AGNICO EAGLE

MELIADINE GOLD MINE

Water Quality and Flow Monitoring Plan

JANUARY 2019
VERSION 1

EXECUTIVE SUMMARY

The Water Quality and Flow Monitoring Plan (the Plan) has been prepared in accordance with the requirements of the Nunavut Water Board Type A water license 2AM-MEL1631. The Plan is one component of the *Aquatic Effects Management Program* (AEMP) and is closely associated with the *Water Management Plan* and the *Metal and Diamond Mining Effluent Regulations (MDMER)*.

Section 2 of this Plan includes an overview of the monitoring programs and mine development schedule. Section 3 provides specific details (including sampling locations and parameters to be measured) for the compliance monitoring program, along with general guidance for the event monitoring program. An adaptive management program is described for regulated discharge and non-regulated discharges in Section 3. Requirements of the flow monitoring program are described in Section 4, and an overview of the reporting requirements in Section 5.

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IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEL1631, Part B, Item 10, the proposed implementation schedule for this Plan is outlined below.

This Plan will be implemented immediately (December 2018) subject to any modifications proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

Environmental Superintendent
Environmental Coordinators
Environmental Technicians

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	18/12/16	All	All	Comprehensive plan for Meliadine project. First version composed by Meliadine Environment Department.

Prepared by:

Agnico Eagle Mines Limited - Meliadine Division

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SECTION 1. INTRODUCTION

The Water Quality and Flow Monitoring Plan (the Plan) has been prepared in accordance with the requirements of the Nunavut Water Board Type A water license 2AM-MEL1631 (the License). The Plan is one component of the *Aquatic Effects Management Program* (AEMP) and is closely associated with the *Water Management Plan* and the *Metal and Diamond Mining Effluent Regulations (MDMER)*. The implementation and periodic updates to this Plan are the responsibility of the Meliadine Environment Department under the guidance of the Meliadine Environment Superintendent or designate.

The Plan summarizes the monitoring locations, sampling frequency, monitoring parameters, compliance discharge criteria and an adaptive management plan for water quality at the Meliadine Gold Project.

The purpose of this Water Quality and Flow Monitoring Plan is to establish the program that is to be implemented and followed by AEM's Meliadine environmental management team to monitor the performance of the waste and water management systems at the Meliadine Gold Project. The program includes:

- Verifying and validating the predicted water quality values with empirical measurements of the mine site water quality and flows;
- A comparison of measured water quality data to compliance requirements stipulated in the License; and
- A framework for adaptive management that allows the identification and rectification, where necessary, of unexpected trends or non-compliance in water quality and flows.

The Plan provides information on the locations of the monitoring stations at the various stages of mining. These monitoring locations are used to evaluate the performance of the mine waste and water management system.

The objectives of the monitoring program are:

1) To track the chemistry of the contact and non-contact water prior to and during discharge;

2) To assist in identifying if water treatment is required prior to discharge; and

3) To minimize the potential impacts of mining activities on the surrounding environment.

Additional locations outside the footprint of the mine (and outside the scope of this Plan) will be monitored under the *Meliadine Gold Project Aquatic Effects Management Program* (Golder 2016).

SECTION 2. OVERVIEW

2.1 OVERVIEW OF SITE WATER MANAGEMENT PLAN

Details of overall water management are discussed in the Meliadine Water Management Plan which is updated annually. A network of berms, dikes, containment ponds, channels, culverts and sumps are in place and maintained to facilitate water management (Section 3 of the *Water Management Plan*).

As specified in the *Water Management Plan*, surface contact water is intercepted, diverted and contained within various containment ponds prior to evaporation or treatment. Contact water from the Underground Mine is collected in underground sumps and recirculated for use in various underground operations. Underground contact water that is not used for operations is stored underground and any excess water that cannot be stored underground is pumped to the Saline Ponds or to the Saline Water Treatment Plant (SWTP) for treatment (See Section 3.9 of the *Water Management Plan*). Additional Saline Storage ponds will be developed on the Meliadine site (surface) in the future as groundwater inflows in the underground workings of the mine are greater than predicted. Agnico Eagle has received approval from the Nunavut Impact Review Board to discharge saline water via a diffuser to the sea in Rankin Inlet (Melvin Bay).

2.2 MONITORING PROGRAMS

This Plan has been divided into two levels of monitoring to characterize the range of impacts between the sources of contact water in the individual mine facilities and the point of discharge or release to the receiving environment. The two levels of monitoring include:

1) Compliance monitoring; and

2) Event monitoring.

2.2.1 Compliance Monitoring Program (CM)

The CM sites are those stipulated in the License; these sites vary from contact water collection ponds, structures such as ditches, culverts prior to discharge to the receiving environment and local lakes surrounding the mine site. The requirements of the License, including water quality limits, will be applied at the applicable mine discharge points identified in the CM program.

