AGNICO EAGLE

MEADOWBANK GOLD PROJECT

Water Quality and Flow Monitoring Plan

In Accordance with Water License 2AM-MEA1525

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 5
March 2016

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-MEA0815 and updated as per the renewed Water License 2AM-MEA1525. The Plan is one component of the *Aquatic Effects Management Program* (AEMP) and is closely associated with the *Water Management Report and Plan*.

Section 2 in 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 both regulated discharges and non-regulated discharges in Section 3 as well. Requirements of the flow monitoring program are described in Section 4, and an overview of the reporting requirements in Section 5.

IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEA1525, Part B, Item 11, the proposed implementation schedule for this Plan is outlined below.

This Plan will be implemented immediately (March 2016) 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	08/08/10			Comprehensive plan for Meadowbank project.
2	09/05/02	3; 5	11-41; 44-45	Revised to incorporate regulatory comments; revised AWPAR monitoring section; deleted QAQC section
3	07/16/2014	all		Revised in support of the Type A License Renewal
4	01/30/2015	2.3.2 and 2.3.3	3-4	Updated information related to early operation phase and late operation phase: - Change in tailings deposition and reclaim water intake (North Cell vs South Cell) - Change in Portage Attenuation Pond Discharge
		Figure 2-1 to 2-4	5-8	Added sampling stations
		Table 2-1	10	Updated completion data for most of the components and start data for the flooding activities and dewatering of Phaser Lake.
		Table 3-1	14	Added sampling stations: - ST-24 Vault Rock Storage Facility Monitoring (Late and Closure phase) - ST-26 Vault Pit Lake monitoring (Closure phase)
		Table 3-2	16	Modified Monitoring Parameters: - Group 1 – remove ammonia, add nitrite, add CN Free and CN Wad if CN Total is detect. - Group 2 – add CN Wad if CN Total is detect for monitoring station in receiving environment. - Group 4 – delete ammonia, CN total, Oil and Grease - MMER – change wording regarding Rainbow Trout and daphnia toxicity. - Full Suite – add note regarding the non-acutely lethal toxicity for discharge only.
		3.2.1 and 3.2.2	27 -28	Add a section on RSF Seepage and Assay Road Seepage
5	03/01/2016	All	All	2016 Comprehensive update

Prepared by:

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Approved by:

Kevin Buck – Environment Superintendent - Nunavut

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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-MEA0815 and updated as per the renewed Water License 2AM-MEA1525. The Plan is one component of the *Aquatic Effects Management Program* (AEMP) and is closely associated with the *Water Management Report and Plan*. The implementation and periodic updates to this Plan are the responsibility of the Meadowbank Environment Department under the guidance of the Meadowbank Environment Superintendent.

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

The purpose of this Water Quality and Flow Monitoring Plan is to establish the program to be implemented and followed by AEM's Meadowbank environmental management team to monitor the performance of the waste and water management systems at the Meadowbank 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 Nunavut Water Board Type A water license 2AM-MEA1525; 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 *Meadowbank Gold Project Aquatic Effects Management Program* and the *Core Receiving Environmental Monitoring Plan (November 2015*).

SECTION 2. OVERVIEW

2.1 OVERVIEW OF SITE WATER MANAGEMENT PLAN

Details of overall water management are discussed in the *Meadowbank Water Management Report and Plan* which is updated annually. All contact water from the mine facilities including the Portage and Vault rock storage facilities, open pits, and other disturbed areas will be directed by pumping or berms and other surface diversions to either of the following:

- Sumps from which the water will be pumped to either the Vault Attenuation Pond or the South Cell Reclaim Pond if required; or

- The open pits during re-flooding and after mining activity has ceased.

As specified in the *Water Management Report and Plan*:

> *"All contact water will be intercepted, contained, analysed, treated, if required, and discharged to the receiving environment only when water quality meets the discharge criteria."*

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 water license; these sites vary from contact water collection ditches and attenuation ponds to sampling in areas prior to discharge to the receiving environment. The requirements of the water 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, to confirm and to 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:

- Meadowbank Gold Project Spill Contingency Plan (September 2015);
- Meadowbank Gold Project Emergency Response Plan (February 2016);
- Meadowbank Gold Project 2015 Freshet Action Plan (March 2016); and
- Meadowbank Gold Project 2015 Water Management Report and Plan (March 2016).

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 Meadowbank Gold Mine consists of several gold-bearing deposits within reasonably close proximity to each other. The three main deposits are: Vault (including Phaser and BB Phaser), Portage (South, Center and North Portage deposits), and Goose. Mining activity progressed from the south, in the area of the Goose (Years 3 to 6) and Portage pits (Years 1 to 9) early in the mine life, then northward to the Vault (Years 5 to 9), Phaser and BB Phaser Pits (Years 7 to 9). The staged mine development has resulted in Goose Pit being completely mined out and undergoing re-flooding during the operational phase of the remaining pits, while the mill and tailings storage facility will operate throughout the mine life. It is for this reason that the monitoring sites change with time as the mining operations progress. Figures 2-1, 2-2, 2-3 and 2-4 show the sequence of staged development of the mine, from the early operations to the late operations, closure and post-closure phases, respectively. The actual configuration of the pits is changing as mining progresses. As a result, the monitoring program (Section 3.0) accommodates changes in the pit designs which may include one or more ponds during the re-filling phase before the single Portage Pit Lake develops from the Portage Pits. Figure 2-5 depicts the Meadowbank Gold Project facilities in the Hamlet of Baker Lake.

The staged development of the mine facilities has been divided into five phases for monitoring purposes. The five phases include:

- Pre-development and Construction phase;
- Early operations phase;
- Late operations phase;
- Closure phase; and
- Post-closure phase.

As the mine is now entering the late operations phase, monitoring associated with pre-development/construction and early operations are completed. A summary of site activities and water quality monitoring issues during these phases is provided below.

2.3.1 Pre-development and Construction Phase

The principal impacts resulting from construction activities has been the increase in turbidity and TSS in Second Portage and Third Portage lakes from the release of particulates during dike construction, surface runoff, the disturbance of lake sediments and the dewatering of future mining zones. Management and monitoring of these impacts are discussed in the AEMP.

2.3.2 Early Operations Phase

During the early operations phase, mining occurred in the Goose and Portage pits. Most of the waste rock generated from the pits was deposited at the Portage rock storage facility (PRSF), however some waste rock was used for construction of mine infrastructure (roads, dikes), and some has been used to backfill Portage Pit for fish habitat structures. Mill tailings are directed into the tailings storage facilities (North Cell (now closed) and South Cell TSF's) for final disposal. Tailings deposition was moved from the North Cell in November 2014 to the TSF South Cell. During the early operations phase, mine water from the individual pit sumps including dike seepage was pumped to the Portage Attenuation Pond (became South Cell TSF in 2014). Water from the Portage Attenuation Pond was discharged to Third Portage Lake during open water season on an annual basis thru a diffusor (Years 1 to 5). This water was treated for TSS removal prior to being discharged. Process water for the Process Plant is recycled from the Reclaim Pond in the TSF's and is not discharged to the receiving environment. Since November 2014, the Portage Attenuation

Pond became the South Cell Reclaim Pond, as tailings are now deposited in the South Cell TSF. During the closure period, any remaining reclaim water will be discharged to either the Portage or Goose Island pit lakes. Water quality modelling for this has been ongoing yearly since 2012 (see *2015 Meadowbank Water Quality Forecasting Update* in Appendix C of the *Water Management Report and Plan)*.

2.3.3 Late Operations Phase

Mining in the Goose pit was completed in April 2015 (Year 6) and will be completed in Portage pit in 2018 (Year 9). The pits will be flooded by natural inflows and water transferred on a controlled basis from Third Portage Lake. Current mine plans estimate that the Portage and Goose pits entire flooding sequence will be completed by 2029.

Mining will take place in the Vault, Phaser and BB Phaser pits during the late operations phase with waste rock delivered to the Vault RSF and ore to the mill in the Portage area. Vault area tailings will be deposited in the Portage TSF. Runoff and infiltration drainage from the Vault RSF, dike seepage and Vault area contact water will be collected in the Vault Attenuation Pond prior to discharge to Wally Lake.

2.3.4 Closure Phase

During the closure phase, mining will have ceased in the Vault, Phaser and BB Phaser Pits. The Vault pit will be allowed to flood using natural inflows and water transferred on a controlled basis from Wally Lake. Current estimates are that it will take about seven (7) years for the Vault Pit to be completely flooded by which time the Vault Attenuation Pond and the Pit Lake will have merged. Phaser Pit Lake is planned to be flooded exclusively from watershed run off inflows until the target elevation of Wally is reached in summer 2027. There are currently no plans to cap the Vault RSF as it is not expected to generate acid rock drainage.

By the end of the late operations phase or early in the closure phase the Goose pit will be completely flooded, the Portage pit will be partially flooded, and the remaining portions of the North Cell TSF capped.

2.3.5 Post Closure Phase

Activities during the post-closure phase are primarily monitoring of selected mine facilities including flooded pit lakes and the reclaimed TSF area. The Goose and Vault Dikes will be breached once water quality within the pit lakes meets discharge criteria – CCME guideline for the Protection of Aquatic Life and background levels for parameters not listed in the CCME guideline.

