P2, W2)	90.54	4.2	2.0 - 4.5	ARGR, NNST	good	Moderate	Multispecies	Medium	Portion of lake	Medium
A9	pit (T1)	1.76	0.5		none	poor	Low		Medium	Altered & refilled	Low
A10	pit (T1)	0.26	0.7		NNST	poor	Low		Medium	Altered & refilled	Low
A11	pit (T1)	0.40	0.5		-	poor	Low		Medium	Altered & refilled	Low
A12	pit (T1)	0.47	0.9		NNST	poor	Low		Medium	Altered & refilled	Low
A13	pit (T1)	0.26	0.3		NNST	poor	Low		Medium	Altered & refilled	Low
A17	WR (B7)	0.16	0.3		NNST	poor	Low		High	Destruction	Low
A19	pit (F3)	1.01	0.9		none	poor	Low		Medium	Altered & refilled	Low
A35	pit (W2)	0.36	0.6		none	poor	Low		Medium	Altered & refilled	Low
A37	pit (W2)	0.92	1.1		NNST	poor	Low		Medium	Altered & refilled	Low
A38	pit (T1)	0.54	0.7		none	poor	Low		Medium	Altered & refilled	Low
A39	pit (T1)	0.12	0.5		none	poor	Low		Medium	Altered & refilled	Low
A50	pit (F3)	0.08	0.6		none	poor	Low		Medium	Altered & refilled	Low
A51	pit (F3)	0.44	0.7		NNST	poor	Low		Medium	Altered & refilled	Low
A52	WR (A45)	7.07	2.0		NNST	poor	Low		High	Destruction	Low
A54	pit (T1)	5.99	1.3		NNST	poor	Low		Medium	Altered & refilled	Low
A58	WR (B7)	0.43	0.5		NNST	poor	Low		High	Destruction	Low
B4	WR (B4)	85.82	2.4	0.3 - 0.8	ARGR, BURB, NNST	good	Moderate	Migration corridor	High	Destruction	Medium
B5	pit (T1, T2)	56.74	3.4	2.4 - 5.0	ARGR, BURB, NNST	good	High	Multispecies	Medium	Portion of lake	Medium
B6	WR (B7)	11.80	4.0	5.3 - 5.8	ARGR, CISC, NNST	good	High	Multispecies	High	Destruction	High
B7	dike for TSF	57.88	5.1	2.5 - 5.6	ARGR, CISC, BURB, NNST	good	High	Multispecies	High	Destruction	High
B8	WR (B7)	1.43	0.8		NNST	poor	Low		High	Destruction	Low
B9	WR (B7)	0.64	1.4		none	poor	Low		High	Destruction	Low
B10	pit (T1)	0.33	0.8		none	poor	Low		Medium	Altered & refilled	Low
B19	WR (B4)	1.57	1.3		NNST	poor	Low		High	Destruction	Low
B22	WR (B4)	0.35	0.8		-	poor	Low		High	Destruction	Low
B30	WR (B7)	0.09	1.1		ARGR, NNST	good	Moderate	Stream-like corridor	High	Destruction	Medium
B31	WR (B7)	0.13	1.2		ARGR, NNST	good	Moderate	Stream-like corridor	High	Destruction	Medium
B32	WR (B7)	0.60	0.9		NNST	poor	Low		High	Destruction	Low
B33	WR (B7)	0.67	1.2		none	poor	Low		High	Destruction	Low
B33a	pit (T1)	0.35	1.0		none	poor	Low		Medium	Altered & refilled	Low
B36	pit (P1)	7.93	0.8		NNST	poor	Low		Medium	Altered & refilled	Low
B37	pit (P1)	0.85	0.6		NNST	poor	Low		Medium	Altered & refilled	Low
B38	pit (P1)	3.30	1.5		NNST	poor	Low		Medium	Altered & refilled	Low
B39	WR (B4)	1.18	0.8		-	poor	Low		High	Destruction	Low
B60	pit (P1)	0.98	1.9		none	poor	Low		Medium	Altered & refilled	Low
B61	disrupted (P1)	1.16	0.9		none	poor	Low		Medium	Altered & refilled	Low
B62	pit (P1)	1.79	1.3		NNST	poor	Low		Medium	Altered & refilled	Low
CH28	WR (Disc)	0.52	0.4		none	poor	Low		High	Destruction	Low
CH29	WR (Disc)	0.75	0.5		none	poor	Low		High	Destruction	Low
CH31	WR (Disc)	1.09	0.7		none	poor	Low		High	Destruction	Low
CH32	WR (Disc)	1.08	1.6		none	poor	Low		High	Destruction	Low
E4	WR (B7)	8.52	3.7	0.4 - 1.4	ARGR, NNST	good	Moderate		High	Destruction	Medium
E5	WR (B7)	1.30	3.0		-	moderate	Moderate		High	Destruction	Medium

Attachment A - Summary of baseline data collection and risk assessment results by waterbody.

Water-body	Associated Infrastructure	Total Area (ha)	Max Depth (m)	DO (mg/L) in Apr 1998 or Apr 2011	Species Present (red text indicates presence implied by catches upstream)	Seasonal Connectivity to Meliadine Lake	Sensitivity to Fish and Fish Habitat	Discussion	Scale of Negative Effects	Discussion	Overall Risk within Meliadine Peninsula
E11	disrupted (road)	0.22	0.8		-	poor	Low		Medium	Altered & refilled	Low
H1	pad (plant)	1.14	1.3		ARGR, NNST	good	Moderate	Stream-like corridor	High	Destruction	Medium
H2	pad (plant)	0.16	0.3		ARGR, NNST	good	Moderate	Stream-like corridor	High	Destruction	Medium
H3	pad (plant)	0.27	0.4		none	moderate	Low		High	Destruction	Low
H4	pad (plant)	0.06	0.6		NNST	moderate	Low		High	Destruction	Low
H5	pad (plant)	0.37	0.6		NNST	moderate	Low		High	Destruction	Low
H6	pad (plant)	0.75	0.6		NNST	poor	Low		High	Destruction	Low
H7	pad (plant)	0.11	0.7		NNST	poor	Low		High	Destruction	Low
H9	WR (B7)	0.42	0.4		none	poor	Low		High	Destruction	Low
H10	WR (B7)	0.10	0.1		NNST	poor	Low		High	Destruction	Low
H11	WR (B7)	0.28	0.3		none	poor	Low		High	Destruction	Low
H12	WR (B7)	0.97	0.8		none	poor	Low		High	Destruction	Low
H13	WR (B7)	3.49	1.0		NNST	poor	Low		High	Destruction	Low
H14	WR (B7)	0.23	0.6		none	poor	Low		High	Destruction	Low
H14a	WR (B7)	0.15	0.4		none	poor	Low		High	Destruction	Low
H15	WR (B7)	1.10	0.8		NNST	poor	Low		High	Destruction	Low
H15d	WR (B7)	0.15	0.3		none	poor	Low		High	Destruction	Low
H15e	WR (B7)	0.21	0.5		none	poor	Low		High	Destruction	Low
H15g	WR (B7)	0.38	0.4		NNST	poor	Low		High	Destruction	Low
H16	pad (plant)	0.18	0.4		none	poor	Low		High	Destruction	Low
H17	Attenuation pond	15.80	1.7		NNST	poor	Low		Medium	Attenuation pond	Low
H18	WR (B7)	0.74	0.7		none	poor	Low		High	Destruction	Low
H19	pad (plant)	2.91	1.4		none	poor	Low		High	Destruction	Low
H20	pad (low grade ore)	9.58	1.6		none	poor	Low		High	Destruction	Low
J2	pad (low grade ore)	1.89	1.3		NNST	poor	Low		High	Destruction	Low
J3	pad (low grade ore)	1.47	1.2		none	poor	Low		High	Destruction	Low
J4	disrupted (road)	0.22	0.5		NNST	poor	Low		Medium	Altered & refilled	Low
J6	disrupted (road)	1.75	0.7		none	poor	Low		Medium	Altered & refilled	Low
J7	pit (W3)	3.51	1.8		NNST	poor	Low		Medium	Altered & refilled	Low
J8	disrupted (W3)	1.35	1.0		NNST	poor	Low		Medium	Water draw-down	Low

TSF	Tailings Storage Facility
WR	Waste Rock
ARCH	Arctic char
ARGR	Arctic grayling
LKTR	lake trout
CISC	cisco
BURB	burbot
NNST	ninespine stickleback
THST	threespine stickleback
none	sampled, but fish were not captured; NNST may be present
-	not sampled; NNST may be present

Attachment B - DFO attributes and integration of these attributes within the proposed sensitivity to fish and fish habitat decision tree

Attribute	DFO Description	Lower Risk (green)	Moderate Risk (yellow)	Higher Risk (orange)	Significant Negative Risk (red)	No HADD (blue)	Flow Chart Question Level	Flow Chart Question	Rationale
Habitat Dependence	Some species may be able to spawn in a wide range of habitats while others may have specific requirements		Migratory; feeding and rearing	Spawning (therefore critical)		No use	1	Do fish use this habitat?	If not, no HADD
							5	Is habitat use year-round?	Recently it has been suggested that spawning is not the only critical habitat, and that life-functions should be weight more equally (Minns)
Habitat Resiliency	Ability of the system to recover from changes in environmental conditions such as:								
	Thermal	Warm water	Cool water	Cold water			N/A	N/A	These are all cold-water systems so would not be impacted by this condition
	Physical	Stable and resilient to change		Unstable and resilient to change			2	Is there physical disturbance?	If not, and no water quality change, no HADD; water quality is also incorporated within the NNL plan as a co-factor
	Flow Regime	Ephemeral	Intermittent	Permanent			N/A	N/A	This is considered in level 5 and 6
Species Rarity	Relative strength of the fish population	Prevalent	Limited distribution		Rare (e.g. SARA-listed)		3	Are there any rare species or their habitat types present?	If yes, significant negative effects
							4	Are all species common in the region?	Stickleback and to some degree, arctic grayling are considered common regionally and within the Meliadine peninsula
Species Sensitivity	Sensitivity of fish to changes in e.g. TSS, temperature, salinity	Resiliant	Moderately resilient	Highly sensitive			2	Is there a change in water quality?	If not, and no physical disturbance, no HADD
Habitat Type Rarity	Prevalence of this particular type of habitat	Prevalent	Limited distribution		Rare		3	Are there any rare species or their habitat types present?	If yes, significant negative effects
							6	Is this habitat type prevalent in the region?	Prevalent = adequate replacement habitat in immediate vicinity

APPENDIX C

Habitat Types in Lakes, Ponds, and Streams Affected by the Project

Table C-1: Areas of Habitat Types within Individual Waterbodies Affected by the Meliadine Project

Lake / Pond	Type of HADD	Surface Area (ha)									
		HT 1 (<2 m; fines)	HT 2 (<2 m; mixed)	HT 3 (<2 m; coarse)	HT 4 (2 m to 4 m; fines)	HT 5 (2 m to 4 m; mixed)	HT 6 (2 m to 4 m; coarse)	HT 7 (>4 m; fines)	HT 8 (>4 m; mixed)	HT 9 (>4 m; coarse)	Total
A2	Disrupted	1.54	0.35	0.47	-	-	-	-	-	-	**2.36**
A2a	Destroyed - road	0.31	0.06	0.04	-	-	-	-	-	-	**0.41**
	Disrupted	1.15	0.13	0.25	-	-	-	-	-	-	**1.54**
A3	Disrupted	0.33	0.07	0.07	-	-	-	-	-	-	**0.48**
A4	Destroyed - road	0.01	0.01	0.01	-	-	-	-	-	-	**0.03**
	Disrupted	0.01	0.01	0.01	-	-	-	-	-	-	**0.03**
A5	Altered - pit	0.30	0.04	0.04	-	-	-	-	-	-	**0.37**
	Altered - road	0.85	0.11	0.11	-	-	-	-	-	-	**1.07**
	Disrupted	0.45	0.06	0.06	-	-	-	-	-	-	**0.56**
A6	Altered - drawdown	2.59	4.31	10.35	10.48	5.24	1.75	0.25	-	-	**34.96**
	Altered - pit	0.19	0.45	1.61	0.26	0.17	-	-	-	-	**2.68**
	Destroyed - drawdown	2.65	4.41	10.58	-	-	-	-	-	-	**17.64**
A8	Altered - pit	0.78	1.25	12.21	0.78	0.47	0.16	-	-	-	**15.65**
	Altered - road	0.23	0.38	3.96	2.51	0.38	0.15	-	-	-	**7.61**
	Disrupted	3.32	5.61	35.44	9.19	7.87	5.67	0.04	0.14	-	**67.28**
B4	Destroyed - waste rock	4.02	11.20	67.87	2.73	-	-	-	-	-	**85.82**
B5	Altered - pit	0.54	0.92	3.36	0.43	0.16	-	-	-	-	**5.42**
	Altered - road	0.22	0.37	1.70	1.22	0.19	-	-	-	-	**3.70**
	Destroyed - waste rock	0.17	1.13	4.06	0.23	0.06	-	-	-	-	**5.64**
	Disrupted	2.13	4.72	19.40	11.19	4.54	-	-	-	-	**41.98**
B6	Destroyed - waste rock	0.12	1.30	7.20	2.95	0.24	-	-	-	-	**11.80**
B7	Destroyed - waste rock	-	-	0.30	-	-	-	-	-	-	**0.30**

