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FINAL REPORT

SD 7-3 Conceptual Aquatic Effects Monitoring Plan - Meliadine Gold Project, Nunavut

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REPORT

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Executive Summary

Agnico Eagle Mines Limited (AEM) has prepared this conceptual Aquatic Effects Monitoring Plan (AEMP) pursuant to the aquatic effects assessment outlined in the Final Environmental Impact Statement (FEIS) for the Meliadine Gold Project (the Project). The conceptual AEMP provides the philosophy and structure that will be applied annually to fulfill AEMP requirements throughout the life of the Project. The currently proposed conceptual AEMP takes into account the range of project activities and potential project-environment interactions identified as being of concern for the aquatic ecosystem and includes effluent, water quality and biological monitoring as required under the Environmental Effects Monitoring (EEM) program of the Metal Mining Effluent Regulations (MMER) of the *Fisheries Act*. The AEMP will also comply with the requirements of the "Guidelines for the Preparation of an Environmental Impact Statement for Agnico Eagle Mines Limited's Meliadine Gold Project (NIRB File No. 11MN034)", Section 9.4.16. The conceptual AEMP provides an outline of aquatic monitoring in relation to the Project effects as they are predicted in the FEIS.

Harmonization of scheduling and reporting requirements for the AEMP and the EEM components of the MMER is proposed. By harmonizing the schedules for the AEMP and EEM components, efficiencies will be created during field programs and data collection activities. Harmonization also encourages the most effective integration of all available data for interpretation of monitoring results. The AEMP will function as an integrated monitoring program, which considers a variety of pathways identified in the FEIS as pertinent to potential effects of the Project on the aquatic environment. The AEMP will be designed to address predicted impacts to the aquatic environment related to changes in surface water quantity and quality, sediment quality, aquatic life, fish habitat and fish health due to physical alterations of the watersheds, and water and air emissions during construction, operations and closure.

A detailed AEMP will be developed after consultation with Inuit communities, stakeholders, and regulatory authorities and will be included with the Type A Water License application. Incorporation of Traditional Knowledge into the AEMP design will be actively pursued during the consultation period. The detailed AEMP design will provide clear descriptions of the type, quantity and quality of data that are required to yield defensible conclusions regarding the effects of the Project on the aquatic ecosystem, and will include field, laboratory and data analysis methods by component, including QA/QC procedures.

The objectives of the AEMP include the following;

- to determine the short- and long-term effects of the Project on the aquatic receiving environment;
- to evaluate the accuracy of predictions made in the FEIS;
- to assess the efficacy of planned mitigation incorporated into Project design; and
- to collect data required to identify the need for potential additional mitigation of Project effects, within a management response framework.

The AEMP study design will use currently accepted statistical design principles. The study design document will include the overall design approach, such as gradient or control/impact study, and will define monitoring areas based on effluent dispersion, water quality modelling results, and availability of suitable reference areas in the

study area. The number of stations and samples within each monitoring area to be sampled will also be included. The frequency of sampling will depend on results of ongoing monitoring and may change over the life of the project as indicated by interpretation of monitoring results.

Sampling locations for the AEMP are anticipated to include Meliadine Lake, Lake B45, and the Pit Lakes. The Pit Lakes will be monitored at post-closure only, following flooding. Additional sampling locations are proposed to include two reference lakes to assist in monitoring of the peninsula lakes. These reference lakes will be selected during the detailed AEMP design, following community consultation and confirmation of appropriate conditions in each lake for each monitoring component.

The reporting approach for the AEMP, including reporting schedule for annual reports and the frequency of periodic AEMP reviews and study design updates, will be described in the AEMP design document to be submitted with the Type A Water License application.

Study Limitations

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Abbreviation and Acronym List

AANDC	Aboriginal Affairs and Northern Development Canada
AEM	Agnico Eagle Mines Limited
AEMP	Aquatic Effects Monitoring Plan
AWAR	All-weather Access Road
FEIS	Final Environmental Impact Statement
EEM	Environmental Effects Monitoring
EIS	Environmental Impact Statement
IQ	Inuit Qaujimajatuqangit (see note [1])
LSA	Local Study Area
MMER	Metal Mining Effluent Regulations
MRP	Management Response Plan
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
Project	Meliadine Gold Project
QA/QC	Quality Assurance/Quality Control
SNP	Surveillance Network Program
WLWB	Wek'e`ezhı`i Land and Water Board

Note: [1] IQ symbol appearing in right hand margin denotes where IQ is referenced in the assessment.

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1.0 INTRODUCTION

Agnico Eagle Mines Limited (AEM) has prepared this conceptual Aquatic Effects Monitoring Plan (AEMP) pursuant to the aquatic effects assessment outlined in the Final Environmental Impact Statement (FEIS) for the Meliadine Gold Project (the Project), located in Nunavut. This document provides the philosophy and structure that will be applied to fulfill AEMP requirements throughout the life of the Project.

Pursuant to the aquatic effects assessment outlined in the FEIS for the Project, AEM will design and implement an AEMP. The AEMP will take into account the range of project activities and potential project-environment interactions identified as being of concern for the aquatic ecosystem. It will incorporate effluent, water quality, and biological monitoring as required under the Environmental Effects Monitoring (EEM) program of the Metal Mining Effluent Regulations (MMER) of the *Fisheries Act* (EC 2012), and will consider the "Guidelines for Designing and Implementing AEMPs for Development Projects in the Northwest Territories" (AANDC 2009a). The "Guidelines for Adaptive Management – a Response Framework for Aquatic Effects Monitoring (*DRAFT*)" (WLWB 2010) and "Toolbox for Applying Traditional Knowledge in Aquatic Effect Monitoring Programs (AEMPs) in the NWT (*DRAFT*)" (AANDC 2009b) will also be considered where possible and appropriate.

This document provides an outline of aquatic monitoring in relation to the Project effects as they are predicted in the FEIS. A detailed AEMP, which will include the detailed study design and methods, will be developed during the Project permitting phase, as the detailed aspects of the Project are finalized. The following provides the background, rationale, objectives and information on data collection and analysis for the communities, public and regulatory authorities participating in the development of the AEMP to illustrate the approach that AEM plans to follow in developing the AEMP.