Figure 2-1: Early operations Phase

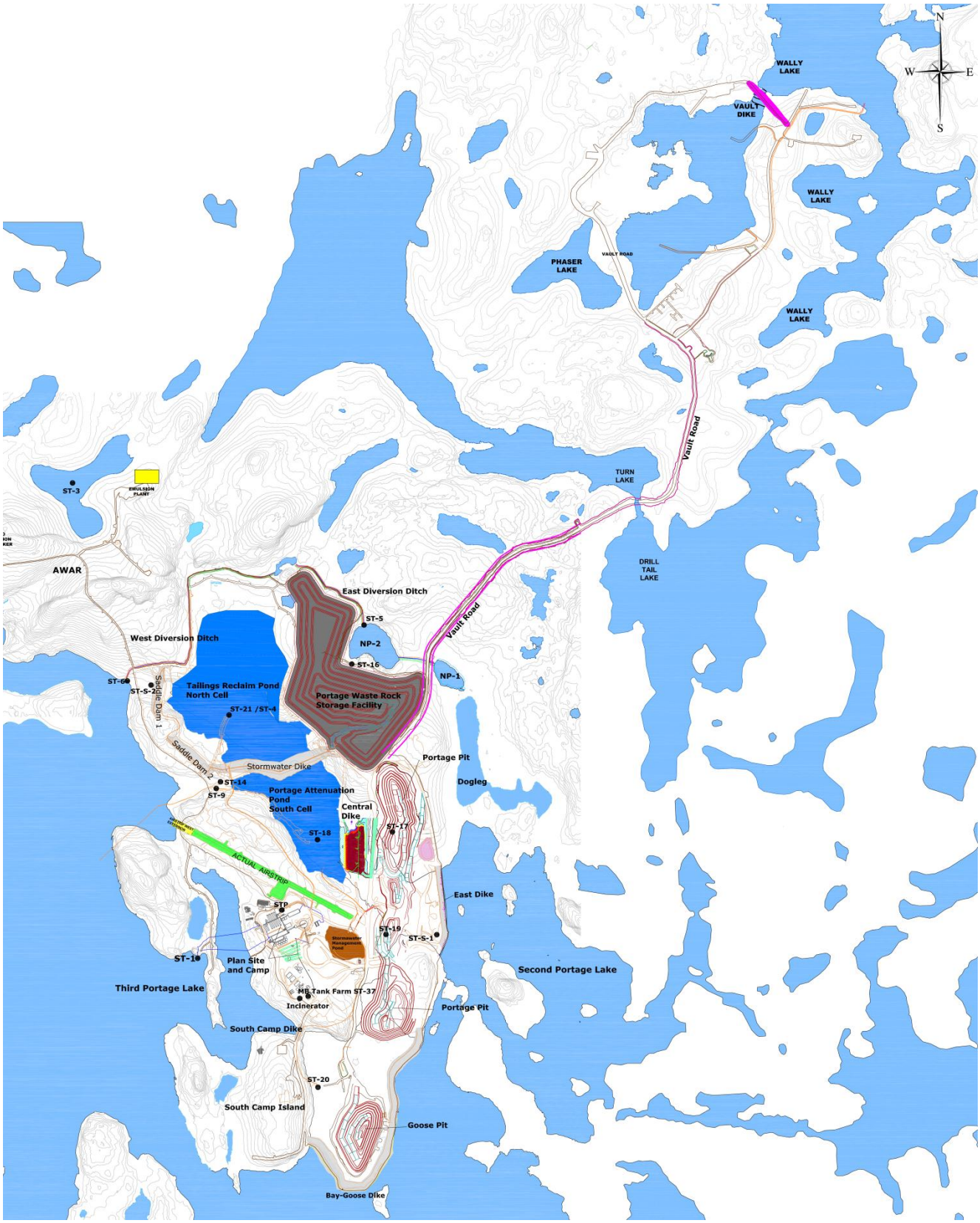

Figure 2-2: Late Operations Phase

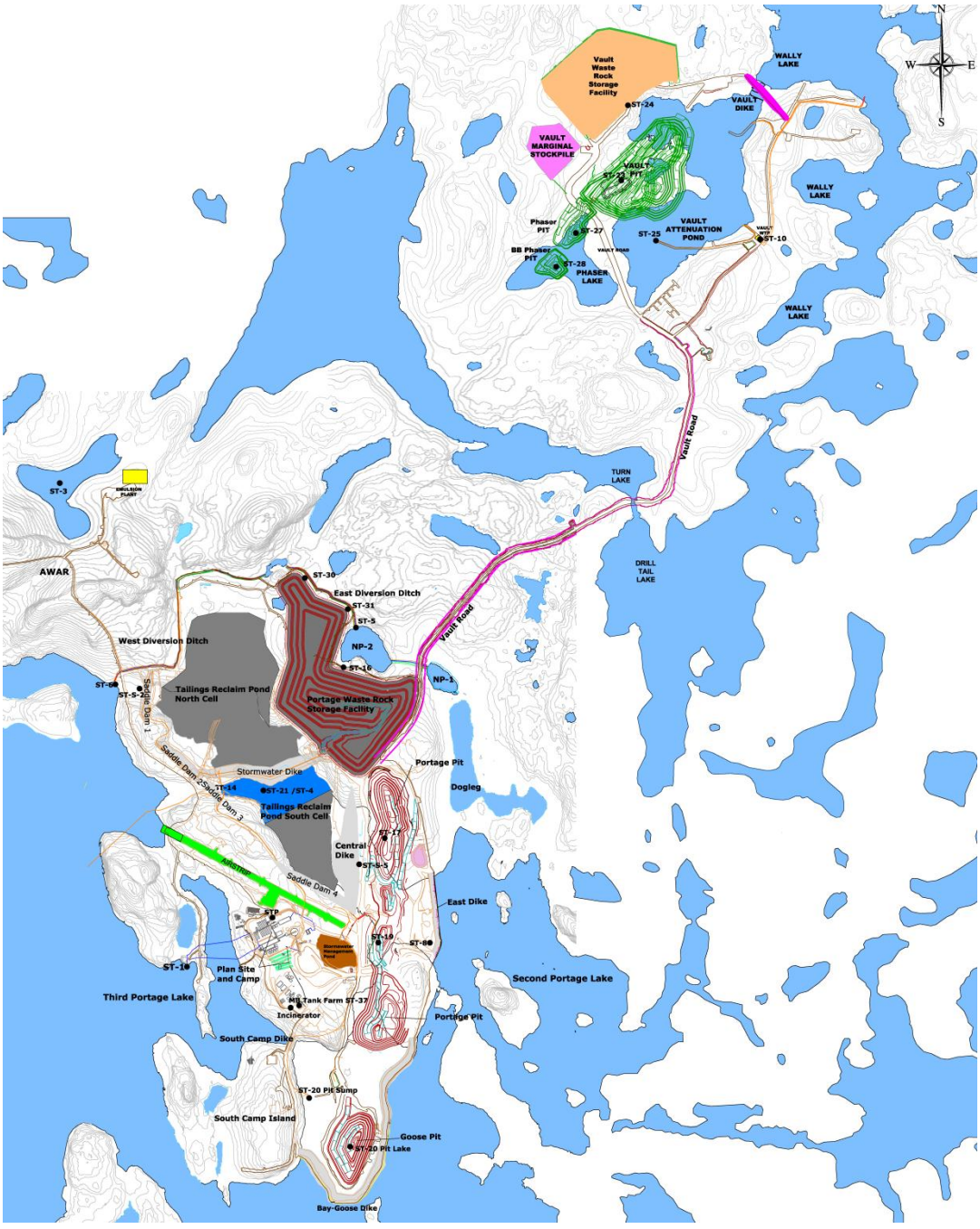

Figure 2-3: Closure Phase

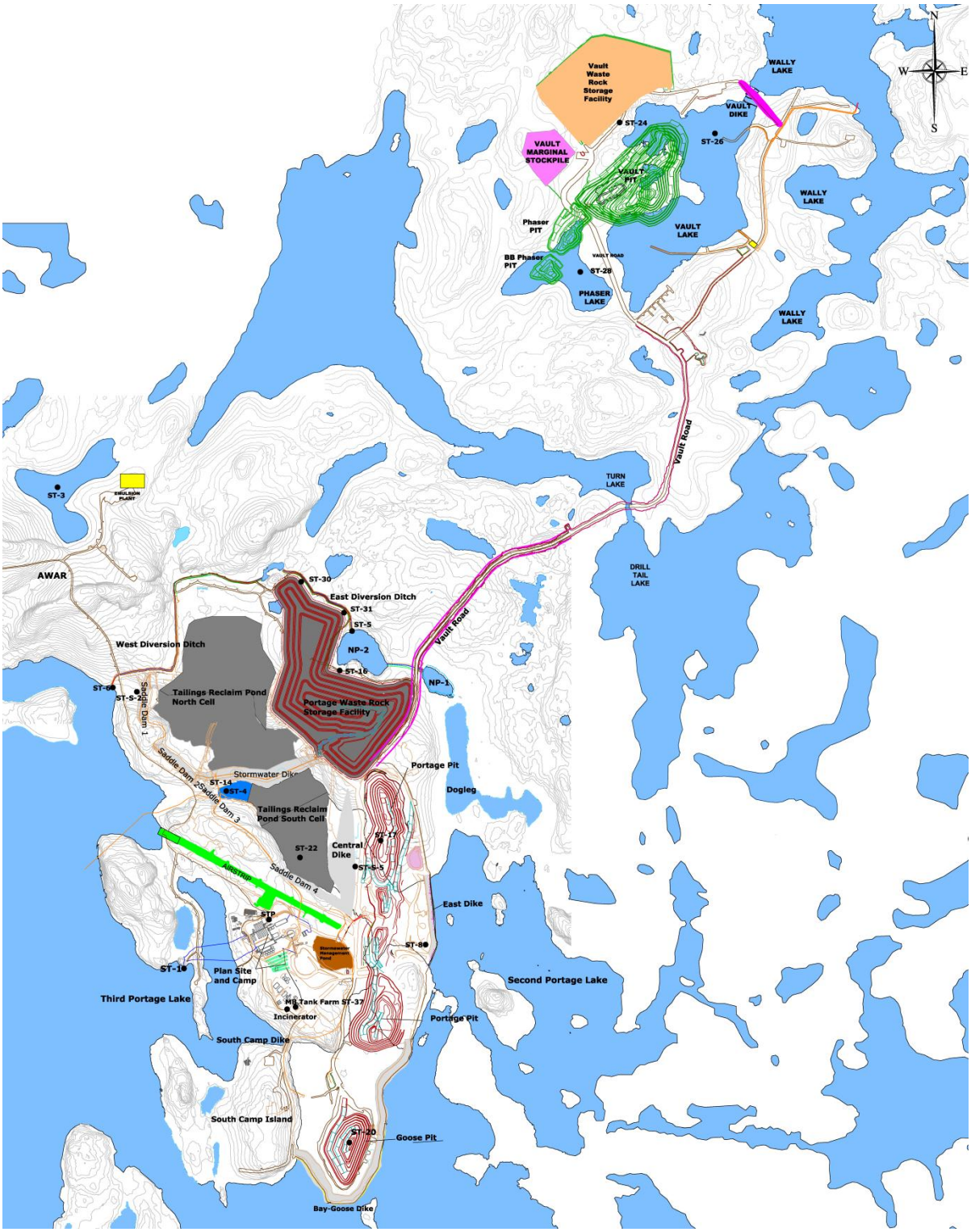

Figure 2-4: Post-Closure Phase

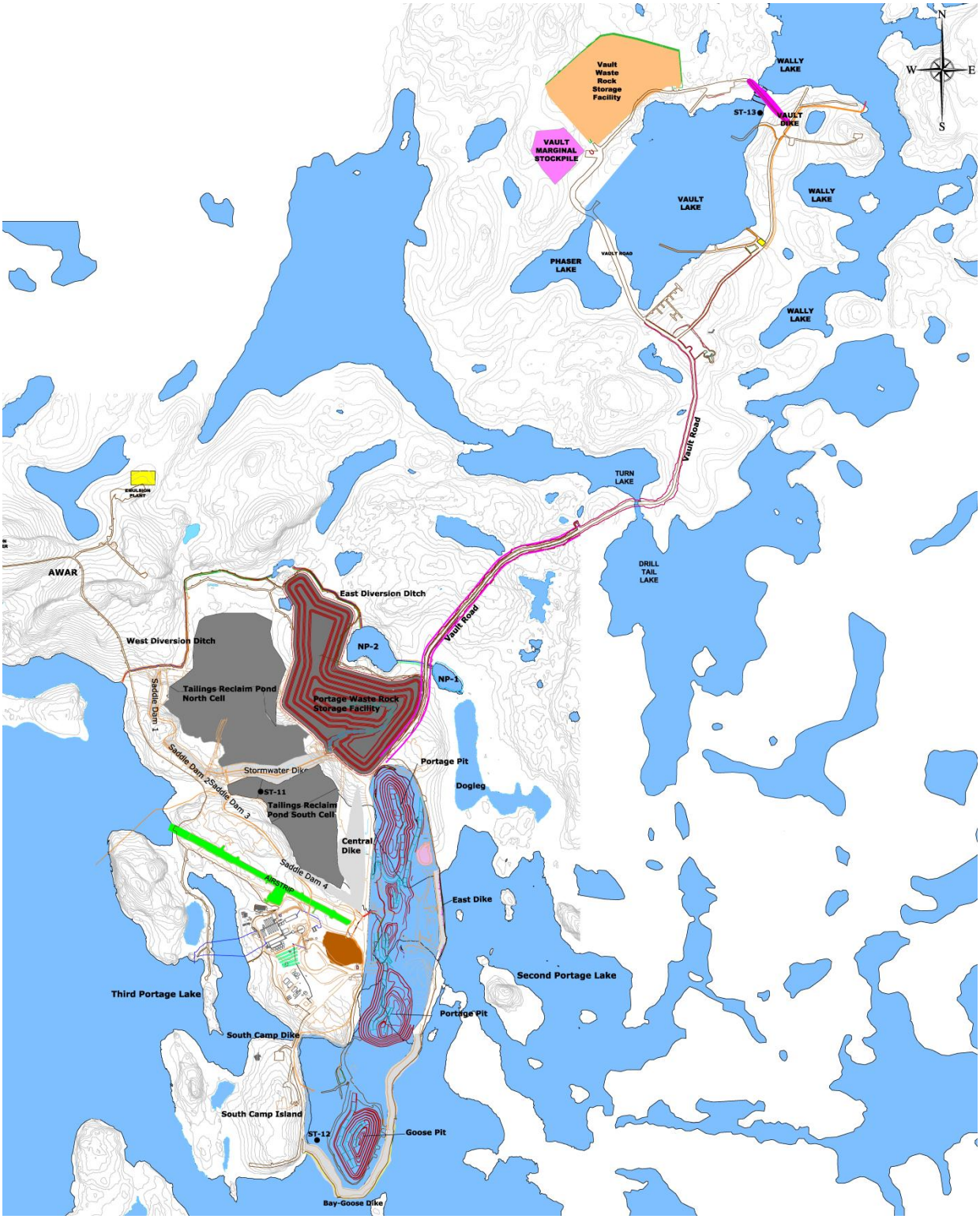

Figure 2-5: Baker Lake Site Facilities

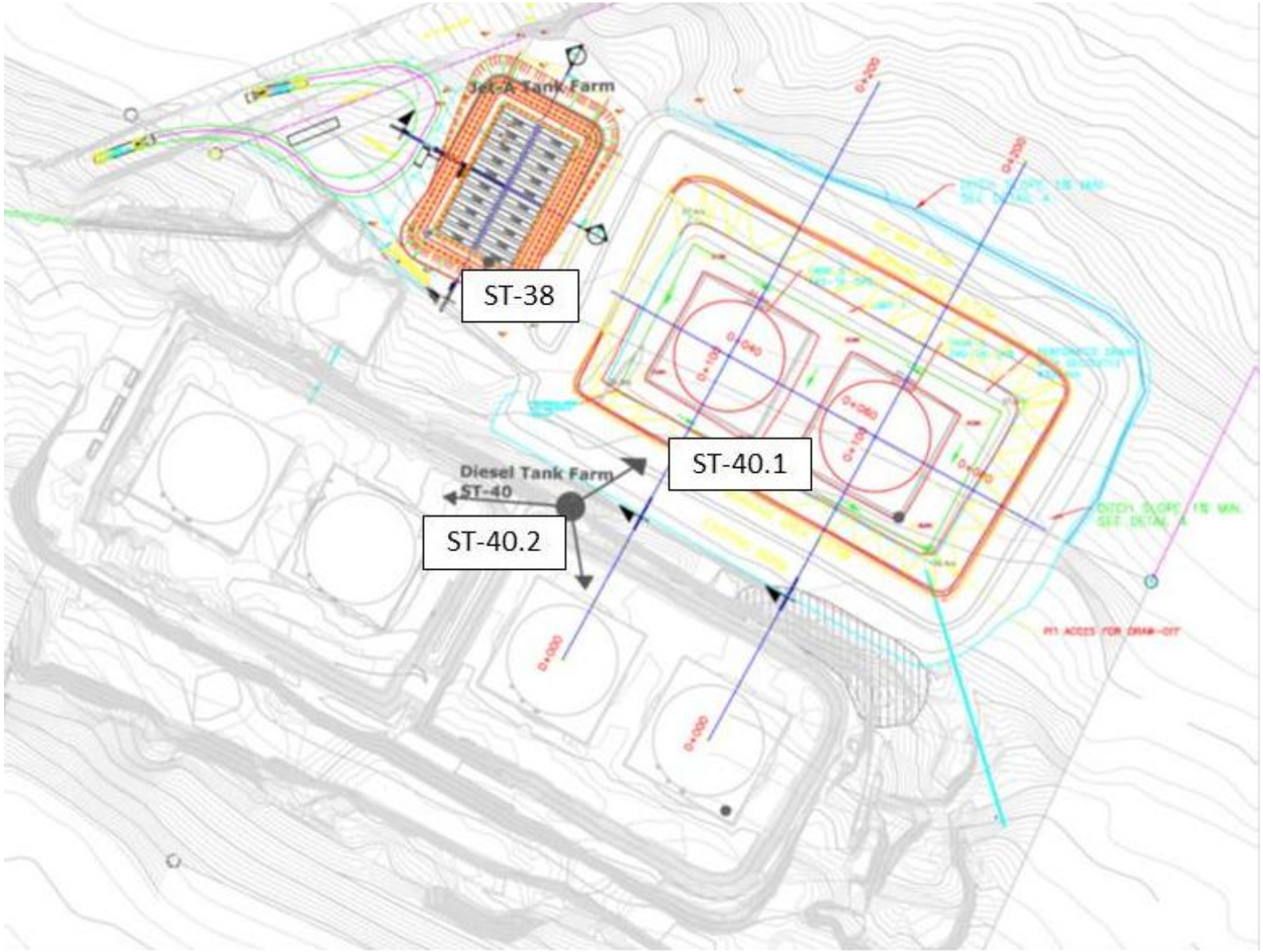

Table 2-1: Staged Development of the Meadowbank Mine Facilities

ACTIVITY	START DATE	END DATE
Pits Mining		
Portage Pit North	January 2010	September 2018
Portage Pit Central	January 2010	April 2013
Portage Pit South	January 2010	Q3 2018
Goose Island Pit	April 2012	April 2015
Vault Pit	January 2014	Q3 2018
Phaser Pit	2017	Q3 2018
BB Phaser Pit	2017	Q3 2018
Tailings Storage Facility Operations		
North Cell[1]	January 2010	November 2014
South Cell	November 2014	Q3 2018
Rock Storage Facility (RSF) Operations		
Portage RSF	January 2009	Q3 2018
Vault RSF	January 2014	Q3 2018
Attenuation / Reclaim Pond Water Management		
Portage Attenuation Pond[1]	January 2009	November 2014
Attenuation Pond Vault Lake	January 2014	Q3 2018
Mill Operations	January 2010	Q3 2018
Other Key Activities		
Dewatering of Vault Lake	June 2013	July 2014
Dewatering of Phaser Lake	Summer 2016	Q3 2016
Flooding of Portage Pit	2018	2029
Flooding of Goose Island Pit	Summer 2016	2029
Flooding of Vault Pit	2019	2024
Flooding of Phaser Pit	2019	2027
Mine Closure completed[2]	N/A	2029

Footnotes:

1 After November 2014, the Reclaim Pond is relocated to the South Cell TSF. After this date, there is no Attenuation Pond and no discharge to Third Portage lake.
2 Goose and Vault dikes breached provided water quality meets discharge criteria – CCME guideline for the Protection of Aquatic Life and background levels for parameters not listed in the CCME guideline.