Table C-1: Areas of Habitat Types within Individual Waterbodies Affected by the Meliadine Project (continued)

Lake / Pond	Type of HADD	Surface Area (ha)									
		HT 1 (<2 m; fines)	HT 2 (<2 m; mixed)	HT 3 (<2 m; coarse)	HT 4 (2 m to 4 m; fines)	HT 5 (2 m to 4 m; mixed)	HT 6 (2 m to 4 m; coarse)	HT 7 (>4 m; fines)	HT 8 (>4 m; mixed)	HT 9 (>4 m; coarse)	Total
B7	Destroyed - TSF	0.93	5.51	35.83	8.99	4.35	0.58	1.39	0.01	-	**57.58**
B30	Destroyed - waste rock	0.07	0.01	0.01	-	-	-	-	-	-	**0.09**
B31	Destroyed - waste rock	0.10	0.02	0.01	-	-	-	-	-	-	**0.13**
E4	Destroyed - road	0.06	0.09	0.16	-	-	-	-	-	-	**0.31**
	Destroyed - waste rock	0.82	1.23	4.92	0.82	0.25	0.16	-	-	-	**8.21**
E5	Destroyed - waste rock	0.12	0.27	0.74	0.17	-	-	-	-	-	**1.30**
H2	Destroyed - pad	0.11	0.02	0.03	-	-	-	-	-	-	**0.16**
ML	Destroyed - jetty	-	-	0.04	-	-	0.03	-	-	0.01	**0.09**
Total		**24.13**	**44.04**	**220.85**	**51.94**	**23.90**	**8.50**	**1.68**	**0.15**	**0.01**	**375.20**

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

Table C-2: Stream Channel Lengths Affected by the Meliadine Project

Stream	Type of HADD	Channel Length (m)						
		HT 11 (<0.5 m; fines)	HT 12 (<0.5 m; gravel)	HT 13 (<0.5 m; coarse)	HT 14 (≥0.5 m; fines)	HT 15 (≥0.5 m; gravel)	HT 16 (≥0.5 m; coarse)	Total
A2-2a	Disrupted	2.4	4.0	8.8	-	0.2	0.6	**16.0**
A2a-3	Disrupted	12.5	20.8	48.1	-	0.8	0.8	**83.0**
A3-4	Disrupted	6.5	5.2	14.0	-	-	0.3	**26.0**
A4-5	Disrupted	16.8	27.9	64.8	-	1.1	1.1	**111.8**
A5-6	Destroyed - pit	190.7	41.6	166.5	4.1	-	4.1	**406.9**
A6-7	Destroyed - culvert	0.7	4.9	29.1	-	-	0.4	**35.0**
	Disrupted	1.6	11.0	64.7	-	-	0.8	**78.0**
A7-8	Disrupted	4.1	14.2	110.4	-	1.3	2.7	**132.7**
B4-5	Destroyed- waste rock	107.9	9.5	28.6	-	-	-	**146.0**
B5-6	Destroyed- waste rock	5.8	8.7	83.5	-	-	-	**98.0**
B5-31	Destroyed- waste rock	31.5	31.1	45.4	-	-	-	**108.0**
B31-30	Destroyed- waste rock	35.7	15.3	51.0	-	-	-	**102.0**
B30-6	Destroyed- waste rock	18.0	1.2	4.8	-	-	-	**24.0**
B6-7	Destroyed- waste rock	1.4	17.2	97.5	-	-	-	**116.0**
B46-59	Altered	130.5	7.3	7.3	-	-	-	**145.0**
H1-2	Destroyed - plant	147.9	17.4	-	8.7	-	-	**174.0**
H2-3	Destroyed - plant	12.3	7.5	14.4	0.4	0.4	0.4	**35.2**
H3-4	Destroyed - plant	95.9	28.2	14.1	1.4	1.4	-	**141.0**
H4-5	Destroyed - plant	30.5	13.9	11.1	-	-	-	**55.4**
H5-17	Destroyed - plant	127.5	15.0	7.5	-	-	-	**150.0**
Total		**980.1**	**301.8**	**871.5**	**14.5**	**5.2**	**11.0**	**2184.1**

Note: Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

APPENDIX D

Habitat Suitability Indices and Biomass Data Used in the Meliadine HEP Model

Table D-1: Habitat Suitability Indices (HSI) for Fish Species in the Meliadine Project area

Habitat Type		Depth	Substrate	Arctic Char				Lake Trout				Arctic Grayling			
				SP[a]	RE[a]	FO[a]	OW[a]	SP	RE	FO	OW	SP	RE	FO	OW
Lakes / Ponds	HT 1	<2 m	Fines	0	0.25	0.25	0	0	0.25	0.25	0	0	0.25	0	0
	HT 2	<2 m	Mixed	0	0.25	0.25	0	0	0.5	0.5	0	0	0.25	0.25	0
	HT 3	<2 m	Coarse	0	0.5	0.5	0	0	1	0.75	0	0	0.5	0.25	0
	HT 4	2 m to 4 m	Fines	0	0.5	0.5	0.75	0	0.5	0.5	0.75	0	0	0.5	0.75
	HT 5	2 m to 4 m	Mixed	0.5	0.75	0.75	0.75	0.5	0.75	0.75	0.75	0	0	1	0.75
	HT 6	2 m to 4 m	Coarse	1	1	1	0.75	1	1	1	0.75	0	0	1	0.75
	HT 7	>4 m	Fines	0	0.25	0.5	1	0	0.25	0.5	1	0	0	0.5	1
	HT 8	>4 m	Mixed	0.5	0.5	0.75	1	0.5	0.5	0.75	1	0	0	1	1
	HT 9	>4 m	Coarse	1	0.5	1	1	1	0.5	1	1	0	0	1	1
	HT 10	<Monimo[b]	none	0	0	0.25	0.75	0	0	0.5	0.75	0	0	0	0.5
Streams	HT 11	<0.5 m	Fines	0	0.25	0	0	0	0.25	0	0	0	0.25	0	0
	HT 12	<0.5 m	Gravel	0	0.75	0	0	0	0.75	0	0	1	0.75	0.25	0
	HT 13	<0.5 m	Coarse	0	1	0.25	0	0	1	0.25	0	0.5	1	0.5	0
	HT 14	≥0.5 m	Fines	0	0.25	0.25	0	0	0.25	0.25	0	0	0.25	0	0
	HT 15	≥0.5 m	Gravel	0	0.75	0.25	0	0	0.75	0.25	0	1	1	0.5	0
	HT 16	≥0.5 m	Coarse	0	1	0.5	0	0	1	0.5	0	0.5	1	0.5	0

Table D-1: Habitat Suitability Indices (HSI) for Fish Species in the Meliadine Project area (continued)

Habitat type		Depth	Substrate	Round Whitefish				Cisco				Burbot			
				SP[a]	RE[a]	FO[a]	OW[a]	SP	RE	FO	OW	SP	RE	FO	OW
Lakes / Ponds	HT 1	<2 m	Fines	0	0.25	0.75	0	0	0.25	0.5	0	0	0.25	0.25	0
	HT 2	<2 m	Mixed	0	0.75	0.5	0	0	1	1	0	0	0.75	0.5	0
	HT 3	<2 m	Coarse	0	0.75	0.5	0	0	1	1	0	0	1	0.5	0
	HT 4	2 m to 4 m	Fines	0	0.25	1	0.75	0	0.25	0.75	0.75	0	0.25	0.25	0.75
	HT 5	2 m to 4 m	Mixed	0.5	0.75	0.75	0.75	0.25	0.5	1	0.75	1	0.5	0.75	0.75
	HT 6	2 m to 4 m	Coarse	1	1	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.5	1	0.75
	HT 7	>4 m	Fines	0	0.25	1	1	0	0	0.75	1	0	0	0.25	1
	HT 8	>4 m	Mixed	0.25	0.25	0.5	1	0.5	0.25	1	1	1	0	0.75	1
	HT 9	>4 m	Coarse	0.75	0.5	0.5	1	1	0.25	0.75	1	0.75	0.25	1	1
	HT 10	<Monimo[b]	none	0	0	0	0.75	0	0	0.75	0.75	0	0	0.25	0.25
Streams	HT 11	<0.5 m	Fines	0	0	0	0	0	0	0	0	0	0	0	0
	HT 12	<0.5 m	Gravel	0	0	0	0	0	0	0	0	0	0.25	0	0
	HT 13	<0.5 m	Coarse	0	0.25	0	0	0	0	0	0	0	0.5	0	0
	HT 14	≥0.5 m	Fines	0	0.25	0	0	0	0	0	0	0	0	0	0
	HT 15	≥0.5 m	Gravel	0	0.5	0	0	0	0	0	0	0	0.25	0.25	0
	HT 16	≥0.5 m	Coarse	0	0.75	0	0	0	0	0	0	0	0.5	0.5	0

Table D-1: Habitat Suitability Indices (HSI) for Fish Species in the Meliadine Project area (continued)

Habitat type		Depth	Substrate	Slimy Sculpin				Ninespine Stickleback				Threespine Stickleback			
				SP[a]	RE[a]	FO[a]	OW[a]	SP	RE	FO	OW	SP	RE	FO	OW
Lakes / Ponds	HT 1	<2 m	Fines	0	0	0.25	0	1	1	1	0	1	1	1	0
	HT 2	<2 m	Mixed	0.25	0.25	0.5	0	0.5	0.5	0.75	0	0.5	0.75	0.75	0
	HT 3	<2 m	Coarse	1	1	1	0	0	0.25	0.75	0	0	0.75	0.75	0
	HT 4	2 m to 4 m	Fines	0	0	0.25	0.75	0	0	0.5	0.75	0	0.25	0.5	0.75
	HT 5	2 m to 4 m	Mixed	0.25	0.25	0.5	0.75	0	0	0.25	0.75	0	0.25	0.5	0.75
	HT 6	2 m to 4 m	Coarse	0.75	0.75	1	0.75	0	0	0.25	0.75	0	0.25	0.5	0.75
	HT 7	>4 m	Fines	0	0	0	1	0	0	0	1	0	0	0	1
	HT 8	>4 m	Mixed	0	0	0.25	1	0	0	0	1	0	0	0	1
	HT 9	>4 m	Coarse	0.5	0.5	0.5	1	0	0	0	1	0	0	0	1
	HT 10	<Monimo[b]	none	0	0	0	0.25	0	0	0	0.75	0	0	0	0.75
Streams	HT 11	<0.5 m	Fines	0	0	0	0	1	1	1	0	0.5	0.5	0.5	0
	HT 12	<0.5 m	Gravel	0	0.25	0.25	0	0	0.25	0.25	0	0.25	0.25	0.25	0
	HT 13	<0.5 m	Coarse	0.5	1	1	0	0	0.5	0.5	0	0	0.25	0.25	0
	HT 14	≥0.5 m	Fines	0	0	0	0	0.5	0	0.5	0	0	0.5	0.5	0
	HT 15	≥0.5 m	Gravel	0.25	0.25	0.25	0	0	0	0.5	0	0	0.25	0.5	0
	HT 16	≥0.5 m	Coarse	0.5	1	1	0	0	0	0.5	0	0	0.25	0.5	0

[a] SP = spawning; RE = rearing; FO = foraging (adults); OW = overwintering

[b] Monimo = pit lake habitat above chemocline that separates monimolimnion from the mixing zone

Table D-2: Fish data used to derive abundance indices for the Meliadine Project

Total Number of Fish Recorded *(includes captured and observed fish)*

Ecotype	Number of Fish Recorded									
	ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST	Total
Meliadine Lake	476	469	208	114	2,503	18	14	5	6,227	**10,034**
Lower Peninsula Lakes	83	40	296	60	198	20	1	724	201	**1,623**
Upper Peninsula Lakes	-	-	612	-	42	3	1	3,635	-	**4,293**
Lower Peninsula Streams	52	62	325	2	6	23	145	810	197	**1,622**
Upper Peninsula Streams	-	-	161	-	-	7	53	1,197	-	**1,418**
Total	**611**	**571**	**1,602**	**176**	**2,749**	**71**	**214**	**6,371**	**6,625**	**18,990**

Note: ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback.

Mean Weight of Fish *(based on individual fish that were weighed)*

Ecotype	Mean Weight of Fish (g)								
	ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST
Meliadine Lake	234	1,156	321	250	97	360	3	2	2
Lower Peninsula Lakes	572	993	227	93	232	98	7	2	2
Upper Peninsula Lakes	-	-	145	-	322	201	-	2	2
Lower Peninsula Streams	21	19	115	20	45	71	6	2	2
Upper Peninsula Streams	-	-	72	-	-	5	5	2	2

Note: ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback.