1.1 Background

The Nunavut Land Claims Agreement (NLCA) identifies monitoring as an important tool for verifying the accuracy of predictions made during environmental assessments and determining the effectiveness of measures taken to mitigate potential adverse environmental effects (Section 12, Part 7; NLCA 1993). As detailed in Section 12.7.2 of the NLCA and cited in the Nunavut Impact Review Board (NIRB) Project Monitoring Guide 8 (NIRB 2008), the purpose of a monitoring program can be summarized as follows:

- to measure the relevant effects of projects on the ecosystem and socioeconomic environments in the Nunavut Settlement Area;
- to determine whether and to what extent the land or resource use in question is carried out within the predetermined terms and conditions;
- to provide the information base necessary for agencies to enforce terms and conditions of land or resource use approvals; and
- to assess the accuracy of predictions contained in the project impact statements.

To meet the principles of NLCA and NIRB (2008), there are 3 key principles relevant to the development of an efficient and effective AEMP:

- First, monitoring data must support decision making relative to mine activities. Monitoring data provide information to interested parties on the potential effects of a Project to the aquatic environment, and the effectiveness of mitigation incorporated into the project design and the potential need for additional mitigation. Monitoring is not performed with the intent of answering fundamental questions regarding ecosystem structure and function.
- Second, monitoring provides answers to specific compliance or follow-up questions regarding current status, spatial extent of effects, and temporal trends in the aquatic receiving environment.
- Third, measurement endpoints must have a clear link to assessment endpoints from the environmental assessment (i.e., the FEIS). Assessment endpoints are the environmental features to be protected (e.g., fish growth and reproduction), while measurement endpoints are the physical, chemical, or biological attributes of the study design that are linked to the assessment endpoints (e.g., water chemistry, plankton biomass, fish length, weight, or gonad size).

2.0 SUMMARY OF PROJECT DESCRIPTION

The Project is located in the Kivalliq District of Nunavut near the western shore of Hudson Bay, in Northern Canada. The nearest community is Rankin Inlet (coordinates 63°1’23.8’’N, 92°13’6.42’’W), located at approximately 25 kilometres (km) south of the Tiriganiaq deposit. Rankin Inlet is an Inuit hamlet on the Kudlulik Peninsula located between Chesterfield Inlet and Arviat. It is the regional center and the largest community of the Kivalliq region, and the second most populated community in Nunavut after the capital of Iqaluit.

The Project involves building, operating, decommissioning and rehabilitating a conventional gold mine. Some facilities development will take place at Rankin Inlet, where materials will be received by air and sea transport. Year-round access between Rankin Inlet and the mine site will be facilitated by the All-weather Access Road (AWAR). The overall Project layout, including the AWAR and proposed infrastructure in Rankin Inlet, is presented in Figure 1.

Project activities have been divided into four phases, as follows:

1) **Pre-Development Phase** – early construction activity of facilities or infrastructure needed to support the construction phase of the Project, including site preparation;

2) **Construction Phase** – construction of the mine infrastructure and facilities leading to the first production of gold;

3) **Operations Phase** – the ongoing operation of the mine and associated facilities to produce gold through the end of the mine life; and

4) **Closure and Post-Closure Phase** – the post operational period, when gold is no longer being produced; during this phase, the mine and associated infrastructure will be decommissioned, demolished and removed, and reclamation will be underway to return the site to a physically and chemically stable condition.

Mine development will include open-pit and underground mining that will provide ore to the mill. The mill, camp, powerhouse, tank farm, tailings storage facility, waste rock storage facilities, water supply and sewage treatment plant are integral components of the Project. Five gold deposits are included in the mine planning, of which Tiriganiaq is the most significant. The Tiriganiaq deposit is centered at 63°1’23.8’’ N, 92°13’6.42”W (National Topographic Survey sheets 55/J, N, and O). The other deposits are Discovery, F Zone, Pump, and Wesmeg. Underground mining is planned for Tiriganiaq. All deposits are open at depth and further exploration work is needed to define if other deposits could also be mined through underground infrastructure. Surface exploration is also ongoing and could lead to the definition of more ore deposits in the area.

The mill and camp infrastructure will be located near the existing exploration camp, and close to the Tiriganiaq deposit (Figure 2). The Discovery deposit is located approximately 22.4 km east-southeast of the proposed main site. It will be mined as a satellite deposit. The F Zone deposit is located approximately 5.1 km southeast of the Tiriganiaq deposit. The Pump deposit is about 3 km south of the Tiriganiaq open pit. Finally, the Wesmeg deposit is about 300 metres south of the Tiriganiaq deposit.

530000
540000
550000
560000
6990000
6980000
6970000

Parallel Lake
Meliadine Lake
Little Meliadine Lake (LML)
Meliadine River
Hudson Bay
Rankin Inlet

N

LEGEND

- Proposed Project Infrastructure
- Open Pit
- Tailings Storage Facility
- Waste Rock Storage Facility
- Borrow Pit/Quarry
- All-weather Access Road (AWAR)
- Road - New
- Road - Existing
- Watercourse
- Waterbody
- Municipal Boundary

400 0 400
METRES

REFERENCE

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

2,500 0 2,500
METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

PROJECT LAYOUT, INCLUDING AWAR AND PROPOSED INFRASTRUCTURE IN RANKIN INLET FOR THE MELIADINE GOLD PROJECT

Golder Associates

PROJECT NO.	10-1373-0076		FILE No.	
DESIGN	DW	19 Nov. 2012	SCALE AS SHOWN	REV. 0
GIS	CDB	19 Nov. 2012		
CHECK	DW	11 Jan. 2013		
REVIEW	DW	11 Jan. 2013		

FIGURE 1

N:\Bur-Graphics\Projects\2013\1428\13-1428-0007\GIS\Mapping\MXD\FEIS\Volume_7\SD_7-3_AEMP\Figure_1_Infrastructure_Rankin_Inlet.mxd

538000 540000 542000 544000

6990000 6988000 6986000 6984000

B7 Waste Rock Storage Facility North

B7 Waste Rock Storage Facility East

B7 Waste Rock Storage Facility West

B7 Waste Rock Storage Facility South

Tiriganiaq Pit #2

Tiriganiaq Pit #1

Wesmeg #1

Wesmeg #2

Wesmeg #3

Wesmeg #5

Wesmeg #4

B4 Waste Rock Storage Facility

Pump Pit #1

Pump Pit #2

F Zone Pit #3

F Zone Pit #2

F Zone Pit #1

A45-2 Waste Rock Storage Facility

N

LEGEND

- Proposed Project Infrastructure
- Open Pit
- Tailings Storage Facility
- Waste Rock Storage Facility
- Borrow Pit/Quarry
- All-weather Access Road (AWAR)
- Road - New
- Road - Existing
- Watercourse
- Waterbody