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 mine contact water and diverted water at specified locations prior to release into the receiving water environment 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 discharged from diversion ditches during operations, and closure phases of the mine and eventually non-contact water from dike seepage;
- mine contact water directed to and discharged from the Vault Attenuation Pond during the operations phase of the mine;
- monitoring points located within the pit lakes before and after the dikes have been breached during the post closure phase of the mine life; and
- runoff from the Tailings Storage Facility after closure.

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, AEM proposes 6 groups of parameters, as identified in Meadowbank's Type A Water License Schedule I Table 1. These include:

- Group 1 – mine site monitoring parameters; includes the former Groups 2 and 3 (from the original WL 2AM-MEA0815) and all parameters identified in SNC (2014) water quality predictions for contaminants that may require treatment including total cyanide, copper and ammonia;
- Group 2 – receiving environment parameters consistent with the CREMP and applied to all AEMP stations (including ground water monitoring); includes dissolved metals to be protective of the aquatic environment;
- Group 3 – sampling prior to discharge; includes MMER parameters plus sulphate, turbidity and Aluminum;
- Group 4- sampling prior to discharge at secondary containment fuel storage areas in Baker Lake and Meadowbank;
- MMER – unchanged; and
- Full Suite – Group 2, plus total petroleum hydrocarbons and turbidity.