The CM program provides a mechanism to assess water quality at specified sites, and to confirm and document compliance of discharge with regulatory requirements. As part of adaptive water management, these internal monitoring stations provide protection to the receiving water environment, provide data to predict pit re-flooding water quality and ensure exceedances of predicted or regulated levels are appropriately managed or mitigated to reduce impacts.

2.2.2 Event Monitoring Program (EM)

The EM sites result from unexpected events such as spills, accidents, and malfunctions. The response programs for such events are discussed in greater detail in the following four (4) documents:

- Meliadine Spill Contingency Plan (March 2019;
- Meliadine Emergency Response Plan (May 2018);
- Meliadine Freshet Action Plan (March 2019); and
- Meliadine Water Management Plan (March 2019).

Each accidental release will require mobilization of site equipment to stabilize the release, procedures to contain, neutralize, and dispose of the discharge, and recommendations for monitoring the site following the incident.

2.3 OVERVIEW OF MINE DEVELOPMENT SCHEDULE

The Mine Plan and key mine development activities, including mine waste management are currently used concurrently with the *Water Management Plan*.

The Mine Plan proposes one underground mine (Tiriganiaq Underground Mine) and two open pits (Tiriganiaq Open Pit 1 and Tiriganiaq Open Pit 2) for the development of the Tiriganiaq gold deposit.

The Mine is estimated to produce approximately 14.9 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 14.9 Mt of tailings. The following phased approach is proposed for the development of the Tiriganiaq gold deposit;

- Phase 1: 3.5 years for Mine Construction. Construction began in 2015 and is estimated to be completed in Q2 of 2019 (Q4 Year -5 to Year Q2 -1);
- Phase 2: 8.5 years for Mine Operations, beginning in 2019 (Q2 Year -1 to Year 8);
- Phase 3: 3 years Mine Closure (Year 9 to Year 11); and;
- Phase 4: Post-Closure (Year 11 forward).

Mining facilities on surface will include a plant site and accommodation buildings, three ore stockpiles, a temporary overburden stockpile, a tailings storage facility (TSF), three waste rock storage facilities (WRSFs), a water management system that includes containment ponds, water diversion channels, retention dikes/berms, and a series of water treatment plant

SECTION 3. MONITORING PROGRAM

The monitoring program is presented in three sections; requirements of the compliance monitoring program, an overview of the event monitoring program, and then details of the adaptive management program for monitoring results.

3.1 COMPLIANCE MONITORING PROGRAM

The CM program monitors the chemistry of four local lake surrounding the mine site (E3, G2, H1 and B5) as well as mine contact water collected and diverted at specified locations prior to release into the receiving water environment. The sampling is conducted in order to confirm and document compliance with regulatory requirements. The types of water and the timing of the CM program include:

- Non-contact water from local lakes;
- Mine contact water collected from drainage of different structures; and
- Monitoring points located within the containment ponds prior to release into the receiving water environment

The CM sampling program has multiple monitoring stations across the project site, with sampling at different stages of the mine life. All of the CM stations, a description of their location, parameters to be monitored and sampling frequency are listed in Table 3.1. Specific details for the monitoring parameter groups are provided in Table 3.2. In summary, Agnico Eagle follows 5 groups of parameters, as identified in Meliadine's Type A Water License Schedule I Table 1.

Figures 3.1 shows the approximate location of each of the sampling sites. The actual location of each sampling site is determined by access and safety considerations and are marked by a stake that defines the exact location of the collection point for sampling events with appropriate attached signage in English, Inuktitut and French.

GPS coordinates for all compliance monitoring stations were confirmed, as required in Part I, Item 6 of the NWB Type A water license.

3.1.1 General Sampling and Analysis Program

Samples are collected in clean laboratory-supplied containers and preserved as directed by the analytical laboratory. During all phases, samples are analyzed offsite at an accredited commercial lab (ALS in Burnaby BC, Maxxam Analytics in Ottawa, AquaTox in Puslinch, or H2Lab in Val d'Or). Samples sent to commericial laboratories may change as the site matures and additional requirements occur.

Table 3.3 summarizes the minimum sample volumes, container, preservation, and holding times for each analyte. This information is from the *USEPA Methods for Chemical Analysis of Water and Waste Water* (*EPA-600/4-79-020, 1979*).