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

MAIN SITE INFRASTRUCTURE FOR THE MELIADINE GOLD PROJECT

Golder Associates

PROJECT NO.	10-1373-0076		FILE No.	
DESIGN	DW	19 Nov. 2012	SCALE AS SHOWN	REV. 0
GIS	CDB	19 Nov. 2012		
CHECK	DW	11 Jan. 2013		
REVIEW	DW	11 Jan. 2013		

FIGURE 2

N:\Bur-Graphics\Projects\2013\1428\13-1428-0007\GIS\Mapping\MXD\FEIS\Volume_7\SD_7-3_AEMP\Figure_2_Infrastructure_Main_Site.mxd

Any water directly affected by mine operations will be controlled, tested, and released to the receiving environment only after meeting Water License and MMER limits. Sumps are planned and will be sized to hold water reporting from the waste rock storage facilities, as well as any water reporting to the open pits. Details of the background and strategies for water management are available in the Site Water Management Plan (SD 2-6). Catchments including areas disturbed as part of the mine development are considered disturbed catchments, while those left unaffected are considered undisturbed catchments. For the purposes of the mine water management, runoff from undisturbed areas is considered non-contact water, while runoff from disturbed areas is considered contact water. Surface water that is diverted around the mine facilities, or groundwater that does not emerge into a mine facility, is considered non-contact water. Any non-contact water that mixes with contact water becomes contact water.

Construction tasks will include all pre-development work and will take approximately 3 years to complete. Construction includes all the steps from engineering to instrumentation and control, including programming (i.e., planning, site preparation, drainage and dewatering, excavation, backfilling, piling, concrete works, buildings construction/installation, piping and plumbing, mechanical, electrical and communication installations). Construction also includes planning and installing ventilation and other underground services, as well as all infrastructure related to rock handling, mill processing and tailings and water management. Operations will include open pit mining, as well as underground operations, although underground mining is only being considered for the Tiriganiaq deposit at this time. Operations is projected to start about 2 years after construction begins and continue for an estimated 10 to 13 years. The closure phase involves decommissioning and reclamation. Where possible, reclamation work will start as soon as an area's operation is complete (i.e., may begin during operations). Most demolition of buildings and infrastructure will occur at the end of the operations phase, however, and would be done in the first 2 years of decommissioning. Reclamation work is expected to be completed within 3 to 4 years of closure. The filling of open pits with water will extend for several years. Post-closure activities will continue until chemical and physical stability of the site is demonstrated (for a minimum of 10 years post-closure; FEIS Volume 2, Section 2.0)

The Project layout and infrastructure, as it changes through different phases of construction, operations, and closure, is described in the Site Water Management Plan (SD 2-6). Portions of the Project footprint, infrastructure and development relevant to the AEMP include the following:

- The Project footprint, including open pits, waste rock and tailings storage facilities, and infrastructure pads will remove waterbodies, alter watershed areas and drainage patterns, and change flows and water levels, all of which may directly affect water and sediment quality, aquatic life, and the quantity of fish habitat.
  - The Project footprint will physically alter the size of watersheds, and alter existing flow paths within the local study area (LSA) during Project operation phases, which may decrease downstream flows and water levels, potentially resulting in indirect (downstream) effects to fish habitat quantity (in Basins A, B, and H).
  - The permanent Project footprint may change the long-term hydrology of Basins A, B, and H, affecting fish habitat quantity, and is addressed in the Fisheries Protection and Offsetting Plan (SD 7-4).
- The active diversion of water from waterbodies to other locations either within or to adjacent sub-basins during operations will decrease flows to downstream waterbodies and watercourses bypassed by the diversion, potentially leading to indirect effects to water and sediment quality, aquatic life and fish habitat quantity, particularly in Basins A and B.

- Release of mine wastewater may cause changes to surface water and sediment quality in Meliadine Lake (i.e., increased nutrient and metal concentrations) and may affect aquatic life.
- Fugitive dust sources and deposition of dust, including particulate matter and nitrogen compounds from blasting, may change water and sediment quality and affect aquatic life.

Effects of Project activities in the marine environment at Rankin Inlet related to transportation and Project activities are predicted to be negligible (FEIS Volume 8 Marine Environment and Impact Statement); these activities include vessel transits (i.e., marine transportation), low intensity sensory disturbance, and project infrastructure in the harbour such as barges and tugs (i.e., 2 barges and 2 tugs during pre-development, and 1 spud barge and 1 tug during construction, operations and decommissioning).

3.0 REGULATORY HISTORY

In early May 2011, AEM submitted a Project Description for the Project to NIRB, the Kivalliq Inuit Association, the Nunavut Planning Commission, and other regulatory agencies. The Project received a positive conformity determination against the Keewatin Regional Land Use Plan, and the Nunavut Planning Commission forwarded the Project Description and their conformity determination to NIRB in June 2011.

Pursuant to Article 12 of the NLCA, NIRB then screened the project proposal and forwarded a recommendation for an Article 12 – Part 5 review of the Project to be led by NIRB to the Minister of AANDC in July 2011. The Minister concurred with the NIRB recommendation and in September 2011 directed that NIRB conduct a Part 5 review of the Project.

Final guidelines for the preparation of an Environmental Impact Statement (EIS) for the Project were issued by NIRB in February of 2012. AEM has since proceeded to prepare the FEIS for submission to NIRB to facilitate the required Part 5 Review. The present conceptual AEMP serves to satisfy Section 9.4.16 (Aquatic Effects Monitoring Plan) of the NIRB Guidelines (as detailed in FEIS Volume 1, Appendix 1.0-A).