Figures 2-1, 2-2, 2-3, 2-4 and 2-5 show 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 with the INAC water inspector, as required in Part I, Item 5 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 Montreal or Multi-Lab Direct in Val d'Or).

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				
ST-DC-1 to TBD	Monitoring stations during Dike Construction as defined in Final Water Quality Monitoring and Management Plan for Dike Construction and Dewatering referred to in Part D Item 5	Construction	As defined in Final Water Quality Monitoring and Management Plan for Dike Construction and Dewatering referred to in Part D Item 5	As defined in Final Water Quality Monitoring and Management Plan for Dike Construction and Dewatering referred to in Part D Item 5
ST-DD-1 to TBD	Monitoring stations during Dike Dewatering as defined in Water Quality Monitoring and Management Plan for Dike Construction and Dewatering referred to in Part D Item 5	Construction	As defined in Final Water Quality Monitoring and Management Plan for Dike Construction and Dewatering referred to in Part D Item 5	As defined in Final Water Quality Monitoring and Management Plan for Dike Construction and Dewatering referred to in Part D Item 5
ST-1	Water Intake for camp, mill and reflooding	Late operation, closure	Volume (m3)	Monthly
ST-1 W	Water Intake for reflooding	Late operation, closure	Volume (m3)	Monthly
ST-3	Water Intake for Emulsion Plant	Late operation, closure	Volume (m3)	Monthly
ST-4	Water reclaimed from Tailings Storage Facility	Late operation, closure	Volume (m3)	Monthly
ST-5	Portage Area (east) diversion ditch	Late operation, closure	Group 3	Monthly during open water
ST-6	Portage Area (west) diversion ditch	Late operation, closure	Group 3	Monthly during open water
ST-8	East Dike Seepage Discharge	Late operation, closure	Group 3	Monthly
ST-9	Portage Attenuation Pond prior to discharge through Third Portage Lake Outfall Diffuser	Early operation	Full Suite	Prior to discharge and Weekly during discharge
			Volume (m3)	Daily during periods of discharge
			Acute Lethality	Once prior to discharge and Monthly thereafter
ST-10	Vault Attenuation Pond prior to discharge through Wally Lake Outfall Diffuser	Late operation	Full Suite	Prior to discharge and Weekly during discharge
			Volume (m3)	Daily during periods of discharge
			Acute Lethality	Once prior to discharge and Monthly thereafter
ST-11	Tailings Storage Facility	Post closure	Group 1	Annually during open water

ST-12	Portage/ Goose Pit Lake	Post closure	Full Suite	Annually during open water season
ST-13	Vault Pit Lake	Post closure	Full Suite	Annually during open water
ST-14 (TEH-11)	Discharge to the TSF from Landfarm sump at mine site	Late operation, closure	Group 4	Prior to discharge
			Volume (m3)	Daily during periods of discharge
ST-16	Portage Rock Storage Facility	Late operation	Group 1	Monthly during open water
		Closure	Group 1	Bi-annually during open water
ST-17**	North Portage Pit Sump	Operation	Group 1	Monthly during open water
			Volume (m3)	Daily during periods of discharge
	Portage Pit Lake	Late operation	Group 2	Monthly during open water
		Closure	Group 2	Bi-annually during open water
ST-19**	South Portage Pit Sump	Early operations	Group 1	Monthly during open water
			Volume (m3)	Daily during periods of discharge
	Third Portage Pit Lake	Late operations	Group 2	Monthly during open water
ST-20	Goose Island Pit Sump	Early operations	Group 1	Monthly during open water
			Volume (m3)	Daily during periods of discharge
	Goose Island Pit Lake	Late operations	Group 2	Monthly during open water
		Closure	Group 2	Bi-annually during open water
ST-21	Tailings Reclaim Pond	Late operation	Group 1	Monthly during open water
ST-22	Tailings Storage Facility	Closure (drainage runoff)	Group 2	Bi-annually during open water
ST-23	Vault Pit Sump	Late operations	Group 2	Monthly during open water
			Volume (m3)	Daily during periods of discharge
ST-24	Vault Rock Storage Facility	Late operation	Group 1	Monthly during open water
		Closure	Group 1	Bi-annually during open water
ST-25	Vault Attenuation Pond	Late operations	Group 1	Monthly during open water
ST-26	Vault Pit Lake	Closure	Group 2	Bi-annually during open water
ST-27	Phaser Pit Sump	Late operations	Group 1	Monthly during open water
ST-28	BB Phaser Pit Sump	Late operations	Group 1	Monthly during open water
ST-29	Phaser Pit Lake	Closure	Group 2	Bi-annually during open water
ST-30	WEP1	Late operations, closure	Group 1	Monthly during open water
ST-31	WEP2	Late operations, closure	Group 1	Monthly during open water
ST-S-1 to TBD	Seeps (to be determined)	Late operations, closure	Group 1	Monthly or as found

ST-GW-1 to TBD	Groundwater wells (to be determined)	Early operations, late operations, closure	Group 2	Annually
ST-AEMP-1 to TBD	Receiving AEMP and CREMP	Late operations, closure	Group 2	A minimum of 5 events per year at CREMP stations. Ideally 3 during open water and 2 during winter (through ice). TPL assay, NP2, NP1 and Dogleg ponds to be monitored monthly during open water (July, Aug, and Sept.) Monthly field limnology data collected throughout year at smaller number of locations (through ice)
ST-MMER- to TBD	Vault, East Dike and Portage effluent outfall	Late operations	MMER	Weekly during open water
ST-37	Secondary containment sump at the Bulk Fuel Storage Facility at Meadowbank	Late Operation, closure	Group 4	Prior to discharge or transfer of effluent
ST-38	Secondary containment sump at the Bulk Fuel Storage Facility in Baker Lake – Jet-A containment	Late Operation, closure	Group 4	Prior to discharge or transfer of effluent
ST-40 (MEA-4)	Secondary containment sump at the Bulk Fuel Diesel Storage Facility in Baker Lake	Late operation, closure	Group 4	Prior to discharge or transfer of Effluent

** ST-17 and ST-19 in Closure become one sampling point

Table 3-2: Monitoring Parameters

Group	Parameters
1	pH, turbidity, hardness, alkalinity, ammonia nitrogen, total metals (aluminum, arsenic, barium, cadmium, chloride, chromium, copper, fluoride, iron, lead, manganese, mercury, molybdenum, nickel, nitrite, nitrate, selenium, silver, thallium, zinc), sulphate, total dissolved solids (TDS), TSS, total cyanide. If CN total is detect in an analysis result; further analysis of CN Free and CN WAD will be trigger.
2	**Total and Dissolved metals:** aluminum, antimony, arsenic, boron, barium, beryllium, cadmium, copper, chromium, iron, lithium, manganese, mercury, molybdenum, nickel, lead, selenium, tin, strontium, titanium, thallium, uranium, vanadium and zinc **Nutrients:** Ammonia-nitrogen, total kjeldahl nitrogen, nitrate nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorous, total organic carbon, total dissolved organic carbon and reactive silica; **Conventional Parameters:** bicarbonate alkalinity, chloride, carbonate alkalinity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, TDS, and TSS, turbidity; Total cyanide and free cyanide. If CN total is detect above 0.05 mg/L in an analysis result for monitoring station in receiving environment; further analysis of CN WAD will be trigger.
3	MMER parameters (total cyanide, arsenic, copper, lead, nickel, zinc, radium 226, total suspended solids, pH), sulphate, turbidity and total aluminum.
4	Total Arsenic, Total Copper, Total Lead, Total Nickel, TSS, Benzene, Toluene, Ethylbenzene, Xylene, TPH, pH
MMER	Total cyanide, arsenic, copper, lead, nickel, zinc, radium 226, total suspended solids, pH, effluent volumes and flow rate of discharge, acute toxicity (Rainbow Trout and Daphnia magna) and environmental effects monitoring (EEM).
Full Suite	Group 2, Total Petroleum Hydrocarbons, Turbidity. Non Acutely-lethal (Rainbow Trout and Daphnia magna) for discharge only.

Table 3-3: Summary of Sampling Requirements for each Analyte

Parameter	Minimum Volume (ml)	Bottle Type	Preservation	Holding Time
pH	250	250 mL, glass or plastic, filled to the top	4˚C	Analyze immediately
Conductivity	125	250 mL, glass or plastic	4˚C	28 days
Hardness	250	250 mL plastic, filled to the top	4˚C, HNO_3	6 months
Oil and Grease (total)	1000	1 L amber glass	4˚C, H_2SO_4	28 days
Turbidity	125	250 mL, glass or plastic	4˚C	48 hours
Total Dissolved Solids (TDS)	125	250 mL glass	4˚C	7 days
Total Suspended Solids (TSS)	125	250 mL glass	4˚C	7 days
Total Alkalinity	250	250 mL, glass or plastic, filled to the top	4˚C	14 days
Bicarbonate Alkalinity	250	250 mL, glass or plastic, filled to the top	4˚C	14 days
Carbonate Alkalinity	250	250 mL, glass or plastic, filled to the top	4˚C	14 days
Total Cyanide	125	250 mL, glass or plastic	4˚C, NaOH	14 days
Free Cyanide	125	250 mL, glass or plastic	4˚C, NaOH	14 days
Benzene, Toluene, Ethylbenzene & Xylene (BTEX)	40 (per vial)	3 X 40 mL, glass, filled to the top	4˚C	7 days
Total Petroleum Hydrocarbons(TPH)	1000	1L, glass	4˚C, H_2SO_4	28 days
Total Metals (ICP-MS) (Aluminum, Antimony, Arsenic, Boron, Barium, Beryllium, Cadmium, Cobalt, Copper, Chromium, Iron, Lithium, Manganese, Mercury, Molybdenum, Nickel, Lead, Selenium, Tin, Strontium, Titanium, Thallium, Uranium, Vanadium, Zinc, Potassium, Magnesium, Sodium)	125	250 mL plastic	4˚C, HNO_3	6 months

Dissolved Metals (Aluminum, Antimony, Arsenic, Boron, Barium, Beryllium, Cadmium, Cobalt, Copper, Chromium, Iron, Lithium, Manganese, Mercury, Molybdenum, Nickel, Lead, Selenium, Tin, Strontium, Titanium, Thallium, Uranium, Vanadium, Zinc)	125	250 mL plastic	4˚C, Filtered on-site, HNO_3	6 months
Ammonia-nitrogen	250	250 mL, glass or plastic, filled to the top	4˚C, H_2SO_4	28 days
Total kjeldahl nitrogen	250	250 mL, glass or plastic, filled to the top	4˚C, H_2SO_4	28 days
Nitrate nitrogen	125	250 mL, glass or plastic	4˚C	48 hours
Nitrite nitrogen	125	250 mL, glass or plastic	4˚C	48 hours
Ortho-phosphate	125	250 mL, glass or plastic	4˚C	14 days
Total phosphorous	125	250 mL, glass or plastic	4˚C, H_2SO_4	28 days
Total organic carbon	125	250 mL glass	4˚C, H_2SO_4	28 days
Dissolved organic carbon	125	250 mL glass	4˚C, H_2SO_4	28 days
Chloride	125	250 mL, glass or plastic	4˚C	28 days
Fluoride	125	250 mL plastic	4˚C	28 days
Sulphate	125	250 mL, glass or plastic	4˚C	28 days
Radium 226	500	1L plastic	4˚C, HNO_3	1 month
Reactive Silica	250	500 mL, plastic	4˚C	28 days

3.1.2 Compliance Monitoring Stations and Discharge Criteria

Further details of the specific CM stations and discharge criteria stipulated under the Nunavut Water Board Type A Water License are provided below.