Table D-2: Fish data used to derive abundance indices for the Meliadine Project (continued)

Total Biomass *= Total Number of Fish Recorded x Mean Weight of Fish*

Ecotype	Biomass (g)									
	ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST	Total
Meliadine Lake	111,568	542,098	66,678	28,463	242,680	6,488	42	8	11,769	**1,009,794**
Lower Peninsula Lakes	47,453	39,734	67,078	5,595	45,971	1,950	7	1,151	380	**209,320**
Upper Peninsula Lakes	-	-	88,669	-	13,524	604	-	5,780	-	**108,576**
Lower Peninsula Streams	1,088	1,187	37,310	40	267	1,639	840	1,288	372	**44,032**
Upper Peninsula Streams	-	-	11,579	-	-	35	289	1,903	-	**13,806**
Total	**160,109**	**583,019**	**271,314**	**34,098**	**302,442**	**10,716**	**1,178**	**10,130**	**12,521**	**1,385,528**

Note: ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback. Some numbers are rounded for presentation purposes, so the totals may not equal exactly the sum of individual values.

Relative Biomass *= (Biomass of Species$_n$ in Ecotype$_y$ / Total Biomass in Ecotype$_y$) x 100*

Ecotype	Relative Biomass (%) of Each Species per Ecotype									
	ARCH	LKTR	ARGR	RNWH	CISC	BURB	SLSC	NNST	THST	Total
Meliadine Lake	11.0	53.7	6.6	2.8	24.0	0.6	<0.1	<0.1	1.2	**100.0**
Lower Peninsula Lakes	22.7	-	32.0	2.7	22.0	0.9	<0.1	0.5	0.2	**100.0**
Upper Peninsula Lakes	-	-	81.7	-	12.5	0.6	-	5.3	-	**100.0**
Lower Peninsula Streams	2.5	2.7	84.7	0.1	0.6	3.7	1.9	2.9	0.8	**100.0**
Upper Peninsula Streams	-	-	83.9	-	-	0.3	2.1	13.8	-	**100.0**
All Ecotypes Combined	**11.6**	**42.1**	**19.6**	**2.5**	**21.8**	**0.8**	**0.1**	**0.7**	**0.9**	**100.0**

Note: ARCH = Arctic char; LKTR = lake trout; ARGR = Arctic grayling; RNWH = round whitefish; CISC = cisco; BURB = burbot; SLSC = slimy sculpin; NNST = ninespine stickleback; THST = threespine stickleback. Some numbers are rounded for presentation purposes, so the totals may not equal exactly the sum of individual values.

APPENDIX E

Contingency Offsetting Option - Improved Access for Arctic Char to Pistol Bay Watershed

TECHNICAL MEMORANDUM

Agnico Eagle Mines Ltd: Meliadine Gold Project
Rankin Inlet, Nunavut, X0C 0B0

Date: October 15, 2012
Subject: Habitat unit estimate for improved access for Arctic char movements from Pistol Bay to five lakes upstream of Pistol Bay Falls.
By: Ryan VanEngen (AEM-Environment Biologist) and reviewed by Jack Patalas (Golder)

1 Introduction

1.1 Background

During informal discussions with the HTO in 2010 and 2011, Josephine Falls and Pistol Bay Falls were mentioned as having barriers to fish passage at the outflow that were preventing Arctic char from overwintering in upstream lakes. There was support from the Rankin Inlet HTO to remove these barriers to enhance the fishery for which commercial fisheries licences exist. As told by one Inuk, the fishery would benefit "if more char are living over the winter, then it would mean more char later on". According to the HTO, there are more opportunities to remove fish barriers than just Pistol Bay and Josephine Falls. As a result of the support, AEM conducted reconnaissance visits at both Josephine Falls and Pistol Bay in late September 2011. The reconnaissance visits at both sites and a follow-up visit to Pistol Bay on August 16, 2012, with AEM and DFO representatives, indicated that Pistol Bay may provide the best opportunity for opening up access for arctic char to upstream areas that are otherwise limited due to a natural barrier.

Since it is normally not possible or cost effective to directly measure production of fish populations (i.e. kg/yr), alternative metrics such as habitat area and suitability are commonly used in fisheries management (Randall and Minns 2002). The concept of a habitat evaluation procedure (HEP) to calculate Habitat Units (HUs) as a surrogate for productive capacity of fish communities was first developed by the US Fish and Wildlife Service in the 1980s and has since been adopted by habitat managers in northern Canada. This memo applies a HEP consistent with the main Meliadine No Net Loss plan, but specifically adopts an access factor to calculate the access of arctic char into lakes upstream of Pistol Bay Falls. This memo provides the methods, results and discussion for excluding arctic char from the pre-compensation HU and recalculates the HU gains to include arctic char in the post-compensation calculations, which assumes full access of arctic char from Pistol Bay, through Pistol Bay Falls, to five upstream lakes.

1.2 Objectives

The following memorandum outlines the reconnaissance and mapping, photographic documentation, qaujimajatuqangit and provides an estimate of Habitat Units (HUs) for improving access to lakes upstream of Pistol Bay falls. The data presented are summarized in support of the Agnico-Eagle Mines Meliadine Gold Project No Net Loss Plan and the calculations in this document are estimates of HU gains based on a conservative theoretical model of species presence/ absence; additional field data collection is required to confirm these estimates and will be collected if this concept for fisheries compensation is deemed appropriate by the DFO.

2 Reconnaissance and Mapping

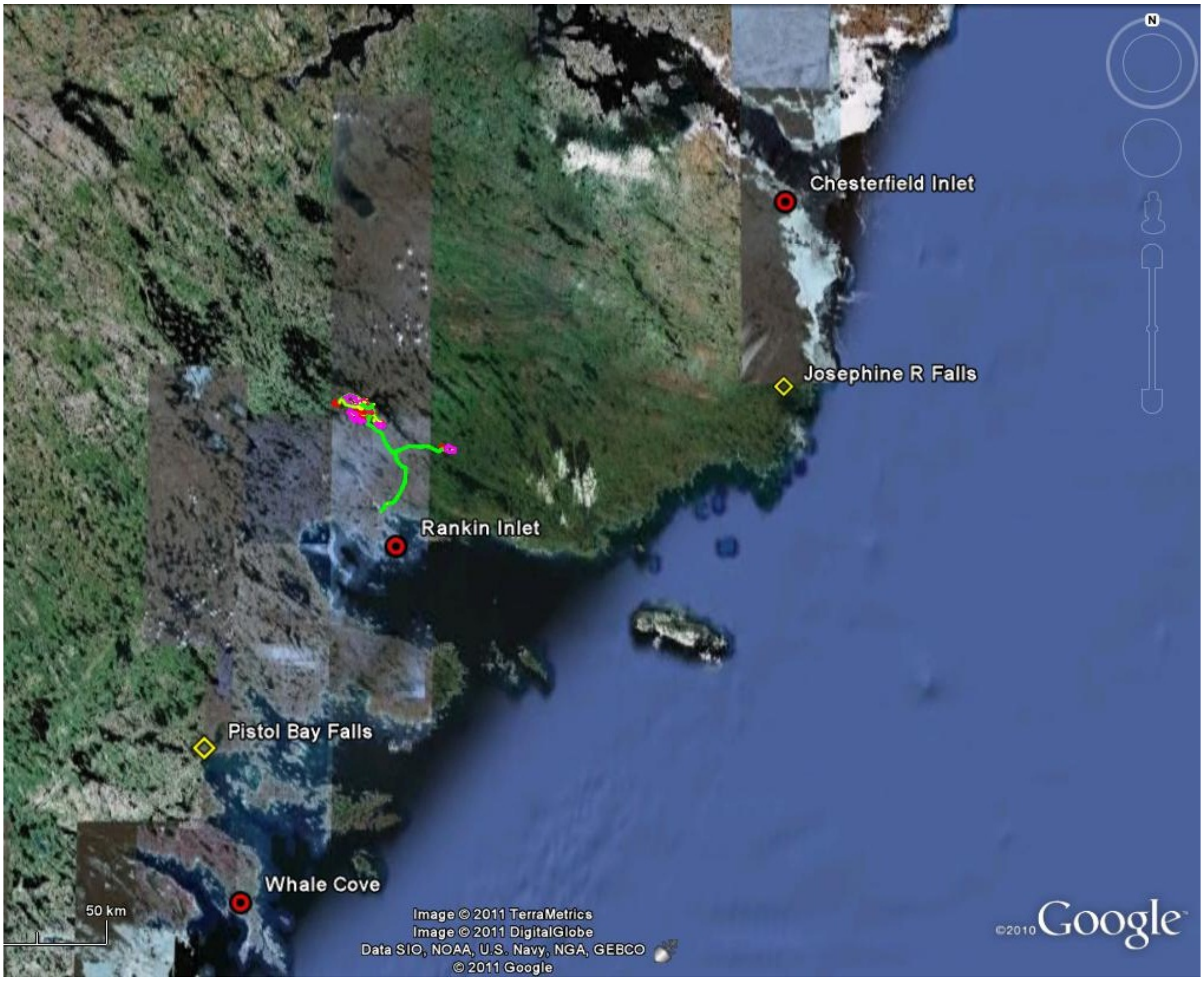
2.1 Location and Mapping

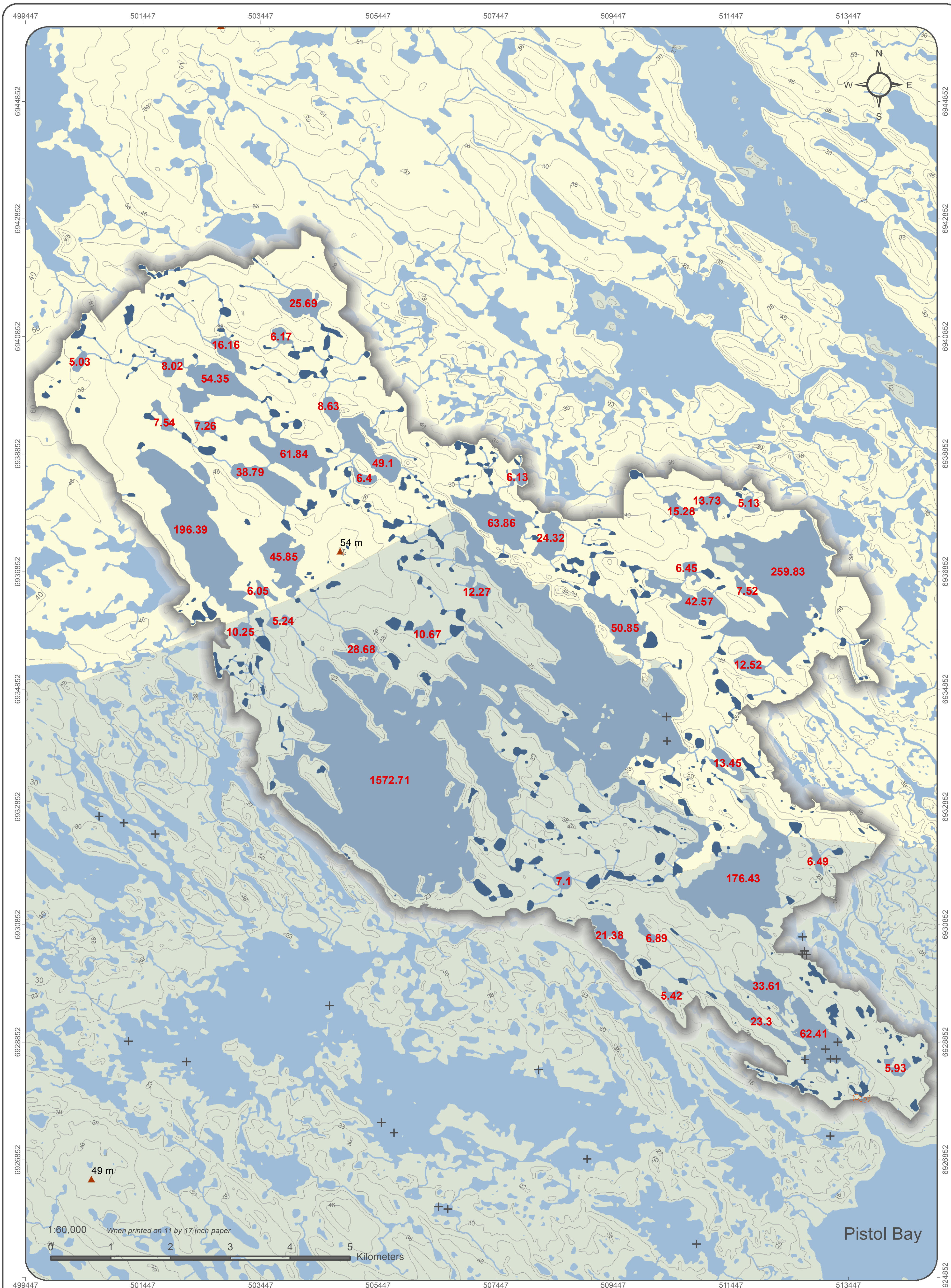
Pistol Bay Falls are located approximately 65 km southwest of the Meliadine Gold Project and is located at a transition from freshwater to marine environment (Figure 2-1). Detailed GIS mapping was completed to improve preliminary knowledge of the Pistol Bay watershed by providing an understanding of watershed size, waterbody sizes, water flow and connectivity that could be verified in future field programs. The Pistol Bay watershed delineation and waterbody size estimates were done through the use of digital elevation data (Canadian Digital Elevation Data (CDED) and National Hydrology Network data). Specifically, waterbodies within the Pistol Bay Falls watershed were mapped and an estimate of the surface area of the lakes was completed; waterbodies that have a surface area > 5 ha are identified in dark blue on Figure 2-2, all other lakes have an area labelled on the map.