4.0 AQUATIC EFFECTS MONITORING PLAN OUTLINE

4.1 Scope

The AEMP will function as an integrated monitoring program, which considers pathways identified in the FEIS to potential effects of the Project on the aquatic environment. Changes in surface water quantity and quality, sediment quality, aquatic life, fish habitat, and fish health due to physical alterations of the watersheds and water and air emissions during construction, operations, and closure will be considered. The AEMP will be designed to address predicted impacts to the aquatic environment related to the following Project activities, as identified in the FEIS:

- Project Footprint: physical alterations in watershed areas and drainage patterns that may result in changes to downstream flows, water levels, and channel/bank stability in streams;
- Project Infrastructure: alteration of drainage patterns and construction of diversion channels and culverts as a result of the AWAR, spud barge and associated marine vessel traffic at Rankin Inlet;

- Dewatering: change in flows, water levels, channel/bank stability, and water quality that may affect aquatic life, fish habitat and the abundance and distribution of fish;
- Diversions: temporary and permanent diversions (i.e., B watershed to P watershed to B watershed, and B watershed to D watershed) that may affect aquatic life, fish habitat and the abundance and distribution of fish;
- Water Emissions: discharges of mine wastewater and treated sewage to Meliadine Lake may change surface water and sediment quality by altering nutrient and metal concentrations, which may affect aquatic life, including the abundance and distribution of fish;
- Dust Emissions: fugitive dust deposition that may change water and sediment quality, which may affect aquatic life, and the abundance and distribution of fish;
- Air Emissions: deposition of sulphur dioxide, nitrogen oxides and particulates that may change water and sediment quality; and
- Blasting: blasting in or near waterbodies that may affect aquatic life, including the abundance and distribution of fish.

4.2 Aquatic Effects Monitoring Plan Design Process

The AEMP will be developed after consultation with communities, stakeholders, and regulatory authorities. Incorporation of Traditional Knowledge into the development of the detailed AEMP design will be actively pursued during the consultation period. On November 7th, 2013 AEM began AEMP consultation with the KHTO and DFO which included a brief description of the project layout, fisheries protection planning and the conceptual monitoring locations for the AEMP. It is anticipated that the conceptual AEMP will continue to be reviewed by local and regional Inuit governments/organizations, federal and territorial governments, regulatory boards and other interested community parties, and feedback from these reviews will be considered in the development of the detailed AEMP design.

It is proposed that the scheduling and reporting requirements for the AEMP and the EEM components of the MMER be harmonized. One report (the AEMP design document) that meets the needs of both requirements will be the most efficient and technically useful. By harmonizing the schedules for the AEMP and EEM, numerous efficiencies will be created during field programs and data collection, which will encourage the most effective integration of all available data for interpretation.

Development of the AEMP design involves the following steps:

- formulation of clear statement(s) of objectives;
- review of the problem formulation presented in the FEIS, and identification of information needed to address the AEMP objectives (e.g., monitoring components, assessment, and measurement endpoints);
- definition of the AEMP study area;
- summary of receiving environment data within the AEMP study area;
- development of a statistically-based sampling design;
- development of field and laboratory methods and associated performance criteria and quality assurance and quality control (QA/QC) procedures;

- development of the analytical approach for the data collected;
- development of the monitoring response framework to link the AEMP to adaptive management (see SD 2-5 Environmental Management Plan for additional information on Adaptive Management); and
- development of details of reporting.

Each of these steps is briefly described in the sections that follow and conceptual level information for the Project is provided, where available.

4.2.1 Aquatic Effects Monitoring Plan Objectives

The anticipated objectives of the AEMP are as follows:

- to determine the short- and long-term effects of the Project on the aquatic receiving environment;
- to evaluate the accuracy of predictions made in the FEIS;
- to assess the efficacy of planned mitigation incorporated into Project design; and
- to collect data required to identify the need for potential additional mitigation of Project effects, within a management response framework.

4.2.2 Review of Problem Formulation

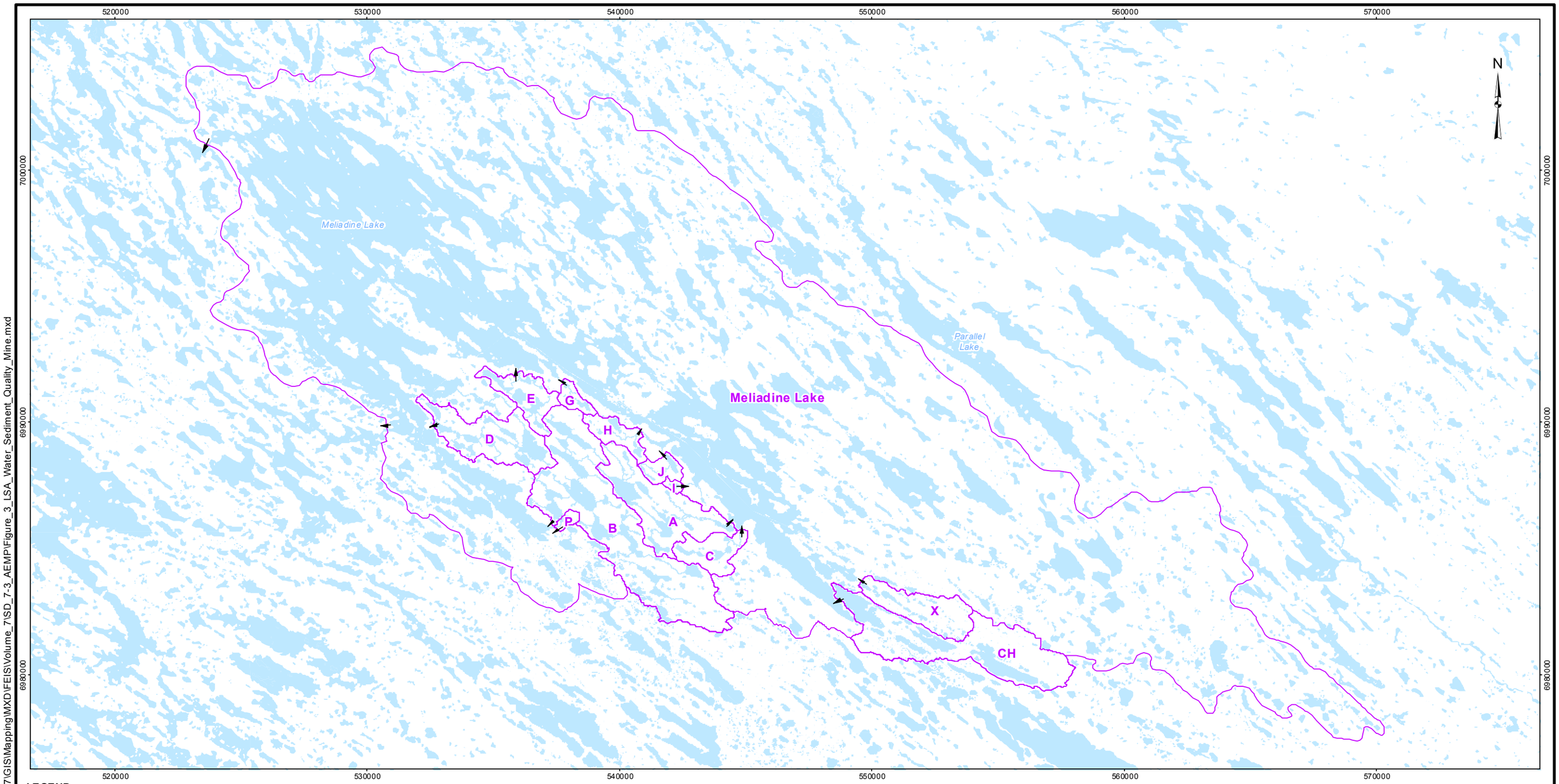
The problem formulation process defines the questions that need to be addressed by the AEMP and identifies the aquatic environmental components that may be affected by the Project. By reviewing and refining the problem formulation as it relates to an AEMP, resources can be focussed on monitoring those endpoints that are most likely to be adversely affected by the Project. A comparable process to problem formulation has been completed by aquatic components as part of the FEIS, and was used for developing effects predictions. The AEMP design will involve review of the FEIS process as a basis for developing the detailed AEMP design.