3.1.2.1 *Construction and Dewatering Activities*

In order to mine the ore in the Portage, Goose and Vault pits, a series of dikes were built to isolate the pits from the surrounding water bodies. The pits, and the corresponding tailings impoundment area, were dewatered to allow access to these areas. The document "*Water Quality Monitoring and Management Plan for Dike Construction and Dewatering at the Meadowbank Mine (April 2010)*" was followed during these projects to specifically address the monitoring requirements for these activities.

CM stations ST-DC or equivalent and ST-DD or equivalent monitored the dike construction and dewatering activities. As stipulated in Part D, Item 7 of the water license, TSS levels at these stations have been compared to the maximum monthly mean and short term maximum values presented in Table 3-4.

Table 3-4: TSS Criteria at CM Stations ST-DC and ST-DD

Parameter	Maximum Monthly Mean (mg/L)	Short Term Maximum(mg/L)
TSS in areas where there is spawning habitat and at times when eggs or larvae are expected to be present (applied at monitoring stations located closest to the high value shoal areas starting Sept 1,2008)	6	25
TSS in all other areas and at times when eggs/larvae are not present	15	50
TSS in impounded areas (e.g. northwest arm of second portage lake) at all times in all areas.	15	50

As the dewatering process took place, mitigation measures were put in place to ensure that effluent from CM stations ST-DD or equivalent didn't exceed the parameter concentrations presented in Table 3-5, as stipulated in Part D, Item 8 of the water license.

Table 3-5: Effluent Criteria at CM Station ST-DD

Parameter	Maximum Monthly Mean	Short Term Maximum
Total Suspended Solids	15.0 mg/L	22.5 mg/L
Turbidity	15 NTU	30 NTU
pH	6.0 to 9.0	6.0 to 9.0
Total Aluminum	1.5 mg/L	3.0 mg/L

All surface runoff during the construction of any facility at the Meadowbank Gold Project, where water flow may directly or indirectly enter a water body, shall not exceed the TSS water quality limits presented in Table 3-6, as stipulated in Part D, Item 12 of the water license.

Table 3-6: TSS Criteria for All Surface Runoff during the Construction of Any Facility

Parameter	Maximum Average Concentration (mg/L)	Maximum Concentration of Any Grab Sample (mg/L)
Total Suspended Solids	50.0	100.0

3.1.2.2 *Water Collection System*

A water collection system comprised of ditches, sumps, attenuation pond and open pits was developed to control surface water at the Meadowbank project. Water that may potentially come into contact with waste rock, tailings or contaminated material is segregated from non-contact water and collected in the applicable Attenuation pond or TSF (currently only the Vault attenuation Pond, water from Portage area discharged to South Cell TSF) and treated, if necessary, prior to discharge into the receiving environment. As discussed above, this water might be used as process water as is the case with the South Cell Reclaim Pond.

The design of the ditches is based on the assumption that drainage can be achieved by gravity flow; the design for the sumps and ponds assumes that all inflows can be collected by gravity. As a result, this infrastructure is considered as low maintenance. However, regular monitoring during freshet (the snowmelt, thawing) and during heavy or prolonged rainfall to identify any issues with regards to:

- The configuration or structure of channels, due to localized thawing, local ground instabilities, subsidence and transport of fine particles;
- The free flow of water, due to an accumulation of ice, sediments and other debris; and
- Potential damage to retention structures and monitoring of seepage.

Maintenance operations consist of cleaning accumulated sediments and debris from the ditches and culverts, and repairing damaged areas as soon as possible. Removed sediments are stockpiled for channel maintenance purposes or disposed of in the South Cell TSF.

During pit flooding, samples will be taken in representative locations of the pit that is being re-flooded. Currently the Goose pit is passively re-flooding (since April 2015). It is likely that the sampling sites will change based on mine sequencing and as the water level in the pits rise in response to flooding. It is anticipated that during the early flooding phase of the Portage Pit (2018), water may accumulate in more than one area of the pit (Section 2.3). The current monitoring program assumes separate samples will be collected from ponds in the North Portage and the South Portage pits during flooding and prior to the two water bodies merging.

The following is a list of the various areas of the water collection system at the Meadowbank mine where samples for the compliance monitoring program are being or will be collected:

- Portage and Goose Island pits areas: diversion ditches (ST-5, ST-6), sumps (ST-17, ST-19, ST-20), seepage discharge (ST-8) and pit lake (ST-12); and
- Vault and Phaser pits areas: sumps (ST-23, ST-27, ST-28), ponds (ST-10, ST-25) and pit lake (ST-13, ST-26, ST-29).

Effluent discharged from the Vault Attenuation Pond at CM station ST-10 shall be directed to Wally Lake through the Wally Lake Outfall Diffuser and shall not exceed the effluent quality limits presented in Table 3-7, as stipulated in Part F, Item 4 of the water license.

Table 3-7: Effluent Criteria at CM Station ST-10

Parameter	Maximum Average Concentration	Maximum Allowable Grab Sample Concentration
pH	6.0 to 9.0	6.0 to 9.0
TSS (mg/L)	15	30
TDS (mg/L)	1400	1400
Turbidity (NTU)	15	15
Total (T)-Al (mg/L)	1.5	3.0
Dissolved (D)-Al (mg/L)	1.0	2.0
T-As (mg/L)	0.1	0.2
T-Cd (mg/L)	0.002	0.004
T-Cu (mg/L)	0.1	0.2
T-Hg (mg/L)	0.004	0.008
NH_3-N (mg/L)	20	40
T-Ni (mg/L)	0.2	0.4
T-NO_3-N (mg/L)	50	100
T-Pb (mg/L)	0.10	0.20
T-P (mg/L)	1.5	3.0
T-Zn (mg/L)	0.2	0.4
T-Cl- (mg/L)	500	1000

Effluent discharged from CM stations ST-9 (no longer applicable) and ST-10 shall be demonstrated to be non-acutely lethal, as stipulated in Schedule 1 of the water license. The following are the toxicity tests that are performed:

- Reference Method for Determining Acute lethality of Effluents to Rainbow Trout EPS 1/RM/13 Second Edition December 2000 (with May 2007 amendments); and
- Biological Test Method; Acute Lethality Test Using Daphnia spp. EPS 1/RM/11 July 1990 (with May 1996 amendments).

All water collected within the non-contact water diversion system during operations at CM stations ST-5 and ST-6, as well as East Dike seepage (ST-8) shall not exceed the effluent quality limits presented in Table 3-8, as stipulated in Part F, Item 6 in the water license.

Table 3-8: TSS Criteria at CM Stations ST-5, ST-6 and ST-8

Parameter	Maximum Average Concentration (mg/L)	Maximum Allowable Grab Sample Concentration (mg/L)
TSS	15	30

3.1.2.3 *Tailings Storage Facility and Reclaim Pond; Portage and Vault Waste Rock Storage Facilities*

Progressive reclamation is planned for the TSF during the late operations phase (commenced with capping in north and east sections of the North Cell TSF in 2014, 2015 and 2016) of the mine using non-acid generating ultramafic waste rock. The current cap design includes a sloped surface to promote runoff and catchment devices to capture the runoff from the TSF. Sampling of the TSF cap runoff will be conducted in either ditches or sumps adjacent to the TSF during the closure and post closure phases. Prior to any release to the environment the water will need to meet discharge criteria. The water will be contained and pumped to the South Cell TSF until such time.

Samples are collected from the open water of the reclaim pond.

At the end of mine life, water in the reclaim pond will be drained to complete the reclamation of the South Cell TSF. Reclaim water will be transferred to the Goose Island or Portage Pit Lakes, which, at that time, will still be isolated from adjacent open waters by the dewatering dikes. Reclaim water quality will be monitored during operation and may be treated prior to release to the pit lakes. AEM conducts annual Water Quality Modelling (SNC – 2012 – 2016) to determine parameters of concern and treatment possibilities (See *2015 Meadowbank Water Quality Forecasting Update* in Appendix C of the *Water Management Report and Plan*). The Goose Island Dike will be breached when water quality has met the appropriate discharge criteria. The discharge criteria, including CCME Guidelines for the Protection of Aquatic Life, background lake concentrations for parameters not listed in CCME and/or other risk-based assessment criteria will be determined through aquatic effects studies, water quality results and modelling and/or an approval process initiated through the NWB and KIA upon submission of the final closure plan.

Waste rock from the open pits not used for site development purposes will be trucked to two mine rock storage facilities (RSF); the Portage and Vault Waste Rock Storage Facilities. Additional waste rock has been stored in the Portage pit which will form part of the fish habitat compensation. These areas will be re-flooded at closure. Monitoring in these areas is included in the CM water collection system discussed in Section 3.1.2.2.

The following is a list of the various areas where samples associated with the TSF and RSF for the compliance monitoring program are to be collected:

- Tailings reclaim pond (ST-21); and TSF drainage run-off at closure (ST-22);
- Portage (ST-16) and Vault (ST-24) waste rock storage facility seepage areas if water is observed at these areas; and
- Waste Extension Pool sumps (ST-30, ST-31) if water is observed at these areas.