2.2 General Description

The Pistol Bay Falls is an approximately 2 meter elevation change from the marine environment to an up-gradient freshwater watershed. Upstream of the falls, a series of waterbodies connects to a chain of larger lakes (>50 ha) that likely provide overwintering habitat for fish. The Pistol Bay Falls watershed area is 9710 ha and contains 432 waterbodies; 45 of which are greater than 5 ha and account for 3053.7 ha (Figure 2-2). The reconnaissance visits in September 2011 and August 2012 confirmed that Pistol Bay Falls is likely a barrier for fish passage to upstream lakes. Furthermore, the reconnaissance and aerial survey identified good connectivity between the falls and lakes PBF-1 to PBF-2, 3 and 4; a meandering, partially braided stream connection between PBF-4 and 5; and a stream- like- corridor with a shallow pond connecting PBF-5 and 6. A likely fish barrier was identified north of PBF-6 (Figure 2-3).

Figure 2-1. Location of Pistol Bay Falls, Josephine River, Meliadine Gold Project, Whale Cove and Rankin Inlet





▲ Elevation Point	Pistol Bay Falls Watershed
Contour (10m intervals)	Aboriginal Lands
Hydrographic Obstacles	**Waterbodies in Pistol Bay Falls Watershed**
Pistol Bay Falls	less than 5 ha
+ Rocks	greater than 5 ha

Note: The hectares (ha) of the waterbodies within the Pistol Bay Watershed with surface area greater than 5 ha are labelled in red.

Pistol Bay Falls Watershed area = 9710 ha

Number of Waterbodies with area <= 5 ha = 387

The total area of the Waterbodies with area <=5 = 352.0 ha

Number of Waterbodies with area > 5 ha = 45

The total area of the Waterbodies with area > 5 ha = 3053.7 ha

minnow environmental inc.

AGNICO-EAGLE

ACCESS

Watershed delinated from GeoBase 30m DEM. CanVec topographic data version 10.
Projection: NAD 83 UTM Zone 15

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(*Last edited by: jlindeman;06/09/2012/09:25 AM*)

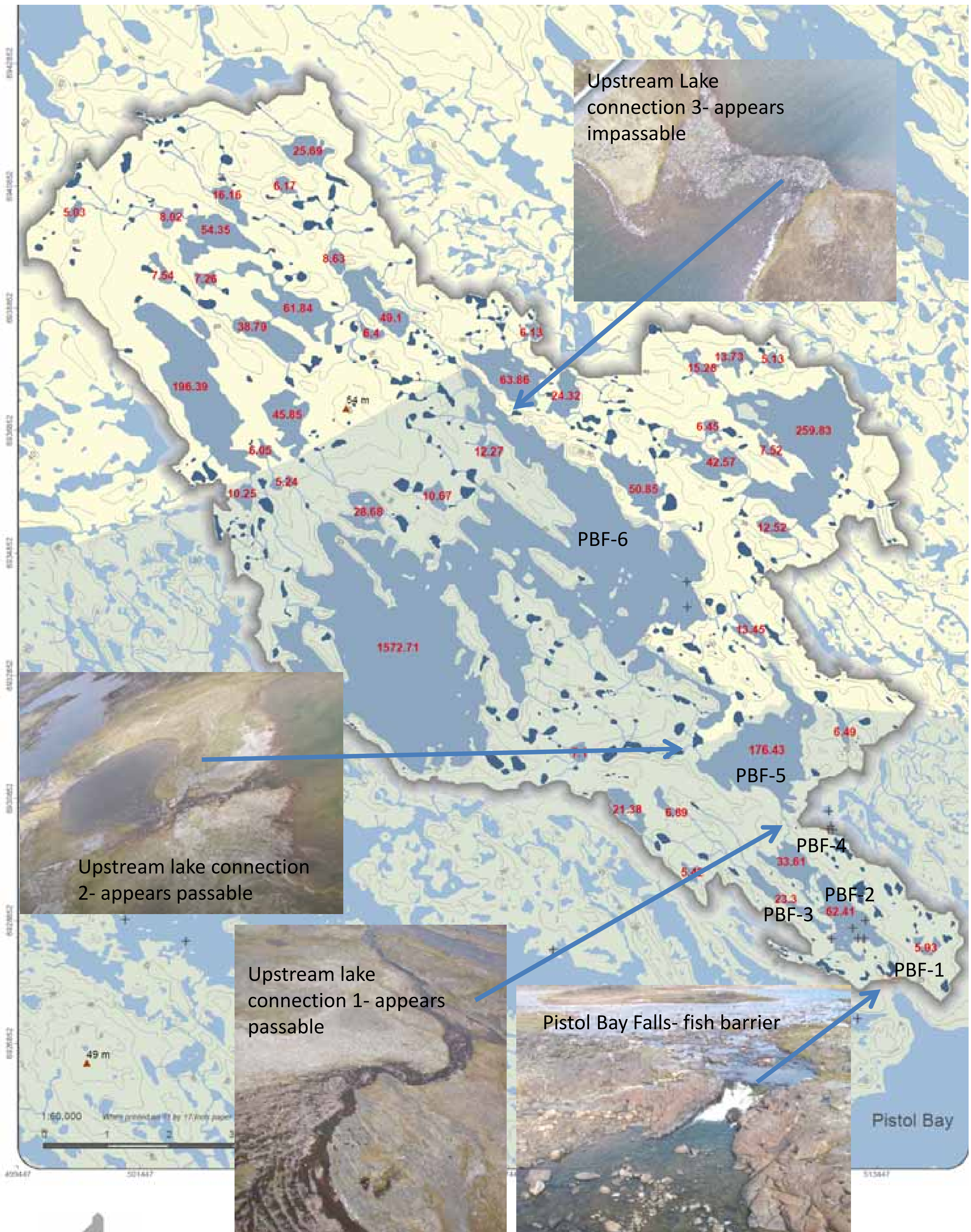

Figure 2-3. Pistol Bay Falls upstream lake aerial survey and identifiers

2.3 Photographic Documentation

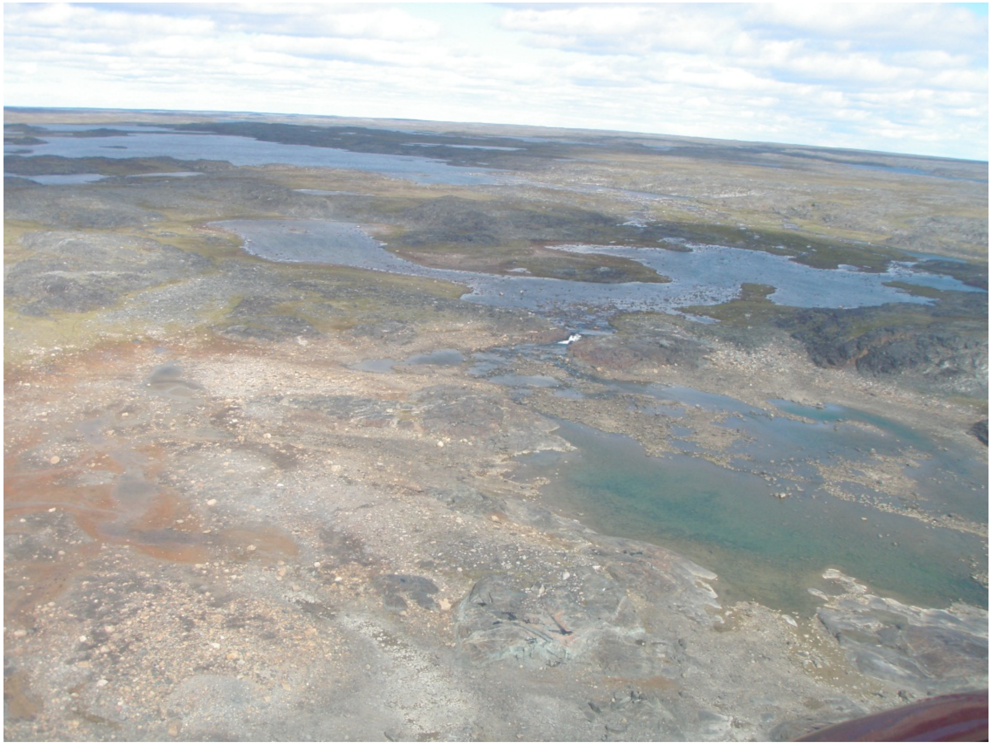

Photo 1- Aerial photo with falls in the middle of the picture

Photo 2- Pistol Bay from the falls viewing the ocean

Photo 3- Pistol Bay Falls

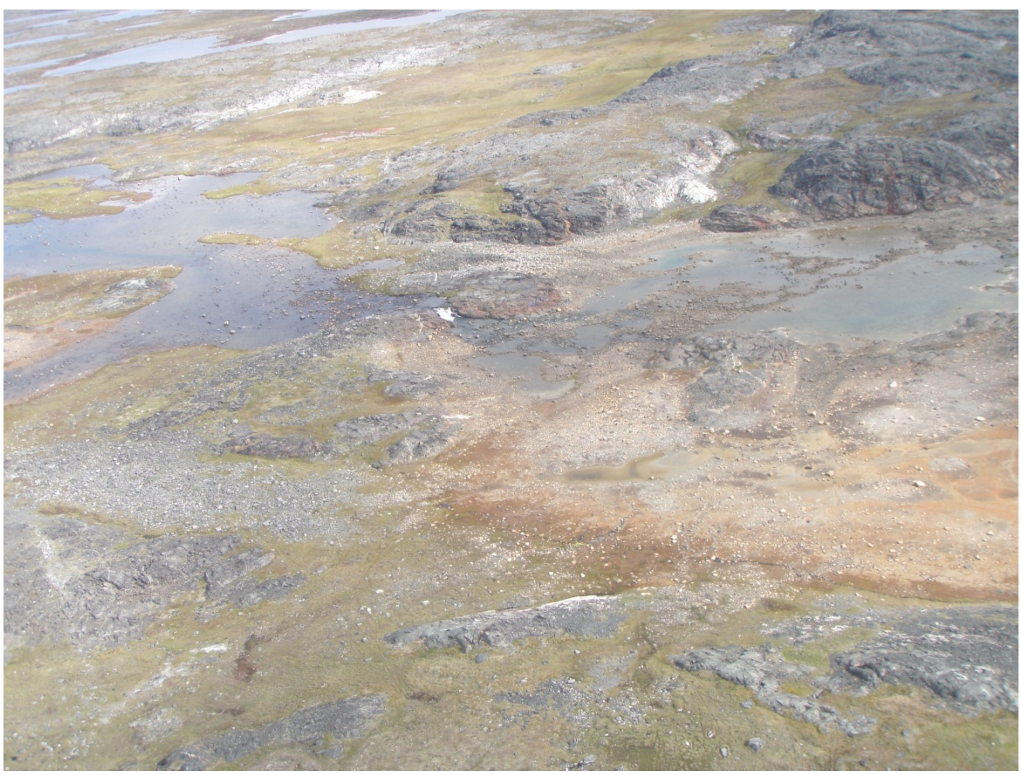

Photo 4- Pistol Bay Falls- gradually sloped boulder field to the north and south; these are possible locations for creating side channels to permit fish passage.

3 Qaujimajatuqangit

During the late-mid 20th century, most people living in Rankin Inlet had wage-labour jobs or were in primary or secondary school during the winter months. Recreation thus became an increasingly important activity. In spring and summer, many families would camp inland. The most important camping areas were Meliadine and Diana lakes, the Meliadine and Diana rivers, Scarab point, Baker Foreland, the Falstaff Islands area, Pangertot Peninsula, Corbett Inlet, and Pistol Bay (Freeman 1976- in Golder, 2012). During summer camping, people would gather berries, fish, and gather eggs near their campsites. Hunting was limited to periods of vacation, or days off work. While the lifestyles of the people of Rankin Inlet became increasingly less traditional, caribou, seals and fish still made up a large part of the Inuit diet (Freeman 1976 in Golder, 2012). Whale Cove was established in 1959, as families relocated from Rankin Inlet after the North Rankin Nickel Mine closed. As a result, Whale Cove families are familiar with hunting in the Rankin Inlet area. Whale Cove is located on the tip of a long peninsula, and the people who settled there were traditionally "inlanders", who often travelled inland as far as Henik Lake, Kaminak Lake, or the Padlei area to hunt caribou, or to run their traplines. They continue to hunt intensively in the coastal areas, around Corbett Inlet, Pistol Bay, and south to Sandy Point and beyond (Nanuk Enterprises 2011, in Golder 2012).