Relevant steps of the problem formulation process provided by AANDC guidance (AANDC 2009a) are as follows:

- refining the list of stressors of potential concern;
- evaluating the potential effects of individual physical, chemical and/or biological stressors on human or ecosystem health;
- evaluating the transport and fate of stressors of potential concern;
- characterizing potential exposure pathways;
- identification of receptors of potential concern;
- developing a conceptual site model; and
- selection of assessment and measurement endpoints.

4.2.3 Study Area

The LSA for an environmental assessment is the area where the potential exists for direct effects due to project activities. There are 2 LSAs for aquatic habitat for the Project: the LSA for the mine (Figure 3), and the LSA for the AWAR and Rankin Inlet (Figure 4) (FEIS Volume 7, Section 7.5 and Volume 8, Section 8.1). The AEMP study area will consist of these 2 LSAs, and includes habitat 100 metres upstream and downstream of the AWAR and bypass road crossings, the marine environment near the spud barge and associated infrastructure, and other project infrastructure in Rankin Inlet with the potential for direct effects to surface waters (e.g., fuel storage area).



LEGEND

- Direction of Flow at Watershed Outlet
- Watercourse
- Watershed Boundary
- Waterbody

REFERENCE

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

3 0 3
KILOMETRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

LOCAL STUDY AREA FOR WATER AND SEDIMENT QUALITY (MINE)

Golder Associates

PROJECT NO. 10-1373-0076			FILE No.	
DESIGN	JL	20 Aug. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	21 Aug. 2012		
CHECK	JR	14 Jan. 2013		
REVIEW	DW	14 Jan. 2013		

FIGURE 3

N:\Bur-Graphics\Projects\2013\1428\13-1428-0007\GIS\Mapping\MXD\FEIS\Volume_7\SD_7-3_AEMP\Figure_3_LSA_Water_Sediment_Quality_Mine.mxd

520000 530000 540000 550000 560000 570000

6990000 6980000 6970000

N

M23.6
M22.6
D1-2
D5.4
D5.9
D8.8
M13.3
M11.5
M8.6
M6.7
M5.0
M3.9
M3.0
M2.1
Char River
R2.9
R2.5
R2.3
R1.9
R0.8
R1.0
R0.7
R0.3
Rankin Inlet
Hudson Bay

4 0 4
METRES

LEGEND

- Watercourse Crossing
- Proposed Project Infrastructure
- All-weather Access Road (AWAR)
- Road - Existing
- Road - New
- Watercourse
- 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
LOCAL STUDY AREA FOR WATER AND SEDIMENT QUALITY (AWAR AND RANKIN INLET)

Golder Associates

PROJECT NO. 10-1373-0076			FILE No.	
DESIGN	JL	20 Aug. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	23 Aug. 2012		
CHECK	JR	14 Jan. 2013		
REVIEW	DW	14 Jan. 2013		

FIGURE 4

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4.2.4 Summary of Receiving Environment Data

This part of the AEMP design document will provide an up-to-date summary of aquatic environmental data (water quality, sediment quality, lower trophic communities and fish) for surface waters in the AEMP study area, including time series plots, where possible.

4.2.5 Detailed Aquatic Effects Monitoring Plan Study Design

The detailed AEMP design will provide clear definitions of the type, quantity and quality of data that are required to yield defensible conclusions regarding the effects of the Project on the aquatic ecosystem, and will include field, laboratory and data analysis methods by component, including QA/QC procedures.

4.2.5.1 Development of Sampling Design

The AEMP study design will use currently accepted statistical design principles, as recommended by the EEM technical guidance document (EC 2012) and AANDC AEMP guidance (AANDC 2009a). The study design will include the following:

- overall design approach, such as gradient or control/impact study;
- monitoring areas, including reference areas, based on effluent dispersion, water quality modelling results, and availability of suitable reference areas in the study area; study areas will be selected with consideration of community guidance;
- number of stations and samples within each monitoring area, determined using statistical power analysis and baseline data, as well as regulatory guidance;
- identification of monitoring species to be used in the fish program, with consideration of the Valued Ecosystem Components (VECs) identified in Volume 7, Section 7.5.2 of the FEIS (i.e., Lake Trout, Arctic Grayling and Arctic Char), and National EEM guidance (EC 2012), with associated parameters and indicators to be measured; and
- frequency of sampling, which may vary by component (e.g., lower frequency for fish monitoring to preserve populations) and depends on the findings from initial annual monitoring (i.e., if annual monitoring results indicate no effect, then monitoring frequency may be decreased for some components).

Monitoring species, associated parameters and indicators to be used in the AEMP will be confirmed during the detailed AEMP design, and will consider the VECs identified in Volume 7, Section 7.5.2 of the FEIS (i.e., Lake Trout, Arctic Grayling and Arctic Char), as well as information provided through the consultation process and traditional knowledge (or Inuit Qaujimajatuqangit [IQ])). For example, fishing for both Arctic char and arctic grayling continue to be important to the people in the region (Volume 9, Section 9.3.1.5.1.3). A small bodied fish species will be included in the AEMP design, as per National EEM guidance (EC 2012). IQ

Additional details are provided below for the remaining aspects of the study design.