3.1.2.4 *Support Facilities*

<u>Mine Site</u>

A rotary biological contactor (RBC) sewage treatment plant is in operation at the Meadowbank mine site. Discharge from the plant is directed to Storm water management pond and then get pumped in the TSF twice a year. Water quality monitoring for this facility is included in the CM water collection system.

The landfill is constructed at the Meadowbank mine within the catchment of the Portage RSF. Only inert

waste material consisting of primarily construction and non-organic domestic waste is disposed of at this facility. Hazardous wastes are stored on site in a waste containment area, and transported annually during the sea lift to an appropriate hazardous waste disposal facility in southern Canada. Further details for these waste facilities can be found in the *Landfill Design and Management Plan (March 2013)* and the *Hazardous Material Management Plan (October 2013).* To date no landfill leachate has been observed to sample. Regular inspections take place at the landfill; if leachate is observed sample monitoring will commence.

A landfarm has been built on site to treat petroleum hydrocarbon contaminated soils beginning in 2012. Monitoring is conducted for the water accumulating within the containment berm from July to October. In the event of water accumulation, the ponded water will be analyzed (sample as ST-14) as described in Part F, Item 23 of the water License prior to discharge to the adjacent Tailing Storage Facility. Further details for the landfarm facility can be found in the *Landfarm Design and Management Plan (February 2013).*

A 5.6 million liter bulk fuel storage tank is located at the Meadowbank mine site. Runoff water from within the containment area is collected within the tank's secondary containment enclosure that is equipped with HDPE liner. Water collected is discharged to land, when necessary, in a controlled manner. Effluent from the fuel containment facilities being discharged to land (sampled as ST-37) shall not exceed the effluent quality limits presented in Table 3-10, as stipulated in Part F, Item 8 of the water license.

Baker Lake 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 HDPE liner; these are designed to contain petroleum products released due to spill events. Water collected in the secondary containment enclosures CM station ST-38 and ST-40 is discharged to land in a controlled manner according to the Nunavut Water Board Type A water license # 2AM-MEA1525.

All effluent being discharged from the secondary containment enclosures at the Baker Lake marshalling facility shall not exceed the effluent quality limits presented in Table 3-9, as stipulated in Part F, Item 8 of the water license.

Table 3-9: Effluent Criteria at CM Station ST-37 to ST-40

Parameter	Maximum Average Concentration	Maximum Concentration of Any Single Grab Sample
pH	6.0 – 9.5	6.0 – 9.5
Total Arsenic (mg/L)	**0.5	1.00
Total Copper (mg/L)	**0.30	0.60
Total Nickel (mg/L)	**0.50	1.00
Total Zinc (mg/L)	*0.50	1.00
TSS (mg/L)	*15.0	30.0
Ammonia (mg/L)	6.0	6.0
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

* Environmental Guideline for Industrial Waste Discharges, 2004

** Metal Mines Effluent Regulations (MMER)

3.1.2.5 *All Weather Access Road (AWAR) and Quarries*

The AWAR extends 108 km between the Hamlet of Baker Lake and the Meadowbank Project site. Twenty two (22) quarries along the AWAR were used to construct the road; some of these quarries will remain open for the duration of the mine life to service the road. There is also one (1) quarry at the Meadowbank mine on the East side of the airstrip to provide rock fill for the mine site roads and building pads. Monitoring procedures along the AWAR and quarries include visual inspections of infrastructure and water quality sampling.

Visual Inspections

The watercourse crossing visual inspection and maintenance program is designed to identify issues relating to watercourse crossings structural integrity and hydraulic function. It has two main objectives:

1) Visual inspection of its infrastructure to identify defects, cracks or any other risks to structural integrity. Particular attention will be paid to the inlet and outlet structures of culverts, and to bridge abutments and their foundations, as required. This inspection is conducted annually by a geotechnical engineer.

2) Visual inspection to identify sediment or other debris accumulation impeding the free flow of water through the crossings. Maintenance operations will consist of hand removal of accumulated debris and repairing damages as soon as possible. Visual inspection of upstream and downstream channels to identify bed erosion or scour around the watercourse crossing structure. Particular attention is to be paid to bridge abutments and abutment foundations as they are vulnerable to scour and erosion. This inspection is conducted weekly during freshet and post freshet season, by a member of the Meadowbank environmental team (See *Freshet Action Plan* in Appendix D of the *Water Management Report and Plan)*.

Results of these inspections are reported in the AEM annual report.

Water Quality Monitoring

Rock quarry geochemistry studies were conducted prior to construction. The results indicated that there are not expected to be any adverse water quality issues associated with the quarried rock1[1]. In June 2008 an additional water quality monitoring and geochemical characterization study was completed at each of the quarries. Results were presented in the AEM 2008 Annual Report; the study concluded that there was no evidence of any significant acid generation or metal leaching issues associated with the 22 road quarries.

Throughout the open water seasons of 2007 and 2008, water seeps and water ponded in contact with the road were collected along the full length of the AWAR in addition to samples upstream and downstream of the 9 major stream crossings. Results were similar between years and indicate naturally elevated metals concentrations in a number of the streams. Overall, the results suggest low risks to aquatic life. Consequently, the water quality monitoring program has been amended to reflect these conclusions.

If issues are observed or a spill occurred near a water course during the winter a full suite of water quality sampling is conducted along the AWAR at areas of concern. This includes:

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[1] *Geochemical Assessment of Potential Quarry Rock Along the Proposed Mine Access Road, Meadowbank Project Nunavut*, Golder, 2007;

Assessment of the Acid rock Drainage and Metal Leaching Potential of Rock from Potential Quarry Site Pit 6, Meadowbank Project Nunavut, Golder 2007;

Assessment of the Acid Rock Drainage and Metal Leaching Potential of Rock Samples Collected from an Esker along the Tehek Lake Access Road, Meadowbank Project, Nunavut, Golder 2007.

- Any significant water seeps and/or water ponded in contact with the road. Other criteria for selecting a sampling location include: areas of evident rock staining (rust color particularly) and areas where an accidental spill has previously occurred.

- Upstream and downstream from the major road stream crossings in order to confirm there are no water quality issues resulting from these crossings or the adjacent road rock fill.

Should the results indicate a significant change in water quality from previous years or elevated risks to aquatic life, further water quality monitoring will be conducted at those specific locations to determine the cause and notification will be provided to regulatory authorities. An action plan will be developed and implemented should the results indicate issues. The results for all access road water quality monitoring are reported in the AEM Annual Report.

The habitat compensation monitoring program for R02 compensation structures is described in the *Meadowbank Habitat Compensation Monitoring Plan (AEM, 2014)*. This monitoring program includes detailed habitat compensation sampling for the AWAR and mine site.

3.1.2.6 *Seeps*

Site specific empirical data for seeps from the RSFs, pit walls, and dikes are used to characterize the hydrochemistry and volumes of seasonal water flows and to calibrate and validate the water quality model (See *2015 Water Quality Forecasting Update* in Appendix C of the *Water Management Report and Plan*).

Water samples are collected from discharge points where seeps are found, according to the requirements. Current sampling locations include:

- Seeps at or near the toe of the Portage RSF and Vault RSF (ST-16 and ST-24; see Section 3.1.2.3); and

- Seeps in the faces or at the base of Saddle Dam 1, Central Dike, and East Dike (ST-S-2, ST-8; and ST-S-5).

All water collected prior to discharge from the East Dike Seepage (ST-8) is to be monitored in accordance with Part F Item 6 of the water license, as presented in Table 3-10.

Table 3-10: Monitoring Station ST-8

Parameter	Maximum Average Concentration (mg/L)	Maximum Allowable Grab Samples Concentration (mg/L)
TSS	15	30

In addition, seepage observations are to be characterized and monitored in accordance with Part I, Item 13 of the water license, as presented in Table 3-11.

Table 3-7: Seepage Observations and Characterization

Characterization of seepage including: precise location; discharge rates and volumes; respective hazard(s) and consequences and prescribed mitigative measure	Minimum Frequency of Observation
Lake water Seepage Through Dewatering Dikes	Monthly
Seepage (of any kind) Through Central Dike	Monthly
Seepage and runoff from the landfill	Quarterly
Subsurface Seepage and Surface Runoff from Waste Rock Piles.	Quarterly
Seepage at Pit Wall and Pit Wall Freeze/Thaw and Permafrost Aggradation	Quarterly

3.1.2.7 *Groundwater*

The *Groundwater Monitoring Plan (September 2015*) describes the groundwater monitoring plan at the Meadowbank Gold Project. Water quality in the groundwater wells is monitored in accordance with the sampling requirements for CM stations ST-GW-1 to TBD. Groundwater data is used to predict the quality of water accumulating in open pits, and to determine any effects of mining on groundwater quality, particularly with respect to tailings deposition. For further details regarding the 2015 Groundwater Monitoring Program see Appendix G3 of the 2015 Annual Report.

3.1.2.8 *Receiving Environment*

Receiving water quality monitoring is discussed in Section 1A of the A*quatic Effects Management Program (AEMP) (November 2015*). Within the AEMP are numerous monitoring programs: of greatest emphasis for the protection of the aquatic environment are the core receiving environment monitoring program (CREMP), Environmental Effects Monitoring studies and targeted monitoring programs.

The core monitoring program includes three areas of sampling stations that surround each of the mine developments (near field, mid field and far field) for early detection of mine-related impacts. The monitoring program is summarized in Table 6.1 of the AEMP and includes: water quality, sediment chemistry, benthos, periphyton, phytoplankton, and fish monitoring (as part of EEM and fish habitat compensation monitoring), the parameters to be measured, sampling locations, sampling frequency, sampling methods, and criteria for data evaluation. Targeted studies are limited in scope and intended to address “specific questions related to particular components of mine development during construction and operation.” In addition to, or superseding, the monitoring requisites in the AEMP, the water quality samples collected under this program are to be monitored in accordance with the requirements for CM stations ST-AEMP-1 to TBD and according to the CREMP design document (AEM, 2015). In 2013, AEM has also added NP-2, NP-1, Dogleg, and TPN basin to AEMP stations.

A water quality monitoring program is also defined in the AEMP for discharge events during operations of the Portage and Vault attenuation ponds. During the first 5 years of mine operation, water was discharged from the Portage Attenuation Pond to Third Portage Lake and during the later years of mine operations, water will be discharged annually from the Vault Attenuation Pond to Wally Lake. CM stations ST-MMER-1 to TBD stipulate the monitoring requirements for these effluent outfalls. Monitoring locations for the effluent outfall diffusers for Second Portage and Wally lakes are to be located at the edge of the 30-m radius mixing zone either within the AEMP core near-field sampling zones or as separate monitoring locations,

depending upon the final location of the diffusers.