Consultation with the Rankin Inlet HTO for the Meliadine Gold Project assisted AEM in identifying opportunities to enhance fish production near Rankin Inlet. During these consultations, Pistol Bay Falls was identified by the HTO as a fish barrier. Many within the HTO have agreed that enhancement or improving access beyond the falls to provide additional overwintering habitat and ultimately enhance the Pistol Bay fishery, for which commercial fisheries licences exist. As told by one Inuk during meetings with the HTO, the fishery would benefit "if more char are living over the winter, then it would mean more char later on".

On October 24, Sam Tututanuak (AEM- community liaison, Rankin Inlet) collected additional qaujimajatuqangit on the Pistol Bay watershed and spoke with representatives from the hamlet of Whale Cove. He asked a series of questions that included:

1. Do char get up the waterfall and spend the winter in the upstream lakes?
2. Is the waterfall too high for the Char to get up it?
3. Does anyone fish these lakes in the summer or winter, or do you know anyone who fished them in the past?
4. Are Char caught in the upstream lakes?
5. Have other species such as lake trout, round whitefish, burbot, cisco, arctic grayling etc been caught in lakes upstream of pistol bay falls?
6. If so, which lakes have these species?

The results from these conversations from the Whale Cove representatives are consistent with the Rankin Inlet HTO consultation, and suggested that char may be able to move up the falls during high water levels, however during low flows (and in particular in the past 5 years) the flow has not permitted char passage from Pistol Bay to upstream lakes. The qaujimajatuqangit suggested that lake trout, arctic grayling, round white fish, burbot and few char (likely land-locked) have been caught in the upstream lakes. However, recently, char have not been caught in large quantities despite much effort. Based on the information gathered between Rankin Inlet and Whale Cove representatives, Pistol Bay Falls is a barrier for char passage to upstream lakes and therefore warrants consideration as a compensation option.

4 Methodology for estimating Habitat Units for access upstream of Pistol Bay Falls

Since it is normally not possible to directly measure production of fish populations (i.e. kg/yr), alternative metrics such as habitat area and suitability are commonly measured (Randall and Minns 2002). In order to establish quantifiable links between fish production and habitat, fish production is often measured directly (Minns 1995) and a habitat-productivity model established. In the absence of direct measurements of productivity, a system to provide managers with repeatable habitat suitability indices based on measurable physical properties, such as the scientifically defensible Habitat Suitability Matrix model is commonly used, as is the case for managers in of fishes of the Great Lakes region (Minns, Moore et al. 2001).

Recently, AEM submitted the Meadowbank NNL Plan (AEM, 2012) which incorporates methods originally proposed for use at the Meliadine Project and adapted for the Meadowbank site. The HEP model used in this memo, is akin to the Meadowbank HEP equation which can be described, for each fish species (spp 1-n) as:

$\mathbf{HU}_{spp\ 1\text{-}n}$=

$\sum_{HT\ 1\text{-}10}$ ($\sum_{sp,nu,fo,ow}$($\mathbf{HT}_{1\text{-}10}$ x $\mathbf{HSI}_{sp,re,fo,ow}$ x **life function weight** x **species weight**)]) **x habitat co-factor x access factor**

Where $HT_{1\text{-}10}$ = area (ha) of habitat types 1 through 10

$HSI_{sp,nu,fo,ow}$ = habitat suitability index for each life function:

Sp = spawning and nursery use

Re= Rearing use

fo = foraging use

ow = overwintering use

The HEP model used in the main report does not specifically include an access factor as is described in this memo, rather accomplishes the same objective by applying a different species assemblage depending on the pre and post-compensation access scenarios to Meliadine Lake.

The access factor was suggested in the review by Dr. Ken Minns and presented to DFO as part of the Meadowbank No Net Loss plan and accepted by DFO for that project. The usefulness in applying the access factor specifically for the Pistol Bay access option is inherent to the compensation concept.

4.1 Habitat Type- Substrate and Depth

The foundation of the HEP is the delineation of “habitat types” – the method by which habitat areas are grouped, and thereby mapped. For the purposes of estimating habitat unit gains, Habitat types 1-9 are applied to natural habitat for various combinations of substrate type and depth zone.

Table 4-1. Physical characteristics of the habitat types used for Pistol Bay estimate.

Habitat Type	Depth Zone	Substrate
1	0-2m	Fine
2	0-2m	Mixed
3	0-2m	Coarse
4	2-4m	Fine
5	2-4m	Mixed
6	2-4m	Coarse
7	>4m	Fine
8	>4m	Mixed
9	>4m	Coarse

In order to calculate the extents of each habitat type, depth zones and substrate are typically mapped. For the purposes of estimating habitat types, it was assumed that lake habitat in the Pistol Bay Falls watershed have a similar habitat type ratio as an average of the Meliadine Project Lakes (See Table 4-2). Unfortunately, larger lakes (>100 ha) were not fully mapped during baseline data collection, therefore an average has been assumed for the Pistol Bay lakes, regardless of their surface area. This is likely to add a level of conservancy to the estimate, especially for lake PBF-6. Based on a regional assessment that provided a relationship between area and depth (Max Depth = $0.8523*\text{Area}^{0.3597}$ $r^2 = 0.731$, n=98), it is likely that lake PBF-1 to 5 have similar bathymetries (with depths between 2.0 - 5.5m) to the project lakes, and therefore an average ratio of habitat types is an appropriate assumption for these lakes. However, PBF-6 is likely to have a depth greater than 12m and therefore the Habitat Types 7-9 are likely underestimated, likely decreases the overall habitat gains for arctic char and is therefore more conservative estimate of gains.

Table 4-2. Average % (+/- 0.5) composition of habitat types from Meliadine Project Lakes >2.0m deep and with an area > 25 ha; this % habitat type was assumed for lakes upstream of Pistol Bay Falls

Lake	Area (ha)	Volume (m^3 x 10^3)	Depth (m) Mean	Depth (m) Max	Hab 1	Hab 2	Hab 3	Hab 4	Hab 5	Hab 6	Hab 7	Hab 8	Hab 9
					Habitat Composition area (%)								
B69	25.03	406.6	1.6	5.4	12	22	32	25	5	3	1	0	0
B52	33.42	329.9	1.0	3.3	19	30	45	5	1	0	0	0	0
B46	44.72	329.7	0.7	2.0	13	57	30	0	0	0	0	0	0
B45	47.37	591.9	1.2	2.3	64	15	19	2	0	0	0	0	0
A6	55.28	834.6	1.5	4.7	6	16	67	6	4	0	0	0	0
B5	56.74	869.1	1.5	3.4	5	13	50	23	9	0	0	0	0
E3	56.82	880.9	1.6	4.7	15	23	30	25	4	2	1	0	0
B7	57.88	855.9	1.5	5.1	2	10	62	16	8	1	2	0	0
B4	85.82	759.9	0.9	2.4	25	13	59	3	0	0	0	0	0
A8	90.54	1414.8	1.6	4.2	5	8	55	14	10	6	1	1	0
				average %	**17**	**21**	**45**	**12**	**4**	**1**	**1**	**0**	**0**

Aerial surveys and mapping indicated that there was a good hydraulic connection between 6 lakes located upstream of Pistol Bay Falls. Although it is possible that adjacent waterbodies are also connected to one-another, lakes smaller than 5 ha were not included in this calculation as they do not provide overwintering habitat; lakes that were likely impassable were not included; and lakes not surveyed by aerial reconnaissance (those north of PBF-6) were not included in the compensation calculation. Although it is very well connected, the PBF-1 waterbody, which is less than 5 ha, was not included in the calculation. Based on this methodology, lakes PBF-2, 3 ,4, 5 and 6 areas were included as an estimate of habitat unit gains through improved access to these lakes from Pistol Bay. The average % of habitat types in the Meliadine project presented in Table 4-2 was applied to these 5 lakes to generate theoretical habitat types for each upstream lake that would have improved connection to Pistol Bay post-compensation. Table 4-3 presents the theoretical areas by habitat type for each of these lakes. These habitat type areas were used to calculate the pre-compensation and post-compensation scenarios.

Table 4-3. Theoretical area of habitat types for PBF-2 to PBF-6 lakes upstream of Pistol Bay Falls

Habitat Type	Average (%)*	PBF-2	PBF-3	PBF-4	PBF-5	PBF-6
1	17	10.61	3.961	5.7137	29.993	267.36
2	21	13.106	4.893	7.0581	37.05	330.27
3	45	28.085	10.485	15.125	79.394	707.72
4	12	7.4892	2.796	4.0332	21.172	188.73
5	4	2.4964	0.932	1.3444	7.0572	62.908
6	1	0.6241	0.233	0.3361	1.7643	15.727
7	1	0.6241	0.233	0.3361	1.7643	15.727
8	0	0	0	0	0	0
9	0	0	0	0	0	0
Total		63.03	23.53	33.95	178.19	1588.44 ha

* +/- 0.5% : margin of error has resulted in small sum of the area by habitat type errors for some of the waterbodies.

4.2 Habitat Suitability Indices

The habitat suitability term represents the relative quality of each habitat type for each life function of each fish species present in the region. In the case of this HEP, the life functions spawning/ nursery, rearing, foraging and overwintering were considered. In this HEP, habitat suitability is indicated through a ranking of 0, 0.25, 0.5, 0.75 or 1. The same HS I is used in this calculation at was used for the main Meliadine NNL Plan.

4.3 Life Function Weight

Consistent with the main Meliadine NNLP method, in this HEP, life function weights were equal, at 0.25 each for spawning, nursery, foraging and overwintering.

4.4 Species Weight

The overall species weights differs slightly in this memo compared to the main plan. In this method the species weight sums to 0.66 for pre-compensation and 1 across species for post-compensation. It is comprised of a biomass weighting (taken from Bay-Goose Basin fishout data set (AEM, 2012); Bay-goose basin is a shallow portion of Third Portage Lake with maximum depth of ~12m) multiplied by the same fisheries value weighting as was used in the main NNL plan. This produces an overall species weight post-compensation of 0.34 for arctic char, 0.34 for lake trout, 0.18 for round white fish, 0.07 for burbot, 0.00 for sculpin, 0.00 for stickleback, 0.03 for cisco and 0.05 for arctic grayling which is similar to Meliadine Lake.

4.5 Fisheries Weight

Consistent with the main NNLP method, the same fisheries weights were used to reflect the relative value of each species for subsistence fishing.

4.6 Habitat Co-Factor

The habitat co-factor represents any changes to non-mapped habitat quality (thermal, hydrological, biological or chemical regimes) that will occur in the fish habitat post-compensation. The use of this factor was suggested by Dr. Ken Minns and his suggested values as presented in a workshop for DFO in February, 2012 (Minns, 2012), are shown in Table 4-6.

Table 4-6. Habitat co-factor for various pre- and post-compensation scenarios, according to Minns, 2012.

Change in regime	Description	Pre-compensation factor	Post-compensation factor
Degradation (expected)	Thermal, hydrologic, chemical and/or biological regime shifts away from preferred state for fish habitat	1	> 0 and < 1
No change	-	1	1
Enhancement (anticipated or proposed)	Thermal, hydrologic, chemical and/or biological regime expected to shift towards preferred state for fish habitat	> 0 and < 1	1

The habitat co- is an appropriate weighting when remediation that leads to water quality changes of non-pristine lakes is proposed as compensation. Since remediation is not proposed as compensation in this option, for the purposes of this calculation, the co-factor was assumed 1 for both pre and post-compensation, and is therefore trivial.

4.7 Access Factor

During a review of the Meliadine NNL methodology and in DFO workshops, Dr. Minns (2012) also suggests the use of an access factor when fish assemblages are expected to change between the pre- and post-compensation scenarios. According to Minns (2012), it is preferable to use a regional fish species assemblage and assign the access factor of 1 for any species present in the habitat area, and 0 for any species not present. If each species receives an access factor in both the pre- and post- calculations (Table), the opening of access to a habitat area for a species that did not have access pre-compensation and results in a gain of habitat units post-compensation. Similarly, the loss of access results in a loss of habitat units. These gains or losses may be complete (affect all species), or partial (only some species are affected). In this case, we assumed arctic char did not have access, were not present or landlocked and therefore were given a score of 0 for pre-compensation and 1 for post-compensation.

For the purposes of this estimate, all species, except arctic char are assumed present pre-compensation and all species, including arctic char are assumed present post-compensation. Although the traditional knowledge is compelling, without field data collection the presence or absence of a species pre-compensation is uncertain, whereas presence or absence in the post-closure scenario is conceptual and will therefore always have a level of uncertainty. Nonetheless, the post-closure scenario will be confirmed after access is created as part of compensation monitoring. As previously noted, although access is incorporated in the main NNL plan, the calculation of access in this memo specifically applies an access factor, which differs slightly in the main document.