4.2.5.1.1 Design Approach

It is anticipated there will be a combined design approach to the AEMP, with both gradient and control/impact study elements to ensure the AEMP design is robust enough to detect spatial and temporal project-related impacts on fish and fish habitat. For example, the water quality, sediment quality and lower trophic community components may take a gradient approach in Meliadine Lake. The fish health and fish tissue components are expected to take a control/impact approach to the study design, collecting fish from Meliadine Lake and appropriate reference areas for inclusion in the fish health and fish tissue surveys.

Specific details regarding monitoring activities and infrastructure which may require protection from major climate events (e.g., extreme flows) such as deployment and security of under-ice and variable water-column depth deployments of data loggers (e.g., conductivity, temperature, or TDS) will be described in the detailed AEMP design document.

4.2.5.1.2 Monitoring Areas

A variety of Project activities may affect the aquatic environment, which will vary in duration and intensity over different phases of mine life (i.e., during pre-development, construction, operations, closure, and post-closure), particularly in the freshwater environment (Table 1). These activities include effluent discharge, dewatering, water diversions, and flooding in the small lakes. The marine environment at Rankin Inlet in Melvin Bay will receive project infrastructure in the form of a spud barge and associated marine vessel traffic, but will not receive any project-related discharge or effluent.

As a result of effluent discharge into Meliadine Lake and Project related impacts due to flooding, the sampling locations for the AEMP are anticipated to include Meliadine Lake, Lake B45, and the Pit Lakes (Exposure areas). The exposure sampling locations, including the geographic extent of monitoring, will be determined during the detailed AEMP design; however, anticipated sampling areas are indicated on Figure 5 together with UTM co-ordinates. The Pit Lakes will be monitored at post-closure only, following flooding. Additional sampling locations are proposed to include two reference waterbodies as part of physico-chemical and biological surveys (i.e., water quality, sediment quality, lower trophic community and fish). Reference waterbodies will be selected during detailed AEMP design, in consultation with community and regulatory agencies, and may require additional field surveys to confirm their suitability for each monitoring component. Downstream areas of Meliadine Lake, Control Lake, Little Meliadine Lake, Peter Lake, and other waterbodies in the regional study area may be considered as potential reference waterbodies (Reference areas; Figure 5).

A summary of predicted changes in hydrology and water quality as a result of Project activities, as well as a list of fish species that have been captured within each waterbody during baseline data collections is presented in Table 1. This information has been used to develop the conceptual AEMP design. Additional information regarding the anticipated monitoring activities that will be required as part of the AEMP during various phases of construction and operations is included, as well as the rationale for including each particular waterbody (i.e., as part of the MMER, Surveillance Network Program [SNP], AEMP, Fisheries and Oceans Canada authorization, or a combination thereof). Anticipated monitoring components are also indicated in Table 1.

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532500 535000 537500 540000 542500 545000 547500 550000 552500

6995000 6992500 6990000 6987500 6985000 6982500 6980000 6977500

Far downstream Meliadine Lake:
Peter Lake

Meliadine Lake
(East Basin)

Meliadine Lake
(South Basin)

Control Lake

Little Meliadine Lake

Discovery Pit

N

LEGEND

- Exposure area for AEMP, post-closure only – Discovery Pit
- Far Downstream Meliadine Lake; Peter Lake
- Exposure area for AEMP, post-closure only – Tiriganiaq, Wesmeg, Discovery and F Zone Pits
- Exposure area for AEMP (proposed)
- Reference areas for consideration in AEMP (proposed)
- Proposed Project Infrastructure
- All-weather Access Road (AWAR)
- Road - New
- Road - Existing
- Watercourse
- Waterbody

REFERENCE

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

1.5 0 1.5
KILOMETRES

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KILOMETRE

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
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TITLE
ANTICIPATED MONITORING LOCATIONS FOR THE AEMP FOR THE MELIADINE GOLD PROJECT

Golder Associates

PROJECT NO.	10-1373-0076	FILE No.		
DESIGN	RS	05 Dec. 2012	SCALE AS SHOWN	REV. 0
GIS	DSC	11 Dec. 2012		
CHECK	DW	11 Jan. 2013		
REVIEW	DW	11 Jan. 2013		

FIGURE 5

Table 1: Proposed Aquatic Effects Monitoring Areas and Predicted Changes during Different Phases of the Project

Waterbody/ Watercourse	Relevance	Predicted Change in Hydrology	Predicted Change in Water Quality	Fish Species Collected during Baseline	Monitor Pre-Development? (Y/N)	Monitor Construction? (Y/N)	Monitor Operations? (Y/N)	Monitor Closure & Post-Closure? (Y/N)	Rationale for Inclusion	Components to be Monitored[b]
Meliadine Lake	MMER discharge receiving waterbody	negligible due to mitigation	Cd above CCME at baseline and edge of mixing zone	Arctic char, Lake trout, Arctic grayling, Round whitefish, Cisco, Burbot, Slimy sculpin, Threespine stickleback	Y	Y	Y	Y	MMER	WQ, SQ, LT, FH, FT
B45	permanently raised during construction	permanently raised	Co, Ti, V	Arctic grayling, Ninespine stickleback	N	Y	Y	Y	AEMP	WQ, SQ, FT
Meliadine River	downstream watershed and community member concern about potential effects on fish (Volume 9, Section 9.3.1.4.2.4)	flow and water levels slightly reduced during closure to refill pits	-	Arctic char, Lake trout, Arctic grayling, Round whitefish, Cisco, Burbot, Ninespine stickleback	N	N	N[a]	N[a]	Hydrology downstream area	WQ, SQ
Pit Lakes[c]	New habitat post-closure following filling	n/a	n/a	n/a	N	N	N	Y (Post-Closure Only)	AEMP	WQ, SQ & when re-colonized LT, FH & FT
Reference Lake 1	Reference area	n/a	n/a	n/a	Y	Y	Y	Y	Reference area	WQ, SQ, FH, FT, LT
Reference Lake 2	Reference area	n/a	n/a	n/a	Y	Y	Y	Y	Reference area	WQ, SQ, FH, FT, LT

[a] Monitoring water quality and sediment quality only if plume migration or existing conditions require ongoing monitoring

[b] Number and type of sampling areas are subject to detailed study design, and may vary among monitoring components

[c] Pit Lakes = open pits become aquatic habitat at post-closure (including Discovery pit)

MMER = Metal Mining Effluent Regulations Environmental Effects Monitoring Program (EEM); DFO = Fisheries and Oceans Canada; Cd = cadmium; Co = cobalt; Ti = Titanium; V = Vanadium; WQ = Water Quality; SQ = Sediment Quality; FH = Fish Health; FT = Fish Tissue; Hab = Fish Habitat; LT = Lower trophic levels (including benthic invertebrates, plankton and periphyton); - = no data; n/a = not applicable.