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 (Meadowbank Gold Project Spill Contingency Plan; September 2015); or
- emergencies (Meadowbank Gold Project Emergency Response Plan; February 2016).

The EM program is designed to verify whether contamination of the surface soil, nearby receiving environment and active zone has occurred as a result of an accidental release of a hazardous material or contaminated water, through monitoring of surface runoff and nearby receiving environment following remediation of any release. It is anticipated that owing to the presence of permafrost beneath most of the mine footprint, there will be minimum impact to groundwater. A complete list of hazardous materials use during operations of the mine is provided in the *Meadowbank Gold Project Hazardous Materials Management Plan (October 2013).*

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 done in coordination with the Environmental Superintendent as described in the *Meadowbank Gold Project Spill Contingency Plan (September 2015).*

In the event of an accidental release, the water quality of the downstream receptor and possibly upstream of the receiving point, if any, is to be sampled (during the ice-free season) and analyzed. Should the spill have happened over snow cover, water and possibly soil sampling is to take place at the earliest feasible time after thaw to verify if there has been any impact to the receiving water or soil quality. 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 hazardous material released.

EM monitoring will occur following the clean-up of a release and the frequency of sampling will depend on the type of material spilled (wet or dry spill), the environment into which the chemical was released (surface water body or soil; frozen or thawed), the quantity of spill material and the status of remediation/clean up measures that were initiated. The EM program for a particular spill will cease upon obtaining satisfactory analytical results (within 20% of background level, to accommodate for analytical accuracy) from the potentially affected areas or as required by regulators.

3.2.1 Portage Rock Storage Facility Seepage

In July 2013, it was noted that seepage from the Waste Rock Storage Facility (RSF) had migrated through a rockfill road at a seepage sump located north-east side of the RSF. The seepage, which contained elevated copper, nickel, ammonia and cyanide, entered NP-2 Lake. It was determined through investigation that the likely source of the contaminants was reclaim water from the North Cell TSF. Due to changes in TSF water levels, this water migrated underneath the RSF through a former watercourse into the seepage sump area (known as ST-16 Sample Station). AEM took immediate measures to stop the seepage and implement corrective measures to prevent a recurrence. The Portage Rock Storage Facility Seepage is an event monitoring for which AEM has created an action plan as describe above in Section 3.2. Refer to Appendix D "*Freshet Action Plan*" of the 2015 Water Management Report and Plan and the 2015 Annual Report for the complete description of the actions taken including the event monitoring program.

3.2.2 Assay Road Seepage

On November 4th, 2013, it was observed that water was seeping thru the road in front of the Assay Lab.

AEM confirmed that the seepage was coming from the process plant due to the presence of CN, Cu and Fe (analysis on and off site). AEM took immediate measures to stop the seepage and implement corrective measures to prevent a recurrence. No contaminated water or material has reached Third Portage Lake. The Assay Road Seepage is an event monitoring for which AEM has created an action plan as describe above in Section 3.2. Refer to Appendix D "*Freshet Action Plan*" of the 2015 Water Management Report and Plan for the completed description of the actions taken including the event monitoring program.

3.3 ADAPTIVE MANAGEMENT PROGRAM

Results of the water quality monitoring are to be reviewed by the Meadowbank Environmental Department and chemical trends of constituents of interest are tracked for mine site monitoring and in the AEMP data (including the CREMP) to allow early detection of significant changes in water quality within the mine site prior to discharge, or if thresholds and triggers are exceeded in the receiving environment. Action plans are then to be implemented to ensure that environmental protection objectives are met.

An adaptive management program has been designed for the Meadowbank 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 water license and by the Metal Mining Effluent Regulations (MMER). The second section is for measured parameters for which no discharge limits have been identified in the water license (i.e. CREMP monitoring).

3.3.1 Adaptive Management Program for Regulated Discharge

3.3.1.1 *Action Plan*

In the case of an exceedance of an NWB license limit or MMER 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 discharge.

Should the TSS value (measured value or calculated from turbidity measurements) of non-contact water at any time during the construction, operation, or closure phases at the Portage mining area exceed regulatory guidelines, the water will be discharged to the TSF South Cell until the cause of the exceedance can be identified and the situation rectified.

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:

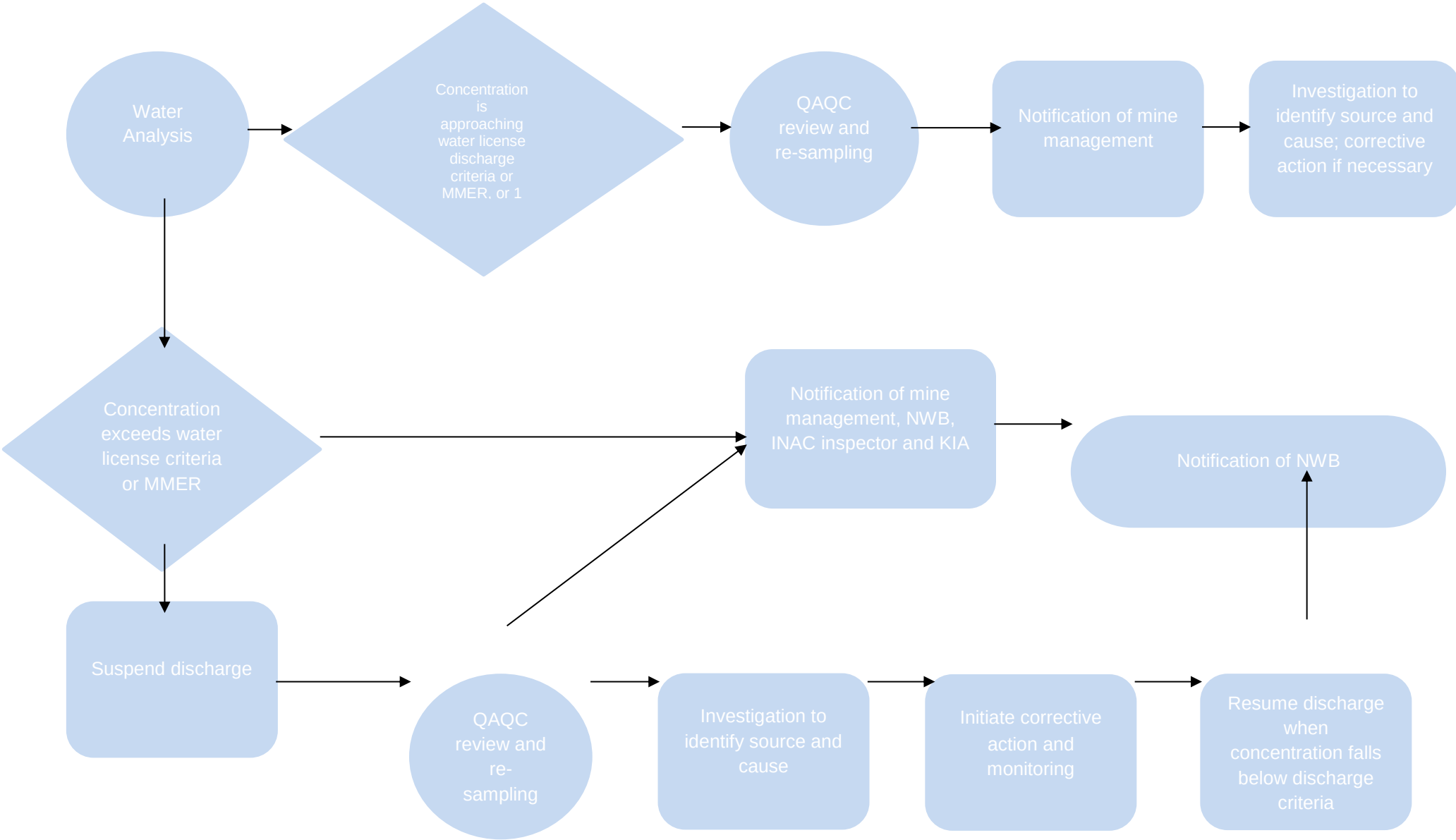
- Best management practices for sediment and erosion control would be employed to reduce TSS concentrations, ie flow control, sedimentation basin construction, etc;
- Addition of a coagulant for the reduction of TSS in pond water;
- Use of geotextile or reamouring of banks to filter and reduce TSS in 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;

- Injection of oxygen or aeration for the reduction of ammonia;
- Addition of lime to increase a low pH value or reduce metal concentrations; and/or
- 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.
- Implementation of the Freshet Action Plan to proactively identify any additional seeps around areas of concern; conduct additional monitoring, and control and contain seepage on site.

Table 3-8: Action Plan for Regulated Discharge

Example	Action Plan
Exceeds water license discharge criteria or MMER	- Suspension of discharge activities; - QA/QC review and analysis, and re-sample water at the particular location if necessary; - Notification of mine management (General Mine Manager and Environment Superintendent) and the Nunavut Water Board, the INAC Water Resources water license inspector and the Kivalliq Inuit Association; - Investigation to identify possible source(s) and cause(s) of the exceedance; - Initiation of corrective actions or water treatment, and follow up monitoring; and - Resumption of discharge when concentrations are below the discharge criteria

Figure 3-1: 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 commissioned following dike construction, the CREMP is the main program aimed at measuring and assessing potential impacts of contaminants in the receiving aquatic environment that are not regulated under MMER or NWB.

This program was designed to take an integrated, ecosystem-based approach that links mitigation and monitoring of physical/chemical effects on key ecological receptors in the receiving environment. It addresses key issues identified in the Meadowbank 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 *CREMP Threshold and Trigger Levels*

As described in the CREMP 2015 Design Document (Azimuth, 2015) trigger levels were developed to facilitate adaptive management of potential water quality issues in the receiving environment. These criteria were developed with the assumption that action will be considered before certain monitored parameters reach levels that cause or have the potential to cause adverse effects to aquatic biota. The criteria for action provide an early warning framework under which management responses may be considered, taking into account findings from other AEMP component programs. Two types of criteria were developed:

- Thresholds are legal requirements, regulatory guidelines (e.g., CCME), or other discrete benchmarks, below which unacceptable adverse effects are not expected and above which adverse effects may occur. If effects-based thresholds do not exist or are not warranted for a particular variable, then early warning triggers (based on statistical criteria) will be developed without thresholds.
- Triggers are early warning criteria that may lead to action. Exceedance of a trigger value does not necessarily imply that an adverse effect may be expected. For variables with a threshold, the trigger was set as the maximum of either the value halfway between the baseline median and the threshold, or the 95th centile of the baseline data. For variables without thresholds, triggers were set equal to the 95th centile of the baseline data except in cases where less than 5% of the data exceeded the current detection limit (DL), in which case the trigger was set to two times the DL.