Table 4-7. Access factor applied to each species, pre- and post-compensation, based on presence/absence (or anticipated presence/absence, for post-compensation).

Scenario	Pre-compensation	Post-compensation
Species Present	1	1
Species Not Present	0	0

5 Summary of Results and Discussion

Preliminary analysis based on qaujimajatuqangit, aerial surveys, reconnaissance and calculations, indicates that improved access will provide a net gain of habitat for the Pistol Bay watershed. Assuming lake trout, round whitefish, cisco, burbot, slimy sculpin and stickleback were present in 5 lakes (PBF-2 to PBF-6), pre-compensation estimates of habitat units were 427.06 HUs. Post-compensation created a total of 588.94 habitat units by improving access to well-connected upstream lakes for arctic char from Pistol Bay beyond the Pistol Bay Falls, and assuming a species assemblage of arctic char, lake trout, round whitefish, cisco, burbot, slimy sculpin and stickleback. This produced a net gain of 161.88 HUs. The data is summarized in Table 5-1. The complete data set is presented in Appendix B.

Table 5-1. Total pre-compensation and post-compensation habitat unit estimates for 5 lakes upstream of Pistol Bay Falls.

Habitat Type	Hectares Pre/ Post	Habitat unit total		Net habitat unit subtotal post-compensation by lake					
		Pre-	Post-	PBF-2	PBF-3	PBF-4	PBF-5	PBF-6	Net
1	317.64	32.75	46.30	0.45	0.17	0.24	1.28	11.41	13.56
2	392.38	70.68	87.43	0.56	0.21	0.30	1.58	14.10	16.75
3	840.81	210.66	282.42	2.40	0.89	1.29	6.78	60.41	71.77
4	224.22	63.76	97.25	1.12	0.42	0.60	3.16	28.19	33.49
5	74.74	33.11	50.65	0.59	0.22	0.32	1.66	14.77	17.54
6	18.68	10.53	16.51	0.20	0.07	0.11	0.56	5.03	5.98
7	18.68	5.58	8.37	0.09	0.03	0.05	0.26	2.35	2.79
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**1887.14**	**427.06**	**588.94**	**5.41**	**2.02**	**2.91**	**15.29**	**136.25**	**161.88**

In the Arctic, the concept of creating access near an aboriginal and sport fishery may be a valuable component of future No Net Loss Planning. Access as compensation has been used in the north at various projects including Doris North- Hope Bay Gold Project (Golder, 2003) and Meadowbank Mine No Net Loss Plan (AEM, 2012). The use of the access factor was first applied at the Meadowbank NNL Plan (AEM, 2012) and the following discussion has been summarized from AEM (2012) to explore the rationale for creating access as a compensation option at Meliadine Gold Project, thereby increasing species diversity and conceptually increasing fisheries productivity in the Pistol Bay watershed.

It is well known that increased species diversity can increase system productivity as a result of optimal resource use (Cleland, 2011 in AEM, 2012). Many isolated lakes or ponds are found in the Rankin Inlet region that may only contain one or two species of fish. Since different species utilize different habitat niches, the introduction of a species through access enhancements could result in an increase in the total fish population, provided an under-utilized habitat niche is available and is suitable for the new species.

Not surprisingly, no information could be found in the published literature regarding species dynamics when arctic char are introduced into northern lakes. However, niche segregation and resource partitioning in arctic fish species have been documented through both observational and experimental studies in northern European lakes. For example, Amundsen et al. (2010, in AEM 2012) found that where they co-occur, arctic char, European whitefish and arctic grayling have distinctly separate patterns of macrohabitat and microhabitat use, as well as different diets. Haugen and Rygg (1996, in AEM 2012) discuss similar patterns in sympatric brown trout and arctic grayling populations. Through 7+ years of surveys of fish populations in the Meadowbank Mine, including analysis of stomach content and stable isotopes, the trophic structure of fish populations has been well established. Adult lake trout occupy the apex predator position, and feed cannibalistically on juvenile lake trout as well as other small fishes, zooplankton and benthic invertebrates. Round whitefish occupy littoral zones, feeding primarily on benthos at all life stages. Arctic char have been found to exhibit a pelagic lifestyle, and feed opportunistically on zooplankton, for which it is highly and within this ecology, uniquely dependant on (demonstrated by the fact that arctic char's isotopic signature is nearly identical to zooplankton). In general, the literature indicates that arctic char are inferior competitors in populations with other large-bodied fishes (e.g. Forseth, Ugedal et al. 2003; Amundsen, Knudsen et al. 2010), suggesting that the provision of access for this species would not significantly impact the productivity of resident fish.

Cott et al. (2011, in AEM 2012) studied trophic position of fish species in the Yellowknife, NWT area, and found that these lakes contained burbot and lake trout in the top trophic piscivores, northern pike as an intermediate piscivore, and lake whitefish as lower-trophic benthic feeders. Inferring from this information that lake trout and round whitefish occupy the same habitat niches in the absence of arctic char as in their presence, it may be assumed that introduction of char would not substantially impact production of other large-bodied fish.

Furthermore, a recent study indicated that benthic production does not appear to be coupled to pelagic production in Arctic lakes (Hershey, Beaty et al. 2006, in AEM 2012). In this report, near-shore benthic invertebrates relied primarily on allochthonous production, and nutrient additions that increased phytoplankton density did not affect their growth. Along with the knowledge that char do not compete directly with other large-bodied fish for specific food resources, this information further indicates that supplies of nutrients for benthic littoral resources (food for round whitefish) and pelagic resources (food for arctic char) are different. Thus, the increased consumption of zooplankton by char is unlikely to even indirectly affect the availability of food resources for (e.g.) round whitefish.

Although the above discussion provides an indication that char would not negatively impact other species, it is possible that arctic char may not themselves be productive in the newly accessible lakes. While this may not be an inherent factor in NNL planning using the common HEP method (because HEPs evaluate the productive capacity of a system based on habitat availability, not species interactions), the ability for a species to be productive in its new environment remains uncertain. However, follow-up monitoring studies that evaluate fish population dynamics following the introduction of other native species will accompany access enhancements at Meadowbank Mine, at the Meliadine Project from Meliadine Lake, and if deemed suitable, at Pistol Bay. Data collected during implementation will provide valuable insight into populations structure changes following access enhancements. Not only is there a potential for significant gains in productive capacity through this compensation option, but it would provide a unique opportunity to collect fundamental information which is lacking from the literature, and which would be beneficial to subsequent development projects in the region.

6 Recommendations

If DFO is supportive of the concept of creating access from Pistol Bay to lakes upstream of the Pistol Bay Falls, AEM proposes to conduct formal field studies on the upstream lakes that will focus on identifying presence/ absence of fish species and specifically target collecting arctic char; if char are present, AEM will determine if they are anadromous or land-locked. Furthermore, AEM will conduct habitat mapping of the lakes that will include bathymetric and substrate surveys to replace the habitat type assumptions in this memo. If the field studies indicate favourable conditions for compensation by creating access to upstream lakes, AEM will conduct additional consultation with stakeholders (DFO, HTO, KIA) to determine if this project is worthwhile pursuing and thereafter conduct additional fisheries and design studies.

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Appendix A- Summary of Whale Cove interviews – October 24th, 2012

Summary of October 24th meetings with Sam Tatanuak and 3 residents of the Hamlet of Whale Cove to discuss Pistol Bay Falls fish passage.

Question	**Participants Responses**		
	Stanley Adjuk	Leopold Ekualaaq	Louis Voisey
Is the waterfall too high for the Char to get up it?	Doesn't think it's too high, because fish are in the lakes north of the river.	The Char can go up the waterfall, but a ladder would be nice	No. The Char cannot travel when water levels are low. Fish levels are about the same for the past 5 years
Does anyone fish these lakes in the summer or winter, or do you know anyone who fished them in the past?	All the Lakes are fished mostly in the Winter	Only in winter. Not many go that way though	Mostly Winter. There is a boat at Pistol Bay
Are char caught in the upstream lakes? Do char get up the waterfall and spend the winter in the upstream lakes	Never heard of it before. Char in the falls and up the lakes.	There are some char there but fish are hard to catch. Char travel upstream lakes	Never caught a big amount of fish in the those lakes. Yes
Have other species such as lake trout, round whitefish, burbot, cisco, arctic grayling etc been caught in lakes upstream of pistol bay falls?	Lake Trout, Grayling, Tiktaalik, small White Fish	There are all kinds of fish, but not a lot to be caught.	There are many kinds of fish, even in the smallest lakes
If so, which lakes have these species?	The lakes marked 1,2,3,4,5 and at Nutiblik Lake, Land Lock Char have been caught	Lake # 4 has no fish.	I think there is fish in all of those lakes

Appendix B- Raw data calculations

Appendix B

GRAND TOTAL									
Habitat Type	Hectares	Net Habitat unit subtotal post-comp by lake					Habitat Unit Total		
	Pre/ Post	PBF-2	PBF-3	PBF-4	PBF-5	PBF-6	Pre-	Post-	Net
1	317.64	0.45	0.17	0.24	1.28	11.41	32.75	46.30	13.56
2	392.38	0.56	0.21	0.30	1.58	14.10	70.68	87.43	16.75
3	840.81	2.40	0.89	1.29	6.78	60.41	210.66	282.42	71.77
4	224.22	1.12	0.42	0.60	3.16	28.19	63.76	97.25	33.49
5	74.74	0.59	0.22	0.32	1.66	14.77	33.11	50.65	17.54
6	18.68	0.20	0.07	0.11	0.56	5.03	10.53	16.51	5.98
7	18.68	0.09	0.03	0.05	0.26	2.35	5.58	8.37	2.79
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1887.14	5.41	2.02	2.91	15.29	136.25	427.06	588.94	161.88

TOTAL BY FEATURE - Summary

HU LOSSES - Species Totals

HU LOSSES -Species Sub-Totals

PBF-2	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	10.61	10.61	0.00	1.09	1.55	0.45
2	13.11	13.11	0.00	2.36	2.92	0.56
3	28.08	28.08	0.00	7.04	9.43	2.40
4	7.49	7.49	0.00	2.13	3.25	1.12
5	2.50	2.50	0.00	1.11	1.69	0.59
6	0.62	0.62	0.00	0.35	0.55	0.20
7	0.62	0.62	0.00	0.19	0.28	0.09
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	63.03	63.03	0.00	14.26	19.67	5.41

HU total per species x access weight								
Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access >>	0	1	1	1	1	1	1	1
1	0.00	0.45	0.47	0.09	0.00	0.00	0.05	0.03
2	0.00	1.10	0.73	0.28	0.00	0.00	0.16	0.08
3	0.00	4.13	1.57	0.73	0.00	0.00	0.35	0.26
4	0.00	1.10	0.67	0.16	0.00	0.00	0.08	0.12
5	0.00	0.58	0.31	0.13	0.00	0.00	0.04	0.05
6	0.00	0.20	0.10	0.03	0.00	0.00	0.01	0.01
7	0.00	0.09	0.06	0.01	0.00	0.00	0.01	0.01
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	7.63	3.90	1.44	0.00	0.00	0.70	0.58

Habitat type area x HSI x species weight x life function weight																
Species >>	ARCH				LKTR				RNWH				BURB			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.23	0.23	0.00	0.00	0.22	0.22	0.00	0.00	0.12	0.35	0.00	0.00	0.05	0.05	0.00
2	0.00	0.28	0.28	0.00	0.00	0.55	0.55	0.00	0.00	0.44	0.29	0.00	0.00	0.17	0.11	0.00
3	0.00	1.20	1.20	0.00	0.00	2.36	1.77	0.00	0.00	0.94	0.63	0.00	0.00	0.49	0.24	0.00
4	0.00	0.32	0.32	0.48	0.00	0.31	0.31	0.47	0.00	0.08	0.33	0.25	0.00	0.03	0.03	0.10
5	0.11	0.16	0.16	0.16	0.10	0.16	0.16	0.16	0.06	0.08	0.08	0.08	0.04	0.02	0.03	0.03
6	0.05	0.05	0.05	0.04	0.05	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01
7	0.00	0.01	0.03	0.05	0.00	0.01	0.03	0.05	0.00	0.01	0.03	0.03	0.00	0.00	0.00	0.01
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.16	2.25	2.26	0.73	0.16	3.67	3.09	0.72	0.08	1.70	1.74	0.38	0.05	0.76	0.48	0.15

Species >>	SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.03	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.00	0.00	0.04	0.04	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.00	0.00	0.18	0.09	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.04	0.00	0.00	0.05	0.07
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.03	0.02
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.30	0.35	0.05	0.00	0.25	0.22	0.11