Arctic Char - *Salvelinus alpinus,* Lake Trout - *Oncorhynchus mykiss*, Arctic Grayling - *Thymallus arcticus*, Round Whitefish - *Prosopium cylindraceum*, Cisco - *Coregonus artedi*, Burbot - *Lota lota*, Slimy Sculpin - *Cottus cognatus*, Threespine Stickleback - *Gasterosteus aculeatus*, Ninespine Stickleback - *Pungitius pungitius.*

A number of additional locations will be monitored as part of the SNP required by the Type A Water License. Data collected at some of these stations will be reported in the annual AEMP report, as relevant for describing aquatic effects or to provide exposure data. Surveillance network program stations are typically located in critical areas, or include locations that have the potential to receive non-point source discharges. The SNP monitoring locations may be temporary (i.e., only monitored during construction) or long-term (i.e., throughout operations, closure and post-closure).

Some anticipated SNP sampling locations include the following:

- downstream of waste rock storage facilities;
- downstream of the tailings storage facility;
- drinking water intake;
- sewage treatment plant;
- water treatment plant;
- groundwater wells or thermistors;
- downstream of dams;
- AWAR road crossings;
- temporary construction locations; and
- effluent discharge location in the receiving environment in proximity to outfall.

It is anticipated the AEMP will be harmonized with both the MMER and the SNP, to best integrate the results and interpretation of environmental monitoring data collected.

4.2.5.1.3 Number of Stations and Samples

Sample sizes will be determined based on the variability in measurement endpoints, and the required statistical power of the monitoring design (AANDC 2009a). It is anticipated that baseline data will be used to determine required sample-sizes during the detailed AEMP design, taking into consideration variability estimates and endpoints.

Where applicable, critical effect sizes will need to be developed for each measurement endpoint to allow estimation of suitable sample sizes using power analysis. A commonly applied effect size in environmental monitoring programs is two standard deviations of the reference area mean or baseline mean, representing the estimated limit of natural variation. Effect sizes will be developed during the detailed AEMP design following consultation with Inuit governments/organizations, federal and territorial governments, regulatory boards and other interested parties. Effect sizes may be modified throughout Project life as monitoring programs further the understanding of variability and normal ranges of measurement endpoints.

4.2.5.1.4 Sampling Frequency

Sampling frequencies will be developed for the Project during the detailed AEMP design following consultation with relevant parties, and with consideration of traditional knowledge, and will change over the life of the Project in response to monitoring outcomes. Sampling frequency for some components of the AEMP will largely be prescribed by the MMER schedule (Table 2); however, sampling frequency is anticipated to be unique to individual components. It is expected that water quality sampling programs (which provide early-warning information) will occur at a greater frequency than lower trophic level and fisheries monitoring programs.

4.2.5.2 Field and Laboratory Methods, Data Analysis Methods, and QA/QC

A sampling and analysis plan will be developed as part of the detailed AEMP design, following the consultation process. The plan will identify those parties responsible for conducting the monitoring (i.e., collecting, analyzing and interpreting the data). The plan will also provide details of procedures for data acquisition, QA/QC procedures, and analyses for each AEMP component, and will provide statistically rigorous tests of impact predictions presented in the FEIS. These activities will be performed according to accepted standards of good scientific practice.

4.2.5.3 Monitoring Response Framework

A Monitoring Response Framework for assessing the overall results of AEMP monitoring will be developed. The Monitoring Response Framework will provide a systematic approach for responding to the results of the AEMP, and will be developed in consideration of the Wek'e`ezhı`i Land and Water Board draft guidelines for Adaptive Management (WLWB 2010). It is anticipated the Monitoring Response Framework will be developed independently and concurrently with the AEMP study design, such that the results from the AEMP will be used, along with other monitoring and management programs, to drive Adaptive Management (see SD 2-5 Environmental Management and Protection Plan includes adaptive management).

It is anticipated the Response Framework will have three action levels: Low, Moderate and High. These action levels indicate conditions or effects that lie between baseline (as identified in the FEIS) and a Significance Threshold (i.e., a clear statement of environmental change which must never be reached). Low Action Levels will be defined in the detailed AEMP design document, wherever existing data and understanding of the natural variability in the ecosystem allows. When a Low Action Level is reached, it is anticipated that a Management Response Plan (MRP) will be drafted and subsequent investigation and management actions, along with additional monitoring actions, would act to minimize further environmental impact. The Moderate and High Action Levels are defined during the MRP process. The goal of the Response Framework is to effectively ensure that significance thresholds are never reached and environmental impact does not exceed predictions made in the FEIS.

4.2.5.4 Reporting

The reporting requirements for the AEMP and the EEM components of the MMER will be harmonized to the extent possible (Table 1). It is anticipated that having one report that meets the needs of both agencies will be the most efficient and technically useful. By harmonizing the schedules for the AEMP and EEM components,

numerous efficiencies will be created during field programs, and data analysis and interpretation. Harmonization of monitoring components enables the most effective integration of all available data for interpretation.

The reporting approach, including reporting schedule for AEMP annual reports and anticipated report organization, will be described in the detailed AEMP to be submitted with the Type A Water License application. The detailed AEMP will also describe the frequency of periodic AEMP reviews to summarize trends, and provide opportunity to update the study design, as appropriate. An annual report will be provided to the Nunavut Water Board (NWB; as per anticipated Type-A Water Licence requirements for the Project) and Environment Canada (as per the MMER requirements), and will be available on the public registry for regulator and stakeholder review and input. Reports filed with EC will be reviewed by a Technical Advisory Panel to satisfy the biological components of the MMER EEM program. Data on fish and lower trophic level monitoring will be entered to a federal government website for integration into a national dataset on biological monitoring at metal mines (EC 2012).