Thresholds were established for 22 variables based on water quality guidelines (e.g. CCME). Variables include total metals, dissolved metals, nutrients and conventional parameters.

Water chemistry data is collected up to six months per year (April, May, July, August, September and November/December) for the annual period of paired sampling to support Before/After Control/Impact statistical analyses, recognizing that in any given year the actual number of samples collected may range from four to six depending on logistical constraints (e.g. snow and ice). Sampling is limited to open water months only for PDL (reference station) and Baker Lake stations. Two randomly located subsamples are collected at each station each month and all samples are 3 m from the surface. In addition, basic water quality data is collected at key near-field areas (i.e. TPN, TPE, SP and Wally) at least once mid-winter to reduce uncertainty regarding the potential occurrence of change over winter.

Annual average concentrations (6-month mean) are compared to trigger values to determine need for action (rather than results from individual sampling events).

Further information on the development of thresholds and triggers is provided in the CREMP 2015 Design Document (Azimuth, 2015). Thresholds and triggers were also established for sediment chemistry and critical effect sizes were established for biological variables under the CREMP program.

3.3.2.2 *Action Plan*

A management response plan (MRP) has been developed for the AEMP (Azimuth, 2015), of which the CREMP is one component. The general MRP for the Meadowbank Mine AEMP is shown in Figure 3.2. Following the integration of the results from each independent program, the response actions are based on the cumulative results of all programs. Therefore, while we expect management actions to be taken in cases where criteria for action are exceeded, the specific actions are not linked to outcomes of the CREMP alone because the CREMP is only one of the monitoring programs under the AEMP. In other words, it is not possible or appropriate to describe the specific management actions that will be taken when CREMP triggers or thresholds are exceeded.

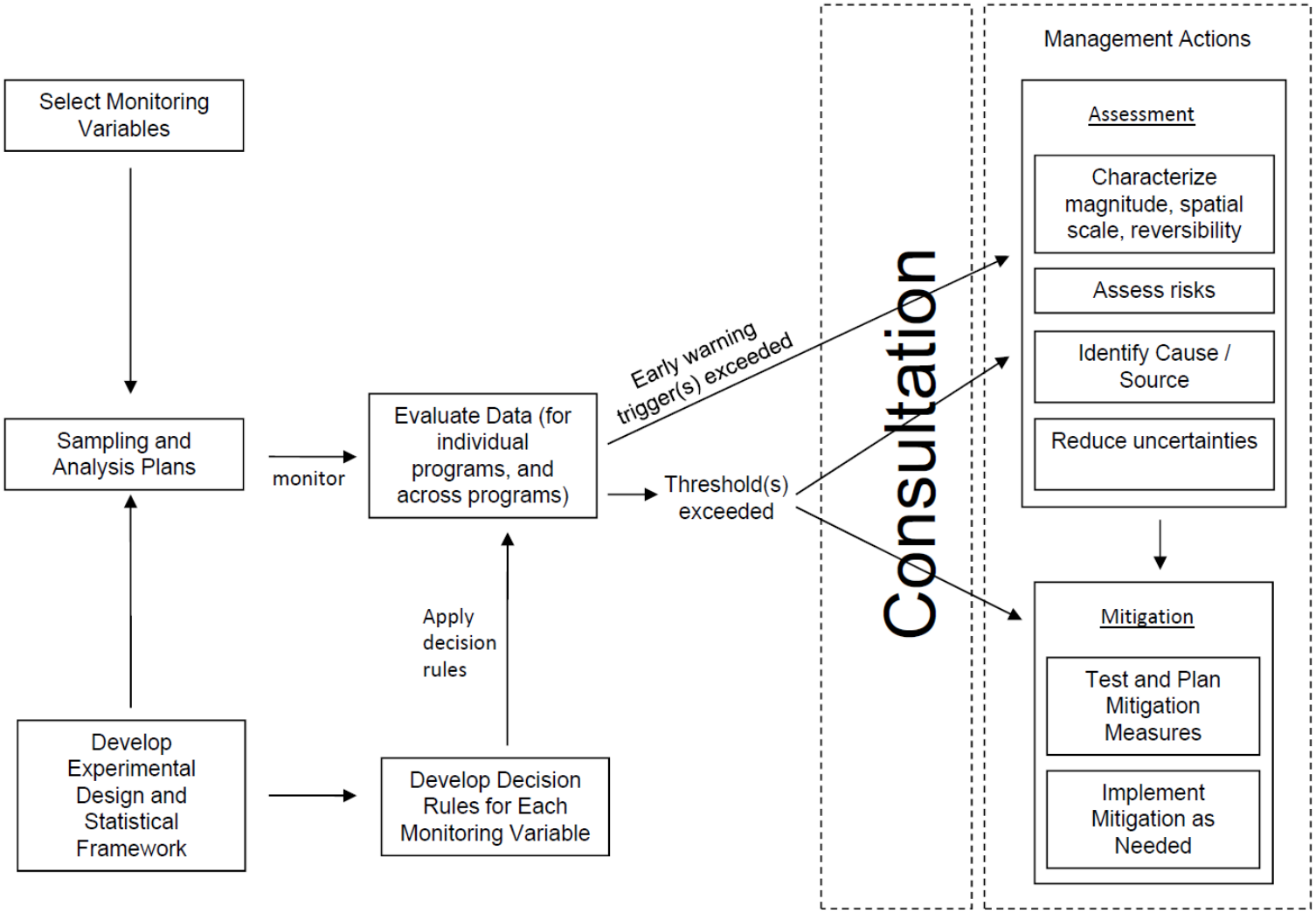
Nevertheless, there are two general classes of management actions – those aimed at further assessment and those aimed at mitigation. In general, exceedance of early warning triggers will trigger further assessment, which may then lead to mitigation, whereas exceedances of thresholds could possibly lead directly to mitigation. It is expected that CREMP triggers will be exceeded occasionally due to chance (given the large number of variables that are monitored, particularly for water chemistry), therefore further assessment will almost always be important.

The specific management action that would be appropriate in a given case depends on the underlying cause. For example, if a metal becomes elevated in receiving water, the identification of options for further assessment and/or mitigation options would be different if the source of the metal is groundwater versus effluent versus dust. The timing of management actions is also case-specific. In cases where further assessment is warranted, that assessment should begin as soon as practically possible. In cases where mitigation is considered, mitigation should begin as soon as the weight of evidence indicates that mitigation is warranted, and the benefits of commencing mitigation immediately outweigh the disadvantages of waiting for further information. Consultation with regulators and stakeholders is important for determining management actions (see Azimuth, 2015).

Further details on the integrated aquatic effects action plan are provided in Azimuth, 2015.

The general staged sequence of responses for triggered parameters is summarized in Figure 3.2 below.

Figure 3-2: Logic Diagram for Non-Regulated Discharge



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, these flows will be measured using permanent in-line flow meters, such as fresh and reclaim water pumping systems. For periodic batch discharges, such as secondary containment sumps, portable flow meters or calculated pump time and capacity methods will be used. In seepage collection ditches flows are measured using either flow measuring weirs or using stream gauging methods.

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 8, and Table 2 of the water license, include:

- The volume of fresh water obtained from Third Portage Lake (CM station ST-1);
- The volume of fresh water obtained from Wally Lake during re-flooding;
- The volume of fresh water obtained from the unnamed lake for purposes of explosive mixing (ST-3);
- The volume of effluent and fresh water transferred to the pits lakes;
- The volume of reclaim water obtained from the TSF for process water (ST-4);
- The volume of water discharged from the Vault Attenuation Pond (ST-10) to Wally Lake diffuser;
- The volume of water discharged to the South Cell TSF from Landfarm sump at mine site (ST-14).
- The flow during periods of discharge from the sewage treatment plant, area sumps (ST-17; ST-19; ST-20; ST-23) collecting contact water, the landfarm, landfills and Rock Storage Facility; and
- The volume of water discharged from the marshalling area bulk fuel storage facility.
- The volume of water transferred from the North Cell TSF (closed) to the South Cell TSF;
- The volume of water transferred from the Stormwater Management Pond to the South Cell TSF;
- Volume of influent water to the pits during re-flooding – estimated freshet inflow

The intervals of pumping for contact water at the Meadowbank Project site are listed in Table 4-1 below.

Table 4-1: Intervals of pumping for Surface Water at the Meadowbank Project, Mine Operation Period

Pumped from	Pumped to
Process Plant (Years 1 to 9)	TSF
Reclaim Pond (Years 1 to 9)	Process Plant
Reclaim Pond (Year 9)	Portage Pit Lake or Goose Island Pit Lake
Portage Pit sump(s) (Years 1 to 9)	Portage Attenuation Pond, South Cell TSF
Goose Island pit sump(s) (Years 2 to 5)	Portage Attenuation Pond
Vault Pit sump(s) (Years 4 to 9)	Vault Attenuation Pond
Phaser Pit and BB Phaser pit sumps (Years 7 to 9)	Vault Attenuation Pond
Portage Attenuation Pond (Years 1 to 5)	Third Portage Lake
Vault Attenuation Pond (Year 4 to 9)	Wally Lake

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 MMER requirements and b) in response to exceedances.

5.1 ANNUAL REPORTING

All water quality monitoring results will bebe compiled into a brief monthly report, and sent to the Nunavut Water Board (NWB), the Indigenous and Northern Affairs Canada (INAC) Water License Inspector and to the Kivalliq Inuit Association (KIA). These reports are due within 30 days of the end of the month being reported on.

An annual report is to be submitted to the NWB, KIA, Department of Fisheries and Oceans, Indigenous and Northern Affairs, 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;
- Annual groundwater monitoring results; activities during the year at each well site and record of well operations, well replacement, and proposed drilling for the next year; and installation details of new wells and identification of any abandoned or destroyed wells.
- 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 MMER; 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 water license or MMER will be reported to the NWB and Environment Canada 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 – MMER accordingly.