PBF-3	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	3.96	3.96	0.00	0.41	0.58	0.17
2	4.89	4.89	0.00	0.88	1.09	0.21
3	10.49	10.49	0.00	2.63	3.52	0.89
4	2.80	2.80	0.00	0.80	1.21	0.42
5	0.93	0.93	0.00	0.41	0.63	0.22
6	0.23	0.23	0.00	0.13	0.21	0.07
7	0.23	0.23	0.00	0.07	0.10	0.03
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	23.53	23.53	0.00	5.33	7.34	2.02

HU total per species x access weight								
Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access >>	0	1	1	1	1	1	1	1
1	0.00	0.17	0.18	0.03	0.00	0.00	0.02	0.01
2	0.00	0.41	0.27	0.11	0.00	0.00	0.06	0.03
3	0.00	1.54	0.58	0.27	0.00	0.00	0.13	0.10
4	0.00	0.41	0.25	0.06	0.00	0.00	0.03	0.04
5	0.00	0.22	0.11	0.05	0.00	0.00	0.01	0.02
6	0.00	0.07	0.04	0.01	0.00	0.00	0.00	0.01
7	0.00	0.03	0.02	0.01	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	2.85	1.46	0.54	0.00	0.00	0.26	0.21

Habitat type area x HSI x species weight x life function weight																
Species >>	ARCH				LKTR				RNWH				BURB			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.08	0.08	0.00	0.00	0.08	0.08	0.00	0.00	0.04	0.13	0.00	0.00	0.02	0.02	0.00
2	0.00	0.10	0.10	0.00	0.00	0.21	0.21	0.00	0.00	0.16	0.11	0.00	0.00	0.06	0.04	0.00
3	0.00	0.45	0.45	0.00	0.00	0.88	0.66	0.00	0.00	0.35	0.23	0.00	0.00	0.18	0.09	0.00
4	0.00	0.12	0.12	0.18	0.00	0.12	0.12	0.18	0.00	0.03	0.12	0.09	0.00	0.01	0.01	0.04
5	0.04	0.06	0.06	0.06	0.04	0.06	0.06	0.06	0.02	0.03	0.03	0.03	0.02	0.01	0.01	0.01
6	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
7	0.00	0.00	0.01	0.02	0.00	0.00	0.01	0.02	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.06	0.84	0.85	0.27	0.06	1.37	1.15	0.27	0.03	0.63	0.65	0.14	0.02	0.28	0.18	0.06

Species >>	SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.02	0.02	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.00	0.00	0.07	0.03	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.03
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.13	0.02	0.00	0.09	0.08	0.04

PBF-4	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	5.71	5.71	0.00	0.59	0.83	0.24
2	7.06	7.06	0.00	1.27	1.57	0.30
3	15.12	15.12	0.00	3.79	5.08	1.29
4	4.03	4.03	0.00	1.15	1.75	0.60
5	1.34	1.34	0.00	0.60	0.91	0.32
6	0.34	0.34	0.00	0.19	0.30	0.11
7	0.34	0.34	0.00	0.10	0.15	0.05
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	33.95	33.95	0.00	7.68	10.59	2.91

HU total per species x access weight								
Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access >>	0	1	1	1	1	1	1	1
1	0.00	0.24	0.25	0.05	0.00	0.00	0.03	0.02
2	0.00	0.59	0.39	0.15	0.00	0.00	0.09	0.04
3	0.00	2.22	0.84	0.39	0.00	0.00	0.19	0.14
4	0.00	0.59	0.36	0.09	0.00	0.00	0.04	0.06
5	0.00	0.31	0.16	0.07	0.00	0.00	0.02	0.03
6	0.00	0.11	0.05	0.02	0.00	0.00	0.01	0.01
7	0.00	0.05	0.03	0.01	0.00	0.00	0.00	0.01
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	4.11	2.10	0.78	0.00	0.00	0.38	0.31

Habitat type area x HSI x species weight x life function weight																
Species >>	ARCH				LKTR				RNWH				BURB			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.12	0.12	0.00	0.00	0.12	0.12	0.00	0.00	0.06	0.19	0.00	0.00	0.02	0.02	0.00
2	0.00	0.15	0.15	0.00	0.00	0.30	0.30	0.00	0.00	0.24	0.16	0.00	0.00	0.09	0.06	0.00
3	0.00	0.65	0.65	0.00	0.00	1.27	0.95	0.00	0.00	0.51	0.34	0.00	0.00	0.26	0.13	0.00
4	0.00	0.17	0.17	0.26	0.00	0.17	0.17	0.25	0.00	0.04	0.18	0.13	0.00	0.02	0.02	0.05
5	0.06	0.09	0.09	0.09	0.06	0.08	0.08	0.08	0.03	0.04	0.04	0.04	0.02	0.01	0.02	0.02
6	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00
7	0.00	0.01	0.01	0.03	0.00	0.01	0.01	0.03	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.09	1.21	1.22	0.39	0.08	1.97	1.66	0.39	0.04	0.91	0.94	0.21	0.03	0.41	0.26	0.08

Species >>	SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.02	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.02	0.02	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.00	0.00	0.09	0.05	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.03	0.04
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.01
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.19	0.03	0.00	0.13	0.12	0.06

PBF-5	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	29.99	29.99	0.00	3.09	4.37	1.28
2	37.05	37.05	0.00	6.67	8.26	1.58
3	79.39	79.39	0.00	19.89	26.67	6.78
4	21.17	21.17	0.00	6.02	9.18	3.16
5	7.06	7.06	0.00	3.13	4.78	1.66
6	1.76	1.76	0.00	0.99	1.56	0.56
7	1.76	1.76	0.00	0.53	0.79	0.26
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	178.19	178.19	0.00	40.33	55.61	15.29

HU total per species x access weight								
Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access >>	0	1	1	1	1	1	1	1
1	0.00	1.26	1.34	0.26	0.00	0.00	0.14	0.09
2	0.00	3.11	2.07	0.80	0.00	0.00	0.46	0.23
3	0.00	11.66	4.43	2.06	0.00	0.00	0.99	0.74
4	0.00	3.11	1.89	0.46	0.00	0.00	0.23	0.33
5	0.00	1.63	0.87	0.37	0.00	0.00	0.11	0.15
6	0.00	0.56	0.28	0.09	0.00	0.00	0.03	0.04
7	0.00	0.26	0.18	0.04	0.00	0.00	0.02	0.03
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	21.58	11.04	4.08	0.00	0.00	1.99	1.63

Habitat type area	Lost Habitat Units per Species per Life Function															
Species >>	ARCH				LKTR				RNWH				BURB			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.64	0.64	0.00	0.00	0.63	0.63	0.00	0.00	0.33	1.00	0.00	0.00	0.13	0.13	0.00
2	0.00	0.79	0.79	0.00	0.00	1.55	1.55	0.00	0.00	1.24	0.83	0.00	0.00	0.48	0.32	0.00
3	0.00	3.39	3.39	0.00	0.00	6.66	5.00	0.00	0.00	2.66	1.77	0.00	0.00	1.38	0.69	0.00
4	0.00	0.90	0.90	1.36	0.00	0.89	0.89	1.33	0.00	0.24	0.94	0.71	0.00	0.09	0.09	0.28
5	0.30	0.45	0.45	0.45	0.30	0.44	0.44	0.44	0.16	0.24	0.24	0.24	0.12	0.06	0.09	0.09
6	0.15	0.15	0.15	0.11	0.15	0.15	0.15	0.11	0.08	0.08	0.06	0.06	0.02	0.02	0.03	0.02
7	0.00	0.04	0.08	0.15	0.00	0.04	0.07	0.15	0.00	0.02	0.08	0.08	0.00	0.00	0.01	0.03
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.45	6.36	6.40	2.07	0.44	10.37	8.74	2.04	0.24	4.80	4.92	1.08	0.15	2.16	1.36	0.42

Species >>	SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.09	0.00	0.00	0.09	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.23	0.00	0.00	0.12	0.12	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.50	0.25	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.10	0.10	0.00	0.00	0.13	0.20
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.03	0.00	0.00	0.09	0.07
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.02	0.02
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.02
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.84	0.98	0.15	0.00	0.71	0.62	0.30

PBF-6	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	267.36	267.36	0.00	27.56	38.98	11.41
2	330.27	330.27	0.00	59.50	73.59	14.10
3	707.72	707.72	0.00	177.31	237.72	60.41
4	188.73	188.73	0.00	53.66	81.86	28.19
5	62.91	62.91	0.00	27.87	42.64	14.77
6	15.73	15.73	0.00	8.86	13.90	5.03
7	15.73	15.73	0.00	4.70	7.05	2.35
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	1588.44	1588.44	0.00	359.47	495.72	136.25

HU total per species x access weight								
Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access>>	0	1	1	1	1	1	1	1
1	0.00	11.22	11.93	2.32	0.00	0.01	1.25	0.84
2	0.00	27.72	18.42	7.16	0.00	0.01	4.13	2.06
3	0.00	103.95	39.46	18.41	0.00	0.01	8.85	6.63
4	0.00	27.72	16.84	4.09	0.00	0.00	2.06	2.95
5	0.00	14.52	7.72	3.27	0.00	0.00	0.98	1.38
6	0.00	4.95	2.46	0.82	0.00	0.00	0.29	0.34
7	0.00	2.31	1.58	0.34	0.00	0.00	0.17	0.29
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	192.39	98.40	36.40	0.00	0.03	17.74	14.50

Habitat type area	Lost Habitat Units per Species per Life Function															
Species >>	ARCH				LKTR				RNWH				BURB			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	5.71	5.71	0.00	0.00	5.61	5.61	0.00	0.00	2.98	8.95	0.00	0.00	1.16	1.16	0.00
2	0.00	7.05	7.05	0.00	0.00	13.86	13.86	0.00	0.00	11.05	7.37	0.00	0.00	4.29	2.86	0.00
3	0.00	30.20	30.20	0.00	0.00	59.40	44.55	0.00	0.00	23.68	15.79	0.00	0.00	12.27	6.14	0.00
4	0.00	8.05	8.05	12.08	0.00	7.92	7.92	11.88	0.00	2.10	8.42	6.31	0.00	0.82	0.82	2.45
5	2.68	4.03	4.03	4.03	2.64	3.96	3.96	3.96	1.40	2.10	2.10	2.10	1.09	0.55	0.82	0.82
6	1.34	1.34	1.34	1.01	1.32	1.32	1.32	0.99	0.70	0.70	0.53	0.53	0.20	0.14	0.27	0.20
7	0.00	0.34	0.67	1.34	0.00	0.33	0.66	1.32	0.00	0.18	0.70	0.70	0.00	0.00	0.07	0.27
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.03	56.72	57.05	18.46	3.96	92.40	77.88	18.15	2.10	42.80	43.85	9.65	1.30	19.22	12.13	3.75

Species >>	SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.84	0.00	0.00	0.84	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.06	2.06	0.00	0.00	1.03	1.03	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	4.42	4.42	0.00	0.00	4.42	2.21	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.88	0.88	0.00	0.00	1.18	1.77
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.39	0.29	0.00	0.00	0.79	0.59
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.07	0.07	0.00	0.00	0.20	0.15
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.10	0.00	0.00	0.10	0.20
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.00	0.17	7.47	8.75	1.35	0.00	6.29	5.50	2.70

Appendix B

GRAND TOTAL									
Habitat Type	Hectares	Net Habitat unit subtotal post-comp by lake					Habitat Unit Total		
	Pre/ Post	PBF-2	PBF-3	PBF-4	PBF-5	PBF-6	Pre-	Post-	Net
1	317.64	0.45	0.17	0.24	1.28	11.41	32.75	46.30	13.56
2	392.38	0.56	0.21	0.30	1.58	14.10	70.68	87.43	16.75
3	840.81	2.40	0.89	1.29	6.78	60.41	210.66	282.42	71.77
4	224.22	1.12	0.42	0.60	3.16	28.19	63.76	97.25	33.49
5	74.74	0.59	0.22	0.32	1.66	14.77	33.11	50.65	17.54
6	18.68	0.20	0.07	0.11	0.56	5.03	10.53	16.51	5.98
7	18.68	0.09	0.03	0.05	0.26	2.35	5.58	8.37	2.79
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1887.14	5.41	2.02	2.91	15.29	136.25	427.06	588.94	161.88

TOTAL BY FEATURE - Summary

PBF-2	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	10.61	10.61	0.00	1.09	1.55	0.45
2	13.11	13.11	0.00	2.36	2.92	0.56
3	28.08	28.08	0.00	7.04	9.43	2.40
4	7.49	7.49	0.00	2.13	3.25	1.12
5	2.50	2.50	0.00	1.11	1.69	0.59
6	0.62	0.62	0.00	0.35	0.55	0.20
7	0.62	0.62	0.00	0.19	0.28	0.09
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	63.03	63.03	0.00	14.26	19.67	5.41

PBF-3	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	3.96	3.96	0.00	0.41	0.58	0.17
2	4.89	4.89	0.00	0.88	1.09	0.21
3	10.49	10.49	0.00	2.63	3.52	0.89
4	2.80	2.80	0.00	0.80	1.21	0.42
5	0.93	0.93	0.00	0.41	0.63	0.22
6	0.23	0.23	0.00	0.13	0.21	0.07
7	0.23	0.23	0.00	0.07	0.10	0.03
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	23.53	23.53	0.00	5.33	7.34	2.02