Table 3.1: Monitoring Program

Station	Description	Phase	Monitoring Parameters	Frequency
Mine Site				
MEL-D-1	Dewatering: Water transferred from lakes to Meliadine Lake during dewatering of lakes	Construction	As defined in the Water Management Plan referred to in Part D, Item 12	Prior to discharge and Weekly during discharge
			Volume (m3)	Daily during periods of discharge
MEL-SR-1 to TBD	Surface Runoff – runoff downstream of Construction areas at Meliadine Site and Itivia Site, Seeps in contact with the roads, earthworks and any Runoff and/or discharge from borrow pits and quarries	Construction, and Operation	As defined in the Water Management Plan referred to in Part D, Item 18 and Part I, Item 11	Prior to Construction, Weekly during Construction
			Group 1	Monthly during open water or when water is present upon completion
MEL-11	Water Intake from Meliadine Lake	Construction, Operation, and Closure	Full Suite	Monthly during periods of intake
			Volume (m3)	Daily during periods of intake
MEL-12	Water treatment plant (pre-treatment) coming from CP1, off the pipe and not in the pond	Construction (prior to release), Operations, and Closure	Group 1	Monthly during periods of discharge
MEL-03-01 (and AEMP Stations)	Mixing zone in Meliadine Lake, Station 1; and MDMER exposure stations for final discharge point within mixing zone	Construction (prior to release), Operations, and Closure	Full Suite, Group 3 (MDMER)	Monthly during periods of discharge
MEL-14	Water treatment plant from CP-1 (post-treatment), end of pipe (before offsite release) in the plant before release.	Construction (upon effluent release), Operations, and Closure	Full Suite, Group 3	Prior to discharge and Weekly during discharge

			Volume (m3)	Daily during periods of discharge Once prior to discharge and Monthly thereafter
			Acute Lethality	Once prior to discharge and Monthly thereafter
MEl-15	Local lake E-3	Operations, and Closure	Group 2	Bi-annually during open water
MEL-16	Local Lake G2	Construction, Operations, and Closure	Group 2	Bi-annually during open water
MEL-17	Local Pond H1	Construction, Operations, and Closure	Group 2	Bi-annually during open water
MEL-18	Local Lake B5	Construction, Operations, and Closure	Group 2	Bi-annually during open water
MEL-19	CP-2 Collection of natural catchment drainage from the outer berm slopes of the Landfarm and industrial pad	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-20	CP-3 Collection of drainage from dry stacked tailings	Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-21	CP-4 Collection of drainage from WRSF1	Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-22	CP-5 Collection of drainage from WRSF1 and WRSF2	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-23	CP-6 Collection of drainage from WRSF3	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-24	Seepage from the Landfill between the landfill and Pond H3	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-25	Secondary containment area at the Itivia Site Fuel Storage and Containment Facility	Construction, Operation, Closure	Group 4, Volume (m3)	Prior to discharge or transfer of Effluent

Table 3.2: Monitoring Parameters

Group	Parameters
1	pH, turbidity, hardness, alkalinity, chloride, fluoride, sulphate, total dissolved solids (TDS), total suspended solids (TSS), total cyanide, ammonia nitrogen, nitrate, nitrite, phosphorus, orthophosphate, Total Metals (aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, and zinc).
2	**Total and Dissolved Metals**: aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc. **Nutrients**: ammonia-nitrogen, total Kjeldahl nitrogen, nitrate-nitrogen, nitrite-nitrogen, orthophosphate, total phosphorus, total organic carbon, dissolved organic carbon, and reactive silica. **Conventional Parameters**: bicarbonate alkalinity, chloride, carbonate alkalinity, turbidity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, TDS, TSS, total cyanide, free cyanide, and weak acid dissociable (WAD) cyanide..
3	**MDMER parameters**: total cyanide, arsenic, copper, lead, nickel, zinc, radium-226, TSS, pH, total ammonia and temperature. **MDMER additional requirements**: Effluent volumes and flow rate of discharge, Acutely Lethality tests (Rainbow Trout and Daphnia magna) and environmental effects monitoring (EEM).
4	Total arsenic, total copper, total lead, total nickel, TSS, ammonia, benzene, toluene, ethylbenzene, xylene, total petroleum hydrocarbons (TPH), and pH
Full Suite	Group 2, Total Petroleum Hydrocarbons, Turbidity. Non Acutely-lethal (Rainbow Trout and Daphnia magna) for discharge only.
Flow	Flow data-logger
Field measurements	Field pH, specific conductivity, dissolved oxygen, and temperature.