5.0 AQUATIC EFFECTS MONITORING PLAN COMPONENTS

The major components of the aquatic ecosystem to be monitored are expected to include water quality, sediment quality, lower trophic levels (i.e., plankton, benthic invertebrates), and fish (i.e., fish health and fish tissue chemistry, as an indicator of fish usability). Table 2 contains a preliminary outline of the AEMP components, locations, and frequency and gives an indication of the various opportunities within and among the monitoring programs for harmonization of data collection and interpretation. Effluent characterization is included in Table 2; it is understood that effluent characterization will be part of the compliance monitoring program specified in the Type-A Water License for the Project (i.e., SNP), as well as a requirement of EEM, and will be part of the AEMP water quality component. Interpretation of AEMP results in annual reports will include summaries of aquatic compliance monitoring data.

Effluent characterization will involve daily, weekly, monthly, and quarterly sampling requirements to determine the physical, chemical, and toxicological characteristics of the Project effluent, as per MMER sampling requirements. Effluent plume characterization will determine the distribution of the effluent plume within Meliadine Lake; it is anticipated the effluent plume will not enter downstream waterbodies (i.e., Meliadine River and Diana River) due to the large size of Meliadine Lake.

The water quality component will determine the physical and chemical characteristics of Meliadine Lake surface waters, as well as selected reference areas and other relevant waterbodies (e.g., Chicken Head Lake, Lake B45). Initially, water quality monitoring will likely be performed monthly during open water conditions, and quarterly the remainder of the year. Sediment quality monitoring will determine the physical and chemical characteristics of sediments in Meliadine Lake and reference waterbodies, and may involve additional areas pending site-specific conditions. Sediment monitoring will likely be performed annually in the initial project phases, and may move to a 3-year cycle during Project life.

Benthic invertebrate and plankton community monitoring will likely include biomass and community characterization in Meliadine Lake and appropriate reference areas, as well as in the Pit Lakes at post-closure. It is anticipated the lower trophic levels will be monitored annually initially, concurrently with sediment monitoring, and then subsequently move to a three-year cycle for the remainder of the Project life.

Fish habitat monitoring, as a component of an AEMP, relates to the physical aspects of fish habitat such as water levels and flows, water temperature and dissolved oxygen content of surface waters and will be performed as part of water quality monitoring for the AEMP. These variables will be monitored as part of the water quality and lower trophic level components. It is anticipated the fish health component of the AEMP will involve a standard EEM style survey of 2 species of fish in Meliadine Lake and relevant reference areas, as well as the Pit Lakes in post-closure upon re-colonization by fish species. The fish health monitoring will likely be performed every three years as per the EEM biological monitoring. Fish usability will also be evaluated every three to six years, and will involve measuring tissue chemistry (i.e., metals and nutrients) in fish collected from Meliadine Lake and reference lakes. Fish usability studies will also be performed in the Pit Lakes at post-closure and other relevant waterbodies (e.g., Lake B45).

Details of the AEMP and associated component monitoring details will be finalized as part of the Type A water licensing process.

Table 2: Preliminary Outline of Components of the Aquatic Effects Monitoring Program for the Project

Component	Description	Locations	Frequency	Harmonization
Effluent characterization	Physical, chemical and toxicological characteristics of the Project effluent, summarized from data collected as part of the SNP and MMER	Meliadine Lake	Will include daily, weekly, monthly, and quarterly requirements	Harmonize with MMER and SNP requirements
Effluent plume characterization	Distribution of the effluent plume and percent effluent concentration in Meliadine Lake and downstream waterbodies	Meliadine Lake, (Meliadine River and Diana River, if required based on effluent dispersion)	Will include initial detailed characterization in support of MMER biological monitoring studies, moving to variable timing in later operations	Harmonize with MMER Plume Characterization Study and SNP requirements
Water quality	Physical and chemical characteristics of surface waters of Meliadine Lake, downstream waterbodies and two reference lakes	Meliadine Lake, Meliadine River, B45, E3, Chicken Head Lake, Rankin Inlet, 2 reference areas and Pit Lakes (post-closure)	Will include monthly (during open water season) or quarterly requirements	Harmonize with MMER and SNP requirements
Sediment quality	Physical and chemical characteristics of bottom sediments in Meliadine Lake, downstream waterbodies and two reference areas; may include additional exposure areas pending site-specific conditions	Meliadine Lake, Meliadine River, B45, E3, Chicken Head Lake, Rankin Inlet, 2 reference areas and Pit Lakes (post-closure)	Likely annually initially, then move to every 3 years for lakes as part of biological monitoring for the MMER	Harmonize with MMER requirements for sediment monitoring as part of biological monitoring of benthic invertebrates
Lower trophic levels	Benthic invertebrate and plankton biomass and community characteristics in Meliadine Lake and reference areas; may include additional exposure areas pending site-specific conditions	Meliadine Lake, Pit Lakes (post-closure), 2 reference areas	Likely annually initially, then move to every 3 years as part of biological monitoring for the MMER; plankton initially may be annual during open water season	Harmonize with MMER requirements biological monitoring of benthic invertebrates
Fish habitat	Physical aspects of fish habitat such as water level and flows, water temperature, and dissolved oxygen concentration in Meliadine Lake and reference areas; may include additional areas pending site-specific conditions	Meliadine Lake, Pit Lakes (post-closure), AWAR, 2 reference areas	Will likely include annual requirements, and will be done as part of water quality monitoring	Harmonize with *Fisheries Act* Authorization monitoring, if required
Fish health	Standard EEM style survey of two species of fish in Meliadine Lake and two reference lakes; may include additional areas pending site-specific conditions	Meliadine Lake, Pit Lakes (post-closure), 2 reference areas	Likely every 3 years as part of biological monitoring for the MMER	Harmonize with MMER requirements biological monitoring of fish
Fish usability	Fish tissue chemistry (i.e., full metal scan, nutrients) of fish in Meliadine Lake and two reference lakes; may include additional areas pending site-specific conditions	Meliadine Lake, B45, Pit Lakes (post-closure), 2 reference areas	Likely every 3 to 6 years as part of biological monitoring for the MMER	Harmonize with MMER requirements biological monitoring of fish

Notes: MMER = Metal Mining Effluent Regulations of the *Fisheries Act*; EEM = Environmental Effects Monitoring; SNP = Surveillance Network Program required by Water License; AWAR = All-weather Access Road

6.0 CLOSURE

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

Yours very truly,

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