PBF-4	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	5.71	5.71	0.00	0.59	0.83	0.24
2	7.06	7.06	0.00	1.27	1.57	0.30
3	15.12	15.12	0.00	3.79	5.08	1.29
4	4.03	4.03	0.00	1.15	1.75	0.60
5	1.34	1.34	0.00	0.60	0.91	0.32
6	0.34	0.34	0.00	0.19	0.30	0.11
7	0.34	0.34	0.00	0.10	0.15	0.05
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	33.95	33.95	0.00	7.68	10.59	2.91

PBF-5	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	29.99	29.99	0.00	3.09	4.37	1.28
2	37.05	37.05	0.00	6.67	8.26	1.58
3	79.39	79.39	0.00	19.89	26.67	6.78
4	21.17	21.17	0.00	6.02	9.18	3.16
5	7.06	7.06	0.00	3.13	4.78	1.66
6	1.76	1.76	0.00	0.99	1.56	0.56
7	1.76	1.76	0.00	0.53	0.79	0.26
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	178.19	178.19	0.00	40.33	55.61	15.29

PBF-6	Hectares			HU		
Habitat Type	Pre-	Post-	Net	Pre-	Post-	Net
1	267.36	267.36	0.00	27.56	38.98	11.41
2	330.27	330.27	0.00	59.50	73.59	14.10
3	707.72	707.72	0.00	177.31	237.72	60.41
4	188.73	188.73	0.00	53.66	81.86	28.19
5	62.91	62.91	0.00	27.87	42.64	14.77
6	15.73	15.73	0.00	8.86	13.90	5.03
7	15.73	15.73	0.00	4.70	7.05	2.35
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
Total	1588.44	1588.44	0.00	359.47	495.72	136.25

HU GAINS - Species Totals

HU total per species x access weight

Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access >>	1	1	1	1	1	1	1	1
1	0.45	0.45	0.47	0.09	0.00	0.00	0.05	0.03
2	0.56	1.10	0.73	0.28	0.00	0.00	0.16	0.08
3	2.40	4.13	1.57	0.73	0.00	0.00	0.35	0.26
4	1.12	1.10	0.67	0.16	0.00	0.00	0.08	0.12
5	0.59	0.58	0.31	0.13	0.00	0.00	0.04	0.05
6	0.20	0.20	0.10	0.03	0.00	0.00	0.01	0.01
7	0.09	0.09	0.06	0.01	0.00	0.00	0.01	0.01
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	5.41	7.63	3.90	1.44	0.00	0.00	0.70	0.58

HU total per species x access weight

Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access >>	1	1	1	1	1	1	1	1
1	0.17	0.17	0.18	0.03	0.00	0.00	0.02	0.01
2	0.21	0.41	0.27	0.11	0.00	0.00	0.06	0.03
3	0.89	1.54	0.58	0.27	0.00	0.00	0.13	0.10
4	0.42	0.41	0.25	0.06	0.00	0.00	0.03	0.04
5	0.22	0.22	0.11	0.05	0.00	0.00	0.01	0.02
6	0.07	0.07	0.04	0.01	0.00	0.00	0.00	0.01
7	0.03	0.03	0.02	0.01	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.02	2.85	1.46	0.54	0.00	0.00	0.26	0.21

HU total per species x access weight

Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access >>	1	1	1	1	1	1	1	1
1	0.24	0.24	0.25	0.05	0.00	0.00	0.03	0.02
2	0.30	0.59	0.39	0.15	0.00	0.00	0.09	0.04
3	1.29	2.22	0.84	0.39	0.00	0.00	0.19	0.14
4	0.60	0.59	0.36	0.09	0.00	0.00	0.04	0.06
5	0.32	0.31	0.16	0.07	0.00	0.00	0.02	0.03
6	0.11	0.11	0.05	0.02	0.00	0.00	0.01	0.01
7	0.05	0.05	0.03	0.01	0.00	0.00	0.00	0.01
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.91	4.11	2.10	0.78	0.00	0.00	0.38	0.31

HU total per species x access weight

Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access >>	1	1	1	1	1	1	1	1
1	1.28	1.26	1.34	0.26	0.00	0.00	0.14	0.09
2	1.58	3.11	2.07	0.80	0.00	0.00	0.46	0.23
3	6.78	11.66	4.43	2.06	0.00	0.00	0.99	0.74
4	3.16	3.11	1.89	0.46	0.00	0.00	0.23	0.33
5	1.66	1.63	0.87	0.37	0.00	0.00	0.11	0.15
6	0.56	0.56	0.28	0.09	0.00	0.00	0.03	0.04
7	0.26	0.26	0.18	0.04	0.00	0.00	0.02	0.03
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	15.29	21.58	11.04	4.08	0.00	0.00	1.99	1.63

HU total per species x access weight

Species >>	ARCH	LKTR	RNWH	BURB	SLSC	NNST	CISC	ARGR
Access facte	1	1	1	1	1	1	1	1
1	11.41	11.22	11.93	2.32	0.00	0.01	1.25	0.84
2	14.10	27.72	18.42	7.16	0.00	0.01	4.13	2.06
3	60.41	103.95	39.46	18.41	0.00	0.01	8.85	6.63
4	28.19	27.72	16.84	4.09	0.00	0.00	2.06	2.95
5	14.77	14.52	7.72	3.27	0.00	0.00	0.98	1.38
6	5.03	4.95	2.46	0.82	0.00	0.00	0.29	0.34
7	2.35	2.31	1.58	0.34	0.00	0.00	0.17	0.29
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	136.25	192.39	98.40	36.40	0.00	0.03	17.74	14.50

HU GAINS -Species Sub-Totals

Habitat type area x HSI x species weight x life function weight

Species >>	ARCH				LKTR				RNWH				BURB				SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.23	0.23	0.00	0.00	0.22	0.22	0.00	0.00	0.12	0.35	0.00	0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.03	0.00	0.00
2	0.00	0.28	0.28	0.00	0.00	0.55	0.55	0.00	0.00	0.44	0.29	0.00	0.00	0.17	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.00	0.00	0.04	0.04	0.00
3	0.00	1.20	1.20	0.00	0.00	2.36	1.77	0.00	0.00	0.94	0.63	0.00	0.00	0.49	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.00	0.00	0.18	0.09	0.00
4	0.00	0.32	0.32	0.48	0.00	0.31	0.31	0.47	0.00	0.08	0.33	0.25	0.00	0.03	0.03	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.04	0.00	0.00	0.05	0.07
5	0.11	0.16	0.16	0.16	0.10	0.16	0.16	0.16	0.06	0.08	0.08	0.08	0.04	0.02	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.03	0.02
6	0.05	0.05	0.05	0.04	0.05	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
7	0.00	0.01	0.03	0.05	0.00	0.01	0.03	0.05	0.00	0.01	0.03	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.16	2.25	2.26	0.73	0.16	3.67	3.09	0.72	0.08	1.70	1.74	0.38	0.05	0.76	0.48	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.30	0.35	0.05	0.00	0.25	0.22	0.11

Habitat type area x HSI x species weight x life function weight

Species >>	ARCH				LKTR				RNWH				BURB				SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.08	0.08	0.00	0.00	0.08	0.08	0.00	0.00	0.04	0.13	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00
2	0.00	0.10	0.10	0.00	0.00	0.21	0.21	0.00	0.00	0.16	0.11	0.00	0.00	0.06	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.02	0.02	0.00
3	0.00	0.45	0.45	0.00	0.00	0.88	0.66	0.00	0.00	0.35	0.23	0.00	0.00	0.18	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.00	0.00	0.07	0.03	0.00
4	0.00	0.12	0.12	0.18	0.00	0.12	0.12	0.18	0.00	0.03	0.12	0.09	0.00	0.01	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.03
5	0.04	0.06	0.06	0.06	0.04	0.06	0.06	0.06	0.02	0.03	0.03	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01
6	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.01	0.02	0.00	0.00	0.01	0.02	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.06	0.84	0.85	0.27	0.06	1.37	1.15	0.27	0.03	0.63	0.65	0.14	0.02	0.28	0.18	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.13	0.02	0.00	0.09	0.08	0.04

Habitat type area x HSI x species weight x life function weight

Species >>	ARCH				LKTR				RNWH				BURB				SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.12	0.12	0.00	0.00	0.12	0.12	0.00	0.00	0.06	0.19	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.02	0.00	0.00
2	0.00	0.15	0.15	0.00	0.00	0.30	0.30	0.00	0.00	0.24	0.16	0.00	0.00	0.09	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.02	0.02	0.00
3	0.00	0.65	0.65	0.00	0.00	1.27	0.95	0.00	0.00	0.51	0.34	0.00	0.00	0.26	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.00	0.00	0.09	0.05	0.00
4	0.00	0.17	0.17	0.26	0.00	0.17	0.17	0.25	0.00	0.04	0.18	0.13	0.00	0.02	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.03	0.04
5	0.06	0.09	0.09	0.09	0.06	0.08	0.08	0.08	0.03	0.04	0.04	0.04	0.02	0.01	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.01
6	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.01	0.01	0.03	0.00	0.01	0.01	0.03	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.09	1.21	1.22	0.39	0.08	1.97	1.66	0.39	0.04	0.91	0.94	0.21	0.03	0.41	0.26	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.19	0.03	0.00	0.13	0.12	0.06

Habitat type area x HSI x species weight x life function weight

Species >>	ARCH				LKTR				RNWH				BURB				SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	0.64	0.64	0.00	0.00	0.63	0.63	0.00	0.00	0.33	1.00	0.00	0.00	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.09	0.00	0.00	0.09	0.00	0.00
2	0.00	0.79	0.79	0.00	0.00	1.55	1.55	0.00	0.00	1.24	0.83	0.00	0.00	0.48	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.23	0.00	0.00	0.12	0.12	0.00
3	0.00	3.39	3.39	0.00	0.00	6.66	5.00	0.00	0.00	2.66	1.77	0.00	0.00	1.38	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.50	0.25	0.00
4	0.00	0.90	0.90	1.36	0.00	0.89	0.89	1.33	0.00	0.24	0.94	0.71	0.00	0.09	0.09	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.10	0.10	0.00	0.00	0.13	0.20
5	0.30	0.45	0.45	0.45	0.30	0.44	0.44	0.44	0.16	0.24	0.24	0.24	0.12	0.06	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.03	0.00	0.00	0.09	0.07
6	0.15	0.15	0.15	0.11	0.15	0.15	0.15	0.11	0.08	0.08	0.06	0.06	0.02	0.02	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.02	0.02
7	0.00	0.04	0.08	0.15	0.00	0.04	0.07	0.15	0.00	0.02	0.08	0.08	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.02
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.45	6.36	6.40	2.07	0.44	10.37	8.74	2.04	0.24	4.80	4.92	1.08	0.15	2.16	1.36	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.84	0.98	0.15	0.00	0.71	0.62	0.30

Habitat type area x HSI x species weight x life function weight

Species >>	ARCH				LKTR				RNWH				BURB				SLSC				NNST				CISC				ARGR			
Life Function >>	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW	SP	NU	FO	OW
1	0.00	5.71	5.71	0.00	0.00	5.61	5.61	0.00	0.00	2.98	8.95	0.00	0.00	1.16	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.84	0.00	0.00	0.84	0.00	0.00
2	0.00	7.05	7.05	0.00	0.00	13.86	13.86	0.00	0.00	11.05	7.37	0.00	0.00	4.29	2.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.06	2.06	0.00	0.00	1.03	1.03	0.00
3	0.00	30.20	30.20	0.00	0.00	59.40	44.55	0.00	0.00	23.68	15.79	0.00	0.00	12.27	6.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	4.42	4.42	0.00	0.00	4.42	2.21	0.00
4	0.00	8.05	8.05	12.08	0.00	7.92	7.92	11.88	0.00	2.10	8.42	6.31	0.00	0.82	0.82	2.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.88	0.88	0.00	0.00	1.18	1.77
5	2.68	4.03	4.03	4.03	2.64	3.96	3.96	3.96	1.40	2.10	2.10	2.10	1.09	0.55	0.82	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.39	0.29	0.00	0.00	0.79	0.59
6	1.34	1.34	1.34	1.01	1.32	1.32	1.32	0.99	0.70	0.70	0.53	0.53	0.20	0.14	0.27	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.07	0.07	0.00	0.00	0.20	0.15
7	0.00	0.34	0.67	1.34	0.00	0.33	0.66	1.32	0.00	0.18	0.70	0.70	0.00	0.00	0.07	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.10	0.00	0.00	0.10	0.20
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.03	56.72	57.05	18.46	3.96	92.40	77.88	18.15	2.10	42.80	43.85	9.65	1.30	19.22	12.13	3.75	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.00	0.17	7.47	8.75	1.35	0.00	6.29	5.50	2.70

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