Table 3.3: Summary of Sampling Requirements for each Analyte

Parameters	Matrix Holding Time				Type of Bottle	Preservative	Volume
	Drinking Water	Waste Water	Surface Water	Ground Water (1)			
Microbiology							
Escherichia coli, total coliforms, A.A.H.B	48h	48h	48h	48h	PPS	TS, E	250ml
Enterococcus	48h	48h	48h	48h	PPS	TS, E	250ml
Thermo tolerant coliforms (fecal)	48h	48h	48h	48h	PPS	TS, E	250ml
Inorganic Chemistry							
Absorbance UV, Transmittance UV				24h	P. T. V	N	125ml
Alkalinity, Acidity, Bicarbonates, Carbonates	14d	14d	14d	14d	P, T, V	N	250ml
Ammonia nitrogen (NH_3-NH_4)	28d	28d	28d	28d	P, T, V	AS	125ml
Kjeldahl ammonia (NTK)		28d	28d	28d	P, T, V	AS	125ml
Anions (Cl, F,SO_4)	28d	28d	28d	28d	P, T, V	N	250ml
Color, Free & total Chlorine	48h	48h	48h	48h	P, T, V	N	125ml
Conductivity	28d	28d	28d	28d	P, T, V	N	250ml
Cyanides total/available, Cyanides	14d	14d	14d	14d	P, T, V	NaOH	250ml
BOD_5/Carbonated BOD_5 (2)		48h/4°	48h/4°		P, T, V	N	250ml
COD (chemical oxygen demand)		28d	28d		P, T, V	AS	125ml
Mercury (Hg)	28d	28d	28d	28d	P, T, V	AN	250ml
Total/dissolved metals (filtered on field)	180d	180d	180d	180d	P, T, V	AN	250ml
Dissolved Metals (filtered in the laboratory)	24h	24h	24h	24h	P, T, V	N	250ml
Total suspended solids & Volatile TSS		7d	7d	7d	P. T. V	N	500ml
NH_3 or NH_4		24h	24h	24h	P.T.V	N+AS	2/125ml
Nitrites (NO_2), Nitrates (NO_3), Turbidity	48h	48h	48h	48h	P, T, V	N	250ml
Nitrites-Nitrates (NO_2-NO_3)	28d	28d	28d	28d	P, T, V	AS	250ml
O-Phosphates (O-PO_4)	48h	48h	48h	48h	P, T, V	N	500ml
pH	24h	24h	24h	24h	P, T, V	N	125ml
Total Phosphorus (P-tot)	28d	28d	28d	28d	P, T, V	AS	125ml
Dissolved solids (TDS)		7d	7d	7d	P. T. V	N	250ml
Total solids		7d	7d	7d	P. T. V	N	250ml
Sulphides (H_2S) (3)	28d	28d	28d	28d	P. T. V	AcZn + NaOH	125ml
Thiosulfates	48h	48h	48h	48h	P. T. V	N	125ml
Radioactive & Organic Chemistry							
Fatty resin acids (S-T)	--	28d	28d	--	VA, VT	AS	1L
Congeners PCB (S-T)	28d	28d	28d	28d	VA, VT	N	1L
Chlorobenzene	28d	28d	28d	28d	2 Vial+1 blank	TSS	2/40ml
Total Organic Carbon (TOC)	28d	28d	28d	28d	P, T, V (B)	AC	100ml
Dissolved Organic Carbon (DOC)	48h	48h	48h	48h	P, T, V (B)	N	100ml
Total Inorganic Carbon (CIT)	48h	48h	48h	48h	P, T, V (B)	N	100ml
Phenolic compound (GC-MS)	28d	28d	28d	28d	VA, VT	AS	1L
Glyphosate (S-T)	14d	14d	14d	14d	P.T	N	500ml
PAH	28d	28d	28d	28d	VB	AS	1L
Oil & Greases (total and non-polar)	28d	28d	28d	28d	VA, VT	AS	1L
C10-C50 HP and/or Petroleum Product Identification	28d	28d	28d	28d	VA, VT	AS	1L

Phenol index	28d	28d	28d	28d	VA, VT	AS	500ml
Radium-226	180d	180d	180d	180d	P, T. V	AN	1L
VOC (MAH, CAH, THM, BTEX) (3)	28d	28d	28d	28d	2 Vial+1 blank	TSS	2/40ml

Type of bottle:
P.S.V.T.: plastic bottle, bag or glass bottle with Teflon cap
P, T: Plastic bottle or plastic bottle with Teflon cap
P.T.V.: Plastic bottle or glass bottle with plastic or Teflon cap
PPS: Sterile propyl ethylene bottle
VA: Clear or amber glass with aluminium or Teflon seal
VB: Amber glass (or clear glass covered with aluminium paper) aluminium seal of Teflon
VT: Clear or amber glass bottle with Teflon seal
Preservative:
AC: 0.1ml (100µl) of HCl per 100ml of sample
AcZn: 0.2ml zinc acetate 2N per 100ml of sample and NaOH 10N to pH >9
AN: HNO3 to pH <2
AS: H2SO4 to pH <2
E: 2.5ml EDTA 1.5% (p/v) per 100ml of sample if heavy metals are suspected
ED: 0.1ml diamine ethylene 45 mg/l per 100 ml of sample
EDTA: 1ml EDTA 0.25M per 100ml of sample
N: No preservative
NaOH: NaOH 10N to >12
TS: Sodium thiosulfate final concentration in the sample of 0.1% (p/v)

3.1.2 Compliance Monitoring Stations and Discharge Criteria

Further details of the specific CM stations and discharge criteria stipulated under the License are provided below.

3.1.2.1 *Dewatering Activities*

All Waters from dewatering activities at Monitoring Program Stations MEL-D-1 through MEL-D-TBD shall be directed to Meliadine Lake and shall not exceed the quality limits presented in Table 3.4 as stipulated in Part D, Item 12 of the License.

Table 3.4: TSS and pH Criteria at CM Stations MEL-D-1 through MEL-D-TBD

Parameter	Maximum Average Concentration (mg/L)	Maximum Concentration of Any Grab Sample
TSS	15.0	30
pH	6.0 to 9.5	6.0 to 9.5

All surface runoff and/or discharge from drainage management systems, at the Monitoring Program Stations MEL-SR-1 to MEL-SR-TBD during the Construction/Operation of any facilities and infrastructure associated with this project, including laydown areas and All-weather Access Road, where flow may directly or indirectly enter a Water body, shall not exceed the Effluent quality limits presented in Table 3.5, as stipulated in Part D, Item 18 of the License.

Table 3.5: Effluent Criteria at CM Station MEL-SR-1 to MEL-SR-TBD

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
Total Suspended Solids (TSS) (mg/L)	50.0	100.0
Oil and Grease	No Visible Sheen	No Visible Sheen
pH	6.0 to 9.5	6.0 to 9.5

3.1.2.2 *Water Collection System*

A water collection system comprised of berms, dikes, containment ponds, channels, culverts and sumps was developed to control water at the Meliadine project (Section 3 of the *Water Management Plan*). Diversion berms, diversion channels and culverts will direct surface water towards containment ponds and associated dikes. Pending salinity levels, water in containment pond CP5 will be treated by a Reverse Osmosis (RO) treatment plant prior to be discharged in CP1.

Contact water from the Underground Mine is collected in underground sumps and recirculated for use in various underground operations. Underground contact water that is not used for operations is stored underground and any excess water that cannot be stored underground is pumped to the Saline Ponds. Saline water collected in the Saline Ponds is temporarily stored and then actively evaporated or pumped to the SWTP for treatment prior to being pumped to CP1.

At CP1, the water is treated for total suspended solids (TSS) at the Effluent Water Treatment Plant (EWTP) and either transferred to the process plant for use as make-up water or discharged through the diffuser located in Meliadine Lake

Effluent discharged from CP1 at CM station MEL-14 shall be directed to Meliadine Lake through the Meliadine Lake Outfall Diffuser and shall not exceed the effluent quality limits presented in Table 3.7, as stipulated in Part F, Item 3 of the License.

Table 3.6: Effluent Criteria at CM Station MEL-14

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
pH	6.0 to 9.5	6.0 to 9.5
TSS (mg/L)	15	30
TDS (mg/L)	1400	1400
Total (T)-Al (mg/L)	2.0	3.0
T-As (mg/L)	0.3	0.6
T-CN (mg/L)	0.5	1
T-Cu (mg/L)	0.2	0.4
NH_4-N (mg/L)	14	18
T-Ni (mg/L)	0.5	1
T-Pb (mg/L)	0.2	0.4
T-P (mg/L)	2.0	4.0

T-Zn (mg/L)	0.4	0.8
Total Petroleum Hydrocarbons (TPH) (mg/L)	5	5

The Discharge of Effluent from the Final Discharge Point at Monitoring Program Station MEL-14 shall be demonstrated to be non-Acutely Lethal under the following test in accordance with the Schedule I of the License:

a. Acute Lethality of Effluents to Rainbow Trout (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13 July 1990, published by the Department of the Environment, as amended in December 2000, and as may be further amended from time to time.

Itivia Marshalling Area

Surface water runoff from the bulk fuel tank storage areas is collected within the tank's secondary containment enclosures that are equipped with an HDPE liner; these are designed to contain petroleum products released due to spill events. Water collected in the secondary containment enclosures at CM station MEL-25 is discharged to land in a controlled manner according to the Nunavut Water Board Type A water license # 2AM-MEL16331.

All effluent being discharged from the secondary containment enclosures at the itivia marshalling facility shall not exceed the effluent quality limits presented in Table 3.9, as stipulated in Part F, Item 5 of the water license.

Table 3.7: Effluent Criteria at CM Station MEL-25

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
pH	6.0 to 9.5	6.0 to 9.5
TSS (mg/L)	15.0	30.0
Benzene (ug/L)	370	370
Toluene (ug/l)	2	2
Ethylbenzene (ug/L)	90	90
Lead (mg/L)	0.1	0.1
Oil and Grease (mg/L)	5.0 and no visible sheen	5.0 and no visible sheen

3.1.2.3 *Receiving Environment*

Receiving water quality monitoring is discussed in the Aquatic Effects Management Program (AEMP) (March 2019). Within the AEMP are numerous monitoring programs: water quality, sediment quality, benthic invertebrate communities, and fish health and fish tissue chemistry. The Meliadine Lake monitoring program was designed around the key aspects of Environmental Effects Monitoring (EEM) requirements under the Metal and Diamond Mining Effluent Regulations. Water quality data are analyzed to determine if there are differences between the Near-field exposure area, the Mid-field exposure area, and the pooled reference areas of Meliadine Lake.

3.2 EVENT MONITORING

The Event Monitoring (EM) program addresses the site specific monitoring that is required following any accidental release. A "release" may be caused by:

- Spills, including unidentified seepage (Meliadine Spill Contingency Plan; March 2018); or
- Emergencies (Meliadine Emergency Response Plan; May 2017).

The EM program is designed to verify whether contamination of the surface soil and/or any nearby receiving environment and active zone has occurred as a result of an accidental release of a hazardous material or contaminated water. Verification is done through monitoring of surface runoff and nearby receiving environment during and following remedial activity. It is anticipated that due to the presence of permafrost beneath most of the mine footprint (active layer app 1.5m in depth), there will be minimal impact to groundwater from surface spills or accidental releases.

The EM plan is developed on a site specific basis subsequent to a spill or other incident, and considers the type of product spilled, the potential receptors and the potential for any remaining contamination after clean up. The plan is coordinated by the Environmental Department.

In the event of an accidental release, the water quality of any downstream receptor as well as an upstream reference (background) is sampled to determine severity of impact. Should the spill have happened over snow cover, as much contaminated snow will be removed as possible. Verification sampling would occur in the area after thaw to determine if the clean – up is complete or if further remediation is necessary. The specific parameters monitored as part of the EM program will depend on the nature of the spill, and will be determined for the specific material released.

The EM program for a particular spill will cease upon obtaining satisfactory analytical results from the potentially affected areas or as required by regulators.

3.3 ADAPTIVE MANAGEMENT PROGRAM

Results of the water quality monitoring are reviewed by the Meliadine Environment Department. Chemical trends of constituents of interest are tracked for mine site monitoring and for the AEMP program. This allows for early detection of significant changes in water quality within the mine site prior to discharge. If triggers and thresholds, such as in the AEMP program, are exceeded in the receiving environment action plans are then implemented to ensure that environmental protection objectives are met.

An adaptive management program has been designed for the Meliadine Gold Project to evaluate the monitoring data and provide a framework for action, if necessary. The program has two levels - a trigger level to compare the monitoring data against, and an action plan of mitigative measures for identified exceedances.

The adaptive management program is divided into two sections, one for parameters with regulated discharge criteria at specific monitoring locations, as specified in the License and by the Metal Diamond Mining Effluent Regulations (MDMER). The second section is for measured parameters for which no discharge limits have been identified in the License such as those in the AEMP or EEM.

Saline Water Treatment Plant Influent and Effluent

Water samples are collected weekly at both the inlet and outlet of the SWTP. Samples taken at the inlet of the SWTP represent the water quality of either Sump 75 or the Saline Pond, which will vary depending on the treatment priority for saline water storage. The results of the sample analysis are used by SWTP

operators to fine-tune the treatment process and ensure its optimal performance. Samples taken at the outlet of the SWTP are analyzed to provide the quality of treated water produced by the SWTP that is transferred to CP1.

Water samples are analyzed for the following parameters: pH, conductivity, temperature, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), chloride, ammonia, nitrite, nitrate, total phosphorus, total metals, total cyanide, and total mercury.

3.3.1 Adaptive Management Program for Regulated Discharge

3.3.1.1 *Action Plan*

In the case of an exceedance of a License limit or MDMER discharge limit, an action plan will be implemented. The adaptive management program requires that if one or more of the key monitored parameters exceed the respective limits, a staged sequence of responses will follow. Table 3.12 summarizes the staged adaptive action plan for the CM program for regulated discharge. Figure 3.1 is a logic diagram showing the decision path for evaluating analytical results for regulated discharges.

In addition to the mitigative measures listed above, a number of other possible alternatives are available to reduce or treat contaminants. These mitigation measures include:

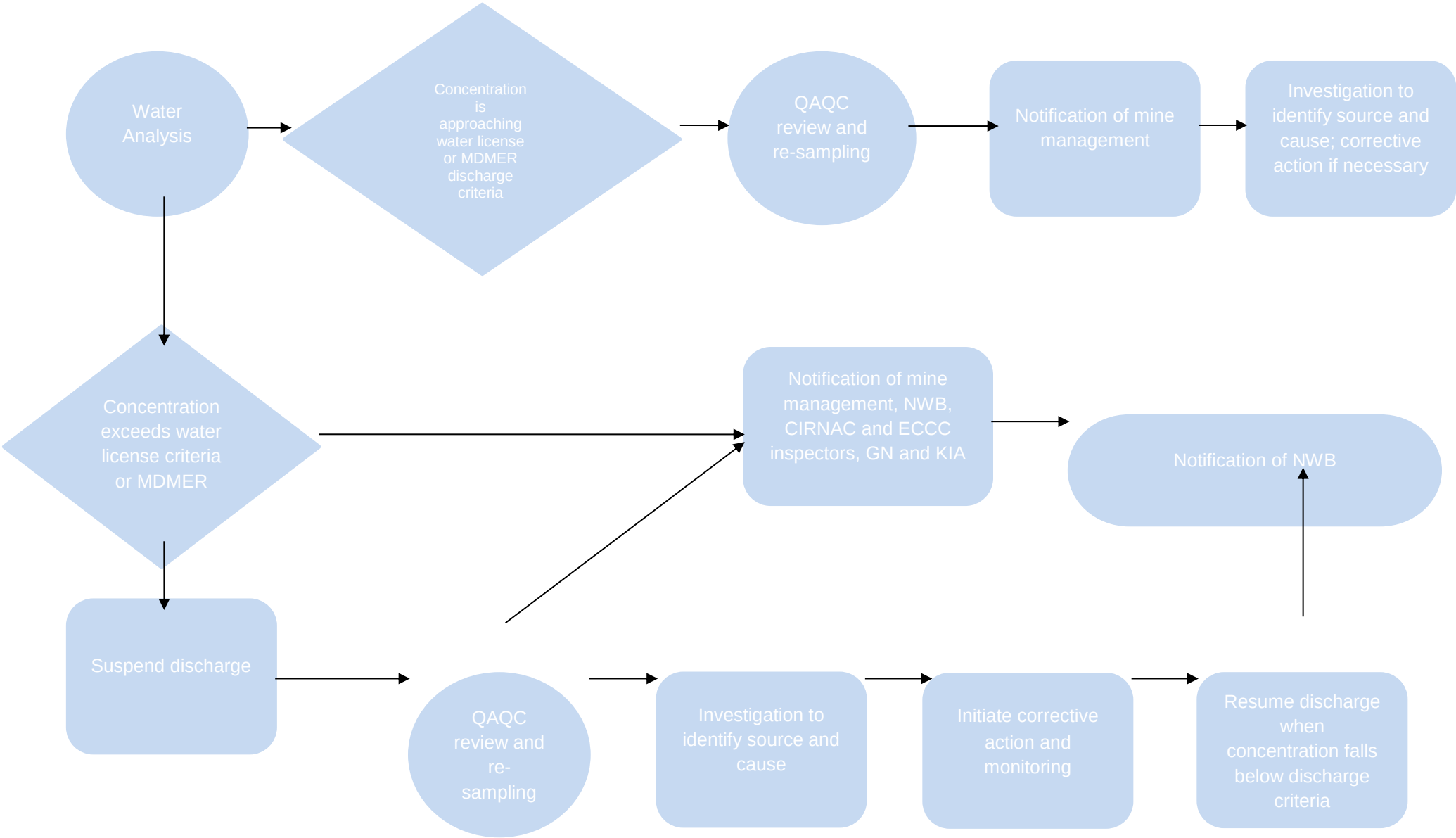
- Best management practices for sediment and erosion control would be employed to reduce TSS concentrations (i.e., flow control, sedimentation basin construction silt fencing, etc; see Sediment and Erosion Management Plan);
- Addition of a coagulant for the reduction of TSS in pond water;
- Use of geotextile or reamouring of banks to filter and reduce TSS in pond/ditch water;
- Deployment of absorbent booms and/or barriers within ponds to isolate surface petroleum hydrocarbon films for removal and/or treatment;
- Adjustments to on-site sewage treatment for the reduction of BOD and E. coli concentrations; Addition of lime to increase a low pH value or reduce metal concentrations;
- Removal of the offending source rock or the prevention of surface waters coming into contact with the offending source rock in the case of ARD; and/or
- Implementation of the *Freshet Action Plan* to proactively identify any issues around areas of concern; conduct additional monitoring, and control and contain seepage or movement of TSS on site.

Table 3.6: Action Plan for Regulated Discharge

Example	Action Plan

Exceeds water license discharge criteria or MDMER	1. Suspension of discharge activities; 2. QA/QC review and analysis, and re-sample water at the particular location if necessary; 3. Notification of mine management (General Mine Manager or designate and Environment Superintendent, or designate) and the regulators: Nunavut Water Board, CIRNAC and ECCC inspectors, GN and the Kivalliq Inuit Association; 4. Investigation to identify possible source(s) and cause(s) of the exceedance; 5. Initiation of corrective actions or water treatment, and follow up monitoring; and 6. Resumption of discharge when concentrations are below the discharge criteria

Figure 3.2: Logic Diagram for Regulated Discharge



3.3.2 Adaptive Management Program for Non-Regulated Discharge

Aside from targeted monitoring studies (i.e. “Effects Assessment Studies”) such as those following construction, the AEMP is the main program aimed at measuring and assessing potential impacts of contaminants in the receiving aquatic environment that are not regulated under MDMER or NWB. This program combines with the Environmental Effects Monitoring (EEM) required under MDMER.

The program is designed to take an integrated, ecosystem-based approach that links mitigation and monitoring of physical/chemical effects to key ecological receptors in the receiving environment. It addresses key issues identified in the Meliadine EA (i.e., mining-related activities with the potential to affect water quality, fish habitat and fish populations). Monitoring results are intended to inform the “adaptive management” process”, supporting the early identification of potential problems and development of mitigation options to address them by comparing results to established threshold and trigger levels.

3.3.2.1 *AEMP Action Level and Significance Threshold*

The AEMP Response Framework links monitoring results to management actions, with the purpose of maintaining the assessment endpoints within acceptable ranges. It is a systematic approach for evaluating AEMP results and responding appropriately, such that potential unexpected effects are identified and mitigation is undertaken to reduce or reverse them, thereby preventing the occurrence of a significant adverse effect. This is accomplished by continually evaluating monitoring data and implementing follow-up actions (e.g., confirmation, further study, mitigation) at pre-defined levels of change in measurement endpoints (i.e., Action Levels). For purposes of this Response Framework, the following terms are used: effect, normal range, benchmark, Action Level, and Significance Threshold.

Action Level – Action Levels (Low, Moderate, and High) are pre-defined levels of environmental change that exceeds normal ranges or benchmarks, or results of statistical tests, or a combination of these. For example, exceedance of the normal range and approach of a benchmark by a water quality parameter in the near-field exposure area may be defined as the Low Action Level. A change that falls within the normal range of variability for the study area would not trigger an Action Level.

Significance Threshold – The Significance Threshold, for the purposes of an AEMP Response Framework, is a magnitude of change that would result in significant adverse effects. It is a clear statement of environmental change that must never be reached. The AEMP Response Framework is designed to prevent reaching the significance threshold for all assessment endpoints.

3.3.2.2 *Action Levels*

The proposed Action Levels are designed to provide an early warning indication of potential adverse effects to plankton and benthos (i.e., food for fish), to fish health, and to the assurance of normal ecological function (including water quality and sediment quality). The proposed Low Action Levels (Table 8-2 and 8-3) are designed such that changes of sufficient magnitude to trigger a Low Action Level response are reported, documented, investigated, and ultimately addressed (i.e., mitigation measures or operation changes are implemented) before Significance Thresholds would ever be reached; if a Low Action Level is reached, Medium and High Action Levels (with response actions) are developed to provide further adaptive management guidance to the Mine to avoid reaching the Significance Thresholds. The type of management response taken after reaching an Action Level will depend on the type and magnitude of effect observed.

Further details on the integrated aquatic effects action plan are provided in Golder, 2018.

SECTION 4. FLOW VOLUMES

Flow volumes within the mine footprint will be measured daily during periods of discharge. Flow volume measurements will be conducted using volumetric flow meters attached to applicable pumps. For permanent pumping arrangements such as fresh water pumping systems flows will be measured using permanent in line flow meters. For periodic batch discharges, such as secondary containment sumps, portable flow meters or calculated pump time and capacity methods will be used.

Detailed pump records are maintained including date, pond/sump number, receiving location of pumped water, pump ID, duration of pumping, and total volume pumped. The average flow rates, total discharge per event and total cumulative discharge will be reported annually.

The monitoring locations for water flow volumes, in accordance with Part I, Item 9, and Table 2 of the Water License, include:

- The volume of fresh Water obtained from Meliadine Lake at Monitoring Program Station MEL-11;
- The volume of fresh Water transferred to the Meliadine Lake during lakes' dewatering activities;
- The volume of fresh Water obtained along the road and Meliadine River for dust suppression activities;
- The volume of Effluent discharged from Final Discharge Point at Monitoring Program Station MEL-14;
- The volume of reclaim Water obtained from CP1;
- The volume of Effluent discharged onto tundra at Monitoring Program Station MEL-25 or transferred to CP1 from the Itivia Site Fuel Storage and Containment Facility; and
- The volume of Effluent and Fresh Water transferred to the pits during pits' flooding.

SECTION 5. REPORTING

Reporting of water quality results is to be conducted on two levels a) monthly and annually with the results of the monitoring program and per MDMER requirements and b) in response to exceedances.

5.1 ANNUAL REPORTING

An annual report is to be submitted to the NWB, KIA, Department of Fisheries and Oceans, Crown-Indigenous Relations and Northern Affairs Canada, Nunavut Impact Review Board, Government of Nunavut, and other interested parties by March 31st of the following year. The report is to summarize the following:

- Monitoring results for each sampling station during the year and for the life of mine (construction to end of closure); activities during the year at each station; and any exceedances at stations, the action plan applied to the exceedance, and the results of the action plan;
- Annual seep water chemistry results; including location of the samples, sources of the water collected, and results of chemical analyses of the samples;
- Receiving water monitoring results;

- Spills and any accidental releases; event monitoring activities conducted following containment, remediation, and reclamation; and the results of EM program, any exceedance in EM results, and the action plan following the exceedance;
- Measured flow volumes;
- Effluent flow rates, volumes and calculated chemical loadings following the requirements of MDMER; and
- Results of QA/QC analytical data.

5.2 EXCEEDANCE REPORTING

Any measured concentration at a CM station exceeding a regulated discharge criterion stipulated in the License or MDMER will be reported to the NWB and Environment Canada and Climate Change upon receipt of the analysis. In addition, results of the action plan will be reported and, where necessary, mitigation options identified within 90 days after receipt of the analyses.

Exceedances in the concentration of a parameter in receiving water will be reported as specified in the AEMP and EEM – MDMER accordingly.

SECTION 6. REFERENCES

Golder Associates Ltd. 2016. Aquatic Effects Monitoring Program (AEMP) Design Plan. Version 1. June 2016. 6513-REP